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JULY 2017

COULD A SUPERCAR DESIGNER'S VISION PUSH THE INDUSTRY TO UP ITS GAME?

LOOSE EQUIPMENT

What's the best way to integrate customers' non-certified items safely?

SUKHOI BUSINESS JET

How USA-based Comlux Completion outfitted a Russian jet and secured European certification for it

LIGHTING INNOVATIONS Details of the exciting new technologies that could outshine LEDs

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Wheels up

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

- OO6 **Pinboard:** The industry's hottest recent designs presented in one place, plus some exciting product launches
- OO8 **News in Focus:** StandardAero discusses the recent transformation of a Falcon 900B cabin for a returning customer
- O1O **Completions Roundup:** This quarter's announcements from completion centers around the world
- O12 **Design Brief:** Pierrejean Design Studio presents a futuristic design complete with 'never-ending' lounge and inflatable floors

Features

- 14 LOOSE EQUIPMENT Aircraft owners' desire to take non-certified equipment on board can lead to a more complicated and prolonged cabin completion, as completion centers strive to make such equipment safe and secure
- 22 PAGANI ACJ319NEO The first aircraft cabin design by automotive design house Pagani Automobili weaves technological wizardry into a luxurious aesthetic, shored up by ACJ's aviation nous
- 28 SUKHOI BUSINESS JET Working out international logistics and gaining EASA certification were the biggest challenges faced by USA-based Comlux Completion in outfitting its first Sukhoi Business Jet
- **36** VIP COMPLETIONS Completion centers are finding uses for a variety of new technologies, including virtual reality, augmented reality and 3D printing

46 GALLEY EQUIPMENT With passengers expecting culinary perfection on board, cabin designers are being challenged to innovate in the galley





LIGHTING

Two exciting new lighting technologies are coming to steal the limelight from LEDs

60

FCC REFURBISHMENT Flying Colours Corp reveals all about the first refurbishment to combine custom elements with pre-engineered components from Inairvation





069 PRODUCTS AND SERVICES The latest product news from our advertisers

- 071 INDEX TO ADVERTISERS
- O72 DESIGN SPY The best designs from other sectors, including a London penthouse by Winch Design

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Cover image: Pagani ACJ319neo concept



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STARS AND CARS

ne detail in a news story from Jet Aviation caught my eye recently. The company had designed and completed an ACJ330 interior for a customer in the Middle East. The detail in question was the starry ceiling, designed to display the constellations seen over Riyadh when the Kingdom of Saudi Arabia was founded in 1932. A special request indeed, and one that illustrates the often exacting nature of customer demands, as well as the fact that lighting can provide the biggest wow factor on board a VIP jet.

In the article on page 52 we explore several exciting new lighting technologies that could open up even more possibilities for designers. One of these – which can turn the ceiling and sidewalls into a canvas for whatever imagery the principal desires – features in the ACJ319neo design pictured on the cover and explored on page 22. This stunning design is the result of ACJ's collaboration with Pagani, a renowned

supercar designer that brings not only its aesthetic sensibilities to the design, but also a unique carbon titanium material originally developed for cars. Could material developments such as these prove a boon to aircraft designers? What else could the two industries share by looking beyond their traditional boundaries?

High-end automotive designers such as Pagani are accustomed to meeting the challenging customer demands seen in both industries; the new factor in creating an aircraft design is working within aviation rules.

Completion centers' efforts in navigating tricky certification projects come up time and again in this issue – from integrating VIPs' favorite items of loose equipment (page 14) to Comlux Completion's achievement in gaining EASA certification, in the USA, for a Russianmade aircraft (page 28). It's proof that the aircraft interiors industry is open to new ideas and is skilled at making customers' dreams come true.

Izzy Kington, editor

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4. SCOTT GROUP CUSTOM CARPETS' LATEST COLLECTION, AERIAL

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FALCON 900B CABIN TRANSFORMED BY STANDARDAERO

Following on the heels of a similar package performed on a Falcon 50EX for the same customer, this 1987 Falcon 900B was inducted at StandardAero's facility in Springfield, Illinois, in March 2016, and redelivered in November 2016.

The company was tasked with an extensive work package including a pre-purchase and 5C inspection, avionics systems upgrade, phone and high-speed data system installations, winglet installation, a complete CMS and entertainment package, LED lighting with headliner and valance modifications, full interior and exterior paint work.

BELOW AND BOTTOM RIGHT: HOW THE FALCON 900B LOOKED BEFORE THE WORK

MAIN AND BOTTOM LEFT: AFTER THE TRANSFORMATION



Æ





The B/E Aerospace seats were modified by service bulletin to replace the existing plug-in headrests with new ones. The seats and divan were upholstered in a combination of Spinneybeck and Edelman leathers, with contrasting stitching. This stitching detail was carried over to custom leather ottomans, which were fabricated for the aircraft.

New cabin equipment includes a Honeywell Ovation CMS, Alto Aviation sound system and three 22in and two 32in bulkhead-mounted monitors from Rosen Aviation.

Metal hardware throughout the aircraft was plated in satin nickel by Signature Plating.

A new dual-leg hi-lo conference table from Enflite was installed at the conference grouping.

All the woodwork was redone in Custom Plywood quartered composite ebony veneer, laid with the grain running horizontally, and completed with a high-gloss finish.

New ATG Powertech electric dualpleated window shades were installed. They can be controlled through the CMS switch panels.

The new carpet from RedRock Custom Carpets is made from a blend of silk and wool, designed to add a lavish feel to the interior.

Shannon Watson

LEAD DESIGNER, STANDARDAERO BUSINESS AVIATION

What was the brief?

The mission of the project was to revitalize a dated aircraft into a piece of equipment that was both stylish and efficient. The aircraft had good bones, but required considerable updates to optimize its functionality. StandardAero's experienced and skilled technicians transformed the aircraft from top to bottom, front to back, inside and out.

How involved was the client?

The collaborative process with the aircraft owner was the aspect of the project that I found most fulfilling. Having worked with the owner on a previous project, I had developed an exceptional rapport with him and a clear sense of his style, which was easily captured in the modern features of the interior. Our relationship gave the owner a sense of assurance that I fully understood his expectations and would attend to the details on his behalf. In the end, StandardAero delivered an expertly crafted interior complete with all the design elements, aesthetic features and comforts that he had envisioned.

How is the customer's style reflected in the design?

The customer's taste is timeless and sensible, so each facet of the interior was completed to highlight simplicity. One example of that simplicity is the lavatory, designed to be beautiful, uncomplicated, bright, functional and clean.

The focus on simplicity is also evident with the sleek wood veneer sideledges, which have custom storage slots for phones and tablets, hidden away at each table. The sideledges, together with new embossed and hand-tipped leather from Garrett Leather, give a more modern feel to the sidewalls. The headliners were also modified, and new StandardAero-designed valances were installed. The maintenancefriendly design features hinged panels that enable easy access to the new Emteq LED lighting system.

The customer was also quite technology-savvy, which accounts for the various bulkhead-mounted monitors and the entertainment hub in the credenza.

Which aspects took the longest?

The project took months to complete, driven primarily by the extensive maintenance inspection being performed, the highly complex avionics systems installed, and the structural modifications required to install winglets to the aircraft. Following completion of the winglet installation and inspection, the aircraft was painted at StandardAero's paint shop in a striking gray, black and red scheme.

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COMPLETIONS ROUNDUP

This quarter's announcements from completion centers around the world

BASEL, SWITZERLAND

Jet Aviation designed and completed an ACJ319 and an ACJ330 for a Middle Eastern customer. It was also tasked with converting two Embraer Legacy jets to have dual medevac and VIP charter roles; designed and delivered a BBJ3 interior; and refurbished a BBJ 737. Plans were unveiled for a new 8,700m² wide-body completions hangar, which should be built by Q4 2018.

BASEL, SWITZERLAND

AMAC, celebrating its 10-year anniversary, is set to outfit the first ACJ320neo when it arrives in Q4 2018. Among other projects, the firm completed a BBJ Demonstrator, and – with PAC and Alberto Pinto – developed a cocoon seat for the B747-8i. It also found a way to reduce cabinet weight by up to 30%; and gained STCs to install JetWave on B737 and ACJ340-500 types. Upcoming work includes an A330-200 refurbishment and the modification of an A340-600 cabin.

GENEVA, SWITZERLAND

RUAG completed a C-check on a Falcon 7X, and a 3C- and a 2C-check on Falcon 2000s. The projects involved 19,000 hours of work; the team worked double shifts.

BORDEAUX, FRANCE

Sabena technics joined the ACJ service center network. It also earned an EASA STC to install JetWave hardware on a wide-body ACJ.

HAMBURG, GERMANY

Two government customers tasked Lufthansa Technik with major modifications on three A340s and an A319, and an A321 completion. The company will also soon redeliver an ACJ319 to a VIP in Greater China, with club seats and divans designed and upholstered by Hermès's bespoke division.

VIENNA, AUSTRIA Dassault appointed Aero-Dienst's Vienna site as an ASC for Falcon 900 and 2000 types.

BERLIN, GERMANY

F/List acquired OHS Aviation Services, a move that also led to cooperation with LBAS in Berlin. Its services range from cleaning to re-upholstery, re-veneering, re-plating and cabinet repairs. Inairvation can be called upon for more thorough modifications.

PETERBOROUGH, CANADA FCC completed the first refurbishment with Inairvation parts (see page 60).

WATERFORD, MICHIGAN Pentastar gained an FAA STC to enable the use of transmitting PEDs on GIV-X aircraft with wireless networks or wi-fi hotspots.

KIRKLAND, WASHINGTON Greenpoint's Washington and Texas sites renewed their AS9100 Rev C certification.

INDIANAPOLIS, INDIANA

Comlux delivered an EASA-certified SBJ (see page 28) and was contracted to refurbish a BBJ and a Global 6000 for clients in Asia.

EAST ALTON, ILLINOIS

West Star's latest STC enables the installation of USB charging ports on Innov8 Cabin Solutions' CabinFlex Charge systems, on Falcon 900/900EX types. West Star also acquired DAS, which specializes in composite structures and assembly repair.

FORT WORTH, TEXAS

GDC Technics installed a Ka-band system on a BBJ 787. A second installation is underway and a third (an A319) should start in Q2 2017.

FORT WORTH, TEXAS

Robinson Aerospace is moving to a new facility, for which it expects to gain an FAA 145 repair station license in 2017. It plans to offer green interior completions, retrofits, refreshes, veneer replacement, design services, MRO and more.

XIAMEN, CHINA

HAECO PJS invested in 3D printing so it can produce scale models of cabin designs. The company is also providing cabin services for a jet in for maintenance at Bombardier's

service center in Tianjin, China; and supporting COMAC with corporate, private and governmental designs for the ARJ21.

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Reechcraft TEXTRON AVIATION

Tawker

wild blue yonder

With the futuristic Think Tomorrow concept – complete with inflatable flooring, holograms and movable monuments – Jacques Pierrejean, principal at Pierrejean Design Studio, is setting out a manifesto to "bring a refreshing bit of craziness to a world of boring conventions".

The design defines the whole cabin as a 'neverending lounge', with only a few partitions, made from electrochromatic glass that can be either transparent or opaque.

Bedrooms, showers, a spa, a gym, a conference room, a dining corner, kids' rooms, a meditation space and galley areas are included as islands that are located according to the customer's wishes and the nature of the trip. "The concept is like a white sheet of paper," says Pierrejean. "With the interchangeable rooms, the aircraft owner can create their own environment for each trip."

Aesthetically, the aim was to produce fluid and soft shapes, incorporate nature wherever possible, and create a young and fresh ambiance, using a combination of reflective materials and lighting sources. "The fluid and asymmetric shapes contrast with the boring rectangles we usually find on board," says Pierrejean.

The concept can be adapted for a wide range of Airbus and Boeing aircraft types. "We do need space to create such an innovative environment," says Pierrejean.

Although Think Tomorrow appears very futuristic, Pierrejean believes the enabling technologies are not that far away. "Tomorrow means almost now!" he says. "Let's make the most of what technologies are available now and allow the concept to evolve as new products become available. Pierrejean Design Studio has always worked as a laboratory for new ideas, creating new products and trends in cooperation with vendors and manufacturers."

In particular, the design firm is currently working on aspects of the spa. "We are developing new concepts to increase well-being," says Pierrejean. "These could include phytotherapy, mesotherapy and light therapy rooms, which would help passengers to take care of their health, and combat feelings of claustrophobia and jet lag. But we need to be patient and give enough time for certification approval."

PROJECTION

Projectors discreetly hidden in the lining or in strategic places could be used to transform the sidewalls and ceiling with representations of the sky or landscapes. "This would give a feeling of openness on board," says Pierrejean. "You could even show moving fractal images, and add an interactive element so that the images move with you."

DNA SOFA

Directly inspired by the helix shape of DNA, the sofa will be like a spinal column running through the aircraft. It would be modular and adjustable, and could be equipped with small pop-up/sliding tables, reading lights or lamps, stowage spaces under the seat pan, an audio system and shiatsu massage function.

HOLOGRAMS

Pierrejean proposes using holograms to represent natural elements such as flowers and trees, as well as for a fireplace and aquariums. "They should be integrated discreetly to make them look natural," he says.



GUIDED TOUR

Multimedia lounge

One area of the 'never-ending lounge' would include a multimedia wall of OLED screens.

Cinema

In the cinema, as in the meditation space, the floor will be inflatable, offering an alternative to seats. "You would be able to watch a film with the whole family," says Pierrejean. "Materials that 'remember' the passenger's form should be used."

Galley

The galley has been designed to be a social space, with stowage compartments accessible on all sides, including displays for magazines, drinks and snacks. "You can walk all around it, enjoy a drink and socialize with other passengers," says Pierrejean.

Master bedroom

This is one area that makes use of partitions that can be switched between transparent and opaque modes. They could also offer dimmable illumination. Pierrejean notes that the partitions could be customized in terms of color.

Gym and spa

Gyms and spas are included already on many of Pierrejean's designs, but the Think Tomorrow concept goes a step further, using holograms to create a calming, natural environment, and introducing dedicated areas for the latest therapies.









or many aircraft owners trying to create a personalized home in the sky, the range of certified cabin equipment available is too limiting, and they wish to bring non-certified 'loose equipment' on board.

However, adding equipment that is outside the scope of certification standards can complicate the completions process. There can also be serious safety implications if loose equipment is not properly secured.

"The kind of loose equipment that is brought on board varies a lot – examples include IFE, bed linen, children's seats and toys, karaoke players, etc," says David Velupillai, marketing director at Airbus Corporate Jets. "When Airbus is aware of

"The certification challenges that may arise are usually around structural requirements, flammability and, for electrical equipment, EMC/EMI" LEFT: THE CHALLENGER 604 THAT ROLLED IN FLIGHT ON JANUARY 7, 2017





what loose equipment is involved – perhaps in creating a cabin specification or in managing cabin outfitting – it will work with the operator to propose suitable stowage space for loose equipment, and/or provisions for it. For example, Airbus might suggest drawers for stowing crockery and cutlery, and fixings on a wall to attach a painting."

But while the manufacturer will advise jet owners on the impact of their loose equipment choices, Velupillai says, it is ultimately the operator's responsibility to address any certification issues.

Ettore Scari, senior sales engineer for completions at Jet Aviation, says some of the more common loose equipment requests are decorative lamps and artwork,

WHY IT MATTERS

Recent events illustrate the need to properly secure loose equipment. As first reported by the *Aviation Herald* in March 2017, on January 7, 2017, a Challenger 604, registered in Germany, was thrown into an uncontrolled roll and suffered a sudden rapid descent of about 9,000ft after crossing the wake of an A380 passing 1,000ft above.

The aircraft was reportedly spun several times before the crew was able to regain control and divert the flight to Muscat, Oman. An interim report by Germany's BFU noted that the flight attendant and four of the six passengers were not seated at the time of the incident. Four passengers needed hospital treatment – one for a broken rib and head injuries, another for a fractured vertebra. Minor injuries included bruising and a fractured nose.

The BFU's interim report noted that the aircraft manufacturer had concluded that the airframe structure could not be returned to a state of airworthiness.

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PICK YOUR BATTLES

Developments in the aircraft interiors industry in recent years have given jet owners a greater range of approved options that satisfy the same needs as certain popular items of loose equipment, with a shorter installation. For example, certified galley inserts now include induction cooking surfaces, dishwashers and even Nespresso coffee makers. However, demand for one category of loose equipment at least looks unlikely to be swayed – PEDs. The integration of tablets and smartphones on board is a major consideration in the development of modern IFEC and CMS. Likewise, finding convenient places to store and charge these devices on board has become an important aspect of cabin design.

as well as productivity and entertainment equipment including printers, laptops, game consoles and Apple TV boxes.

PAPER TRAIL

While using equipment they are familiar with on the ground is attractive to jet owners, this kit can pose certification challenges. "Loose equipment is usually commercial, off the shelf; it wasn't developed to meet aeronautical standards," says Scari. "It typically isn't delivered with all the paperwork required to demonstrate repetitiveness and conformity. One component could behave differently from another apparently identical one. The certification challenges that may arise are usually around structural requirements, flammability and, for electrical equipment, EMC/EMI. We generally recommend using airworthy equipment when possible. For example, we have solutions for approved deco lamps."

It can take a long time to develop and gain approval for innovations such as these – it is not unusual for the Technical Standard Order (TSO) approval process to take a year or longer. While progress is being made in certifying a greater variety of decorative elements and finishes, there will ABOVE: PED USE IS FULLY CATERED FOR ON THE GULFSTREAM G550

BELOW: JET AVIATION RECOMMENDS USING APPROVED AIRWORTHY EQUIPMENT WHERE POSSIBLE, SUCH AS ITS DECO LAMPS, SHOWN ABOVE THE BED continue to be items jet owners want on board that have no certified equivalent.

"Using solely pre-certified loose equipment can limit available choices, so we also work with off-the-shelf items," says Scari. "We have considerable experience in certifying commercial off-the-shelf (COTS) equipment for aircraft use, but we caution customers that this can be a timeconsuming process."

Readers' poll

Passengers can bring consumer devices on board as loose equipment – should there be more rules regarding these devices? As of publication day, our online readers say...

> 45% Yes 55% No



A COLD GRISP WHITE A COLD CRISP WHITE A PERFECT CHILLED CHAMPAGNE



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LEFT: LUFTHANSA TECHNIK'S FIRELESS FIREPLACE

RAINING IN MY HEARTH

Lufthansa Technik's Fireless Fireplace, introduced during EBACE 2015, simulates a homely fire safely using illuminated water mist and imitation burning wood.

While the 'flame' is cold, the sky-high hearth emits heat and sound to make the experience more realistic and comforting. These settings, as well as the intensity of the burning flame, can be adjusted via remote control.



Lufthansa Technik takes a similar approach to customer requests, and tries to help certify loose equipment wherever possible, or to find solutions to make them safe for aircraft operations. "Common loose equipment requests include decorative blankets, pillows, tablet computers, cutlery, china and tableware," says Felix Winkelmann, chief engineer, conversion and completion, VIP and Special Mission Aircraft Services, Lufthansa Technik. "Purchase of these items is usually under the customer's responsibility and we take care to provide adequate stowage. Loose equipment needs to be stowed away safely during taxi, take-off and landing. Exercise equipment and other large equipment is requested from time to time and in these cases we support the customer, finding a way to get things into the aircraft."

FIXED ABODE

Technically, not all loose equipment is loose. Fixed personal items add another layer to the certification process. "Decorative items including artwork, crests and sculptures are usually not removable – thus, they are part of the design package and they have to comply with the

"Some regulations may be interpreted less strictly for private aircraft"



Exercise equipment Exercise equipment isn't just an appealing idea for VIP jet owners. idea for VIP jet owners. idea for VIP jet owners. Airbus's Silicon-Valley outpost Airbus's Silicon-Vall

applicable regulations," explains Winkelmann. "In general, all items that are permanently installed on an aircraft must comply with regulations. This includes interior, system and structural modifications. The two main aspects for certification are flammability and the physical strength of the component. We must show that the component will not become a hazard to passengers. But there are no guidelines for clearing personal components, or groups of components, in general. Each component needs to be assessed individually, corresponding to the aircraft's type."

Winkelmann also points out that regulators allow more room for creativity in the outfitting of personal jets. "Authorities differentiate between private and commercially operated aircraft and some regulations may be interpreted less strictly for private ones," he says.

Whenever possible, Lufthansa tries to find materials or components that are already certified to satisfy the same needs, or develop its own certified solutions, guided by customer feedback. Such developments include an induction cooking top, an exercise bike and an imitation fireplace. The approval process for these items is still an effort, but Lufthansa Technik says this approach enables it to get ahead of demand – taking on the time-consuming approval process up-front saves subsequent customers time and money in their completion projects.

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THE FIRST AIRCRAFT CABIN DESIGN BY AUTOMOTIVE DESIGN HOUSE PAGANI AUTOMOBILI WEAVES TECHNOLOGICAL WIZARDRY INTO A LUXURIOUS AESTHETIC, SHORED UP BY ACJ'S AVIATION NOUS

Words by Izzy Kington



PAGANI ACJ319NEO

DESIGN PHILOSOPHY

Proprietary composite materials have been at the core of Pagani Automobili's bespoke car designs since its foundation in 1993. "Our approach is to take care of form and function together – balancing style and technology, design and science," says Horacio Pagani, chief designer at Pagani Automobili. "This is a concept that we borrowed from Leonardo da Vinci, who saw art and science walking hand in hand." This philosophy is evident in the Infinito cabin, the Italian design firm's first aircraft cabin, for which it partnered with Airbus Corporate Jets (ACJ). "ACJ gave us a lot of freedom in terms of design, but at the same time, imparted a lot of practical advice, for example concerning customers' habits in the aircraft," says Pagani. "The result is a really good combination of science and design."

ENTRANCE

The entrance and galley area is designed to feel more like a club than a traditional aircraft entrance. There's a welcome desk/bar area, with two pop-out stools.

"Pagani has brought a new perspective," says Sylvain Mariat, head of creative design at ACJ. "Galleys usually look like a nuclear submarine. This one is more free and welcoming."



DOORS

The cabin dividers are a good example of Pagani's focus on making design statements out of practical elements. Each is framed in carbon fiber, and the divider between the cinema room and the dining area is made from electrochromatic glass, which can be switched between transparent and opaque states.

Pagani also made a feature out of the door handles. They have a leather strap and a lever lock, which is designed to be both practical and tactile. "We have to be able to secure every compartment, to comply with fire regulations," says Mariat "Sometime I like to hide the locks because they don't look nice. But here, Pagani has brought another kind of design."

024

As it does with its As it does with its cars, Pagani created a bespoke set of luggage to match luggage to match the cabin, using the same leather

Analog gauges give passengers information about the aircraft's altitude and direction, while being reminiscent of a car's dashboard

CUSTOMIZATION

minito

Unsurprisingly, given Pagani's business hinges on creating bespoke designs, the Infiniti cabin offers multiple opportunities for customization.

"There are a lot of fashion brands we can work with to create specific fabrics for projects such as this," says Pagani. "We can try to work together to find the right way to create a bespoke material."

Various colorways can also be achieved. For example, the company has produced designs for a blue version – one tweak of which being a floor made from layering carbon-fiber offcuts.



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Any desired scenario can be projected onto the ceiling

The divan in the cinema area is designed as four separate but linked seats

COMPOSITE MATERIALS

The concept makes great use of carbon titanium, a material Pagani developed in-house and first deployed in 2009, for the central monocoque of a car. The exclusive material comprises carbon fiber reinforced with titanium wires, included for strength and to absorb energy in a crash. The material can be finished with the paint of the customer's choice, or left unpainted.

"The material can save lots of weight in the cabin, is very rigid and gives you the freedom to create shapes that were not available previously," explains Pagani. "It is also going to last longer, and can be tailored around the customer's wishes."

Meanwhile, in the lavatory, carbon fiber has been mixed with an aviation 'glass'. "It was really difficult to bake the two materials together," says Pagani.



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SUKHOI BUSINESS JET

WORKING THROUGH INTERNATIONAL LOGISTICS AND GAINING EUROPEAN CERTIFICATION WERE THE BIGGEST CHALLENGES FACED BY USA-BASED COMLUX COMPLETION IN OUTFITTING ITS FIRST JET MADE BY RUSSIAN MANUFACTURER SCAC Words by Izzy Kinglon

"Doing this first SBJ was a way to be positioned with this manufacturer, like we are with others, and before other completion centers"

> This is the first Sukhoi Business Jet to enter the charter market



head of the availability of the next generation of narrow-body airliners from Airbus and Boeing – the ACJneo and BBJ Max families – there is an opportunity for Russian manufacturer Sukhoi Civil Aircraft Company (SCAC) to get its foot in the door with the Sukhoi Business Jet (SBJ), says Arnaud Martin, executive vice president at Comlux. The SBJ is based on the Superjet 100, a regional airliner that entered service in 2011. Comlux's completion center – which has completed numerous Airbus and Boeing narrow-bodies – recently became the first external company to outfit an SBJ. It was completed for Kazakhmys, a mining company based in Kazakhstan.

"Customers are waiting for the ACJneo and BBJ Max types, but they are not arriving until the end of 2018 and early 2019," says Martin. "We are well positioned for these new aircraft, but we want to offer even wider capabilities. SCAC is really eager to enter the market, and I'm sure they will sell more aircraft. In particular, the SBJ has a lot of potential in the Russian Federation and CIS countries. Doing this first SBJ was a way to be positioned with this manufacturer, like we are with others, and before other completion centers."

WHAT'S ON BOARD?

With a cabin width of 10ft 7.4in, height of 6ft 11in and length of 67ft 11in, the Sukhoi Superjet 100 can be configured for up to 103 economy passengers. Kazakhmys' corporate version seats 21 passengers, with 19 seats certified for taxi, take-off and landing. The brief was to create an elegant corporate environment to suit missions of around six hours.

Following the entrance zone and VIP lavatory, is a VIP lounge configured with a divan and a club-four. Martin describes the seating as classical in terms of design, but given a modern look with wood. This area features multicolored mood lighting. LEFT: THERE IS A VIP LAVATORY AT THE FRONT OF THE AIRCRAFT. A SHOWER WAS NOT REQUIRED GIVEN THE AIRCRAFT'S SIX-HOUR MISSIONS

ABOVE: THE ENTRANCE AREA

Beyond this is an executive zone with 15 seats in a 2-1 layout. The seats were original equipment, but had yet to be certified to 16g when the aircraft arrived at Comlux. "We considered whether we should certify the seats on the existing seat rails or put Boeing or Airbus seat rails in," reveals Martin. "After dynamic testing, we choose to certify the seats on the existing seat tracks."

Passengers will rely on their PEDs for entertainment on board, because high-

WEIGHT SAVINGS

There was a strong focus on weight saving on this project, to maximize range. "Boeing or Airbus cabins are a bit bigger but they are never below 5.5 or 6 metric tons," says Arnaud Martin of Comlux.

This SBJ interior came in at 3.7 metric tons. "Achieving this was a real challenge," says Martin. "We only used very light materials, especially on partitions and all the deco panels."





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SPORTY SPACE

Back in July 2016, SCAC presented a version its SSJ100 tailored for professional sports teams, which it said would be certified in 2018.

The move was made to capture a slice of the sports air transportation market, which Sukhoi reckons is worth in excess of US\$600m annually. "We are sure that flights for professional sports teams on SportJets will eventually become an integral part of the air transportation market," said Evgeny Andrachnikov, senior vice president of commerce at SCAC.

Developed in consultation with sports physicians, experts and managers, the SportJet interior features medical and IT solutions intended to combat jet lag, hypoxia, dehydration, stress on the body and aerophobia.

speed satcom is not yet available for the aircraft type. "Our customer chose not to develop fancy IFE because they would want that to be attached to a good communication system," says Martin. BELOW: THE EXECUTIVE ZONE SEATS 15 PASSENGERS

TARGETING KA-BAND

He adds that SCAC is working on making Ka-band connectivity available, but it's not decided if this customer would want to retrofit satcom and IFE on this aircraft. "The retrofit would involve reworking at least one partition to install a big screen, and probably a bit of wiring, although we will try to use a lot of wireless access points," says Martin.

The completion took 12 months, four months longer than planned – which Martin says was due to engineering challenges involved in it being the first completion of its kind and the company's first interaction with SCAC. There were also complicated certification and logistical challenges to overcome.

DECOMPRESSION MODEL

The main engineering challenges concerned the aircraft's decompression model, electrical consumption and center of gravity. "SCAC had certified a couple of versions of the aircraft for the airline market, but none with separate decompression zones," says Martin. "When we asked them for more data – for example concerning how the air comes through the panels – to work out decompression for multiple zones, this data was not available – a big departure from our projects with Airbus and Boeing. Our engineers worked together with SCAC to rebuild the aircraft's decompression model and ensure it was validated by the authorities."

This model can now be used on subsequent Comlux completions. "We'll be much better positioned than any other completion center to go through these technical challenges on a SCAC jet, because although the native IP is SCAC, we know how to use it, and there are certain practices that are our IP," says Martin. "For example, we developed and certified frangible doors with a mechanism that allows very easy decompression. We will reuse that on other aircraft."

POSITION CRITICAL

The location of Comlux's completion center – in Indianapolis, Indiana, USA – also posed challenges to the completion of this Russian A variant of the Sukhoi Superjet 100 Sukhoi Superjet 100 with a 50% range increase (to 4,578km) gained EASA certification in December 2016



SBJ TIMELINE

APRIL 2011 SSJ100 enters airline service

NOVEMBER 2014 A business version of the SSJ100, the Sukhoi Business Jet, is certified

> Q1 2015 Completion contract signed

AUGUST 2015 Aircraft arrives at Comlux's facility in Indianapolis, Indiana

> DECEMBER 2016 Aircraft redelivered

"With the huge CIS market and the fact that it can be certified in Europe, the SBJ can probably compete very well with Airbus and Boeing types"



aircraft, particularly as the customer required European certification. "Just receiving the aircraft in Indianapolis was a challenge," says Martin. "First it had to be re-delivered in Europe so that it can have a European type certificate. We are the first completion center in the USA to obtain an EASA-specific certification."

DETAILS, NOT EQUIVALENCE

The EASA certification was necessary because the aircraft doesn't have a US FAA type certificate. "Another challenge was that although EASA has certified this aircraft type, it has done so more by equivalent models," says Martin. "This meant that we had to validate everything we did in full detail. On an Airbus or a Boeing, a lot of things are certified by equivalence, because the certification people have seen probably 10 aircraft with similar elements."

Language differences also came into play. "The documentation was partially in Russian and partially in

Comlux's completion center opened in 2009 and was expanded in 2012

FIGHTING TALK

The Russian connection resulted in around two months being lost through imported parts being held up in customs. "After weeks of problems that we never usually have, we visited the customs agent," says Arnaud Martin of Comlux. "He said, 'The documentation is in Russian, and it just says it's SCAC parts – SCAC does military fighter aircraft and you want to import that into the USA without checking'. We tried to explain it was for a VIP aircraft, and the guy said, 'How can you do a VIP interior in a fighter aircraft?' In the end I told him to visit the hangar to see that it's not a fighter aircraft."

TOP: IN THE VIP SECTION, THE CLUB FOUR CONVERTS INTO A DOUBLE BED, AND THE DIVAN INTO A SINGLE

ABOVE: THE AIRCRAFT WILL BE AVAILABLE FOR CHARTER OPERATIONS THROUGH COMLUX KZ English, and this added to the challenges, but now we have a good grounding for the future," says Martin. "Our engineers know this aircraft very well and we have a great relationship with SCAC."

He believes the aircraft has great potential. "SCAC showed this aircraft to President Putin and he was very satisfied by the interior; he said the quality was great," says Martin. "It's a good aircraft, with a lot of modern technology. There are a couple of things that still need to be developed, which SCAC is working on, but with the huge CIS market and the fact that it can be certified in Europe, the SBJ can probably compete very well with Airbus and Boeing types." Solution
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VIP COMPLETIONS

COMPLETION CENTERS ARE FINDING USES FOR A VARIETY OF NEW TECHNOLOGIES, INCLUDING VIRTUAL REALITY, AUGMENTED REALITY AND 3D PRINTING Words by Chris Colvin

LASER PROJECTION IS NOW USED AS A POSITIONING AND ALIGNMENT AID ON LUFTHANSA TECHNIK'S VIP CABIN COMPLETION PROJECTS

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VIP COMPLETIONS

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BELOW: EMBRAER LISES MIXED REALITY FOR DESIGN REVIEWS

EMBRAER

he VIP interior completion industry's reliance on physical mock-ups is diminishing as more sophisticated, computerized design tools take hold. Over the past decade a number of new technologies - including virtual reality (VR), augmented reality (AR), 3D printing and virtual prototyping - have been adopted by those keen to try out new methods to test fit and finish and obtain crucial customer feedback.

Lufthansa Technik is a prime example. In 2010 it began using digital mock-ups that integrate installation data and 3D scans of the aircraft cabin - a move that paved the way for the company to adopt a wide raft of visualization technologies.

"VR/AR is now a foundational aspect of our completion process," says Ralf Walter, head of product sales and design, digital geometries, for Lufthansa Technik's VIP and Special Mission Aircraft Services division. "We use Samsung's Gear VR equipment during the acquisition, preliminary design review and critical design review processes. Then we employ a digital mock-up unit throughout design engineering. Laser measurement and projection (AR) are used during the production phase. We also utilize 3D printing, not only to provide customers with scale cabin models, but mainly for rapid prototyping and installation purposes, for example when manufacturing complex spherical air ducting tubes."

reality, virtual objects are superimposed onto the real-world view

With augmented

3D PRINTING

Jet Aviation has also adopted digital tools for its VIP completions. "The use of 3D imaging and in-context design during the early stages of a project allows us to compile data that can be used for VR or equivalent applications," explains Ettore Scari, senior sales engineer for completions at Jet Aviation. "We have embraced 3D printing as a valuable design tool. Even before a contract is signed, we offer our customers the possibility of seeing a scaled 3D-printed model of their cabin or a section of the cabin. However, this technology is increasingly less relevant given the development of VR in the industry."

Using its JetVision app, Jet Aviation can share 3D cabin models with customers remotely, enabling them to take a VR tour

VIP COMPLETIONS





MAIN AND ABOVE: WITH LUFTHANSA TECHNIK'S COMPONENT POSITIONING TECHNIQUE, A LASER-PROJECTED TEMPLATE CORRESPONDS WITH A VIRTUAL 3D MODEL THAT TAKES COMPONENT CONTOURS INTO ACCOUNT via their personal portable devices. "To complement this remote experience, we are also assessing the pros and cons of using AR tools – such as goggles – when customers visit us," says Scari. "This is still at the exploration level, but we do feel that the technology, coupled with our knowhow, will be mature enough to introduce in the near future."

SPEED AND PRECISION Key aims in implementing these new technologies are to make the completion STANDARD

Ettore Scari of Jet Aviation believes that the main limit to the wider use of VR and AR relates to establishing processes and industry standards. "We think that VR will gradually spread throughout the industry as other new technologies have done elsewhere," he says. "New standards and expectations will be created. Processors are continually increasing in capability, and wireless and touchless technologies are growing and maturing. New products and solutions are constantly being developed, and companies will need to be prepared to pay for the cost of these updates."

process more precise and expedient. "Using these technologies, we are able to enhance and shorten a lot of processes, improve the quality of our product and increase the transparency of communication between all project stakeholders, especially with the customer," says Lufthansa Technik's Walter. "For example, we use the digital mock-up unit data in our backshops to validate

> the dimensions of interior parts and prepare installations in advance. Displays showing the digital mock-up unit are provided everywhere along the production line to provide a complete overview of installations and the aircraft environment."

Laser technology is used at Lufthansa Technik to obtain accurate geometric measurements for components. During installation, laser projection is used to align the furnishings precisely in the aircraft. Walter says that this speeds

"Using these technologies, we are able to enhance and shorten a lot of processes, improve the quality of our product and increase the transparency of communication"



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The latest news & Free Magazine archive installation remarkably, using the example of simple brackets that must be installed multiple times throughout the aircraft. "The bracket contour is projected onto the aircraft frame, in the precise location where it must be attached. Thus the mechanic is able to assemble and mount it directly without time-consuming marking and

re-measuring. Doing the procedure this way saves time, is more efficient, and enhances quality tremendously."

RISK AVERSE

For Jet Aviation's Scari, the key benefit of the new crop of visualization technologies lies in their ability to shorten reaction times. "The entire decision-making process is made easier and more convenient for the customer," he explains. "This in turn reduces the risk involved in such projects – for example, the risk that a customer will not like a choice they made earlier and want it reworked – so these technologies can reduce project time and related costs considerably."

Lufthansa Technik's Walter sees a growing variety of uses for VR/AR. "For example, you can display installation data and interfaces within the environment. These technologies will be also used for training, teaching and communication purposes, for instance to display a maintenance checklist. Instead of using CAVE, a room with projection screens, design engineers will use headmounted displays for VR reviews, even with multiple users worldwide. Our customers are already delighted

HAECO Private Jet Solutions announced its Solutions announced its investment in 3D printing in April 2017. The Chinese in April 2

ABOVE: LUFTHANSA TECHNIK USES 3D VISUALIZATION ON ITS COMPLETION PROJECTS Readers' poll

I BURNER BURNER

What's the best way to present a cabin design to a VIP customer? As of publication day, our online readers say...

that they can, in the late stages of product definition, see a 360° view of their cabin on their cell phone, tablet or through VR glasses. The next step will be a hologram projection in their homes."

1:1 MOCK-UPS

C60

Jet Aviation's Scari predicts greater use of 3D printing in the industry, especially as costs drop. "It is likely that it will be increasingly used for fast prototyping and gradually be adopted as an established manufacturing process," he comments. "As the technology evolves and costs drop, we see the potential for printing 1:1 mock-ups for technical parts and even for actual flying parts. This has been made possible by the availability of 3D-printable materials that meet cabin safety requirements, enabling Jet Aviation to design, produce and deliver shapes and components that were hard to achieve with traditional manufacturing."

11% 3D printed model
11% Augmented reality
33.5% Renderings
11% Video
33.5% Virtual reality

FUTURE-PROOFED DESIGN CENTER

Technologies including VR, 3D printing and projection mapping feature prominently in the National Transport Design Centre (NTDC), which opened in May 2017 at Coventry University in the UK.

The facility was built at a cost of £7m (US\$9m) to "contribute to the long-term competitiveness of the UK's aerospace industry". As well as supporting postgraduate design studies, the NTDC is open to companies in automotive, rail, marine and aerospace.

"Our aim is to meet the demand for specialized skills, building on Coventry University's existing expertise in transport design with a range of new courses and research programs," says David Wright, the university's director of strategic initiatives.

Equipment includes a 6m interactive 'power wall' for exploring concepts in VR; a projection mapping system for transposing digital images onto 3D objects; claymilling facilities; precision CNC milling machines; 3D printing; and wearable devices to support the creation of virtual, augmented and mixed reality environments.

> TOP RIGHT: LUFTHANSA TECHNIK SAYS LASER PROJECTION POSITIONING INCREASES ACCURACY AND SAVES MONEY

INSET: THE NTDC AT COVENTRY UNIVERSITY IN THE UK

Scari also sees VR becoming a standard design tool for the industry. "VR will potentially become a standard in the design process for customer decisions," he says. "1:1 virtual cabins or VR rooms with certain configuration options are already possible. We also see interesting applications for maintenance and postdelivery. Imagine walking into an actual cabin, using VR or AR goggles to see behind the panels, or having the ability to interact wirelessly with intelligent components for remote diagnostics. With JetVision, our long-term plan is to substitute 2D information with 3D data as customers and stakeholders get accustomed to it."

However, even with all these exciting possibilities, neither Walter nor Scari thinks that the traditional mock-up is going away. "The need for physical mock-ups has decreased remarkably with the implementation of the digital mock-up unit, but they are still useful for some projects – for small parts of the cabin or for functional testing installations," says Walter of Lufthansa Technik. "Until haptic

properties can be realized with AR or VR, some items will always need to be modeled with a traditional mock-up. A digital mock-up will never completely replace a real mock-up, but should be seen as a gift – a new tool to accelerate processes, optimize efficiency and quality, create transparency for stakeholders and minimize risk."

PHYSICAL PROPERTIES

Scari agrees that VR, AR and 3D printing, while useful, cannot replace traditional mock-ups entirely. "The advantage of these technologies is that once the infrastructure is in place, it is quicker and more costeffective to use a 3D approach than traditional mock-ups, especially if multiple options have to be assessed," says Scari. "However, there are certain elements that cannot be reproduced in VR, such as comfort, tactile feeling and the aesthetic finishes and details that physical interaction provides. We believe that technology enhances

> craftsmanship but does not replace it, and we still take a very hands-on approach to design and production. This means using 3D printing as a tool to establish proof of concepts in a bespoke interior, but the final monuments are crafted in our workshops, where technological advances are paired with hands-on techniques. Engineering and production expertise and skill is the real key to ensuring the best possible product. Advances in technology just support this process."

"There are certain elements that cannot be reproduced in VR, such as comfort, tactile feeling and the aesthetic finishes and details"



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The Luxury of Experience.



With passengers expecting culinary perfection on board, cabin designers are being challenged to innovate in the galley



Steve Daschel SENIOR DIRECTOR OF ENGINEERING, GREENPOINT TECHNOLOGIES



Tim Fagan MANAGER, INDUSTRIAL DESIGN, BOMBARDIER



Daron Dryer VICE PRESIDENT OF ENGINEERING AND CERTIFICATION, COMILIX



Tray Crow DIRECTOR, INTERIOR DESIGN, GULFSTREAM



GALLEY EQUIPMENT

STEVE DASCHEL

Appliances in demand include induction cooktops, espresso makers, freezers, wine chillers, dishwashers, microwaves, refrigerators, trash compactors, odor extractors and other appliances found in restaurants and residences, but that are not typical in aircraft. The hurdles to installing these are typically certification, space and power requirements.

TRAY CROW

Operators want the flexibility to change equipment easily to suit each mission. On the G500 and G600, tea and coffee makers can be pulled out and replaced with espresso machines and vice versa, with very little effort. We are also extending the cabin experience into the galley – for example by incorporating uplighting in the glass racks – and have seen new materials come into galleys, such as stone and wood flooring. What trends are influencing galley and galley insert design?

TIM FAGAN

We now aim to bring most of what you would find in a modern kitchen. For example, we are introducing multipurpose appliances on the Global 7000 and Global 8000. We have an oven that combines the microwave and convection functions into a single unit. The other unit combines the convection and steam oven capability. Much more attention is being given to maximizing storage and ergonomics. Our engineers and industrial designers are always challenging the thickness of partitions, the use of space by systems and the sizing of every feature, to increase usable space.

DARON DRYER

There is a move away from an industrial look to a more modern, improved aesthetic. I'd like to see the look and feel of private yachts or homes translated into aircraft, so the galley is more welcoming and not purely about function. The challenges to overcome are certification and the lead time involved in developing custom equipment.

FAR LEFT: INTERCHANGEABLE BEVERAGE MAKERS ARE AVAILABLE FOR THE GULFSTREAM G500 AND G600 GALLEYS

LEFT: THE GALLEY ON BOMBARDIER'S GLOBAL 7000

STEVE DASCHEL

Typical VIP and head-of-state service involves timely delivery of plated gourmet food to each passenger group without the use of galley carts. The capacity of ovens, warmers and chilled compartments is critical, as is the size and location of work surfaces and storage compartments for china, cutlery and stemware.

DARON DRYER

The biggest challenge is incorporating all the equipment and stowage needed to enable adequate service for extended flights, without excessive reduction of cabin space. In some cases it is good that there is standardization, but for items such as microwaves and other specialty equipment, it would be nice to have options for size and shape.

TRAY CROW

Gulfstream's standard amenities package begins with five-piece place settings for each passenger. Getting all of this (and any additional materials) stored and secured can sometimes seem like a puzzle, but we continue to succeed and make improvements in optimizing space.

tim fagan

The biggest challenge is to keep up with consumer product trends. There have been many developments in terms of household appliances, including combining various functionalities. Coffee makers also evolved with the introduction of capsules and single-cup serving units that yield faster brewing and more flexibility to cater to personal taste. Adapting these developments to an aircraft environment involves investment to meet certification requirements, but these investments are critical to continue advancing the passenger experience on our products. Therefore, Bombardier keeps adding new appliances.

What are the biggest challenges in galley design?



SUPERJET WISH LIST

Sukhoi Civil Aircraft Company (SCAC), manufacturer of the Sukhoi Superjet 100, concentrated on the key challenge of balancing work and storage spaces on its latest business jet galley. The company also notes growing demand for fresh, restaurant-grade food, cooked on board. "We will need to find ways to fry and grill food on board, enable several things to be cooked simultaneously, and incorporate more storage for fresh and frozen food," says a spokesperson. "We also need to enable people to prepare beverages in the way they are on the ground."

The company believes future advances will include being able to control the galley remotely. "Other opportunities for improvement include improving ergonomics, reducing weight and power requirements further, and informing personnel about the condition and time remaining to cook the food," the spokesperson says. "We would also like to see more equipment aimed at fulfilling our customers' demands; for example, we need special devices for cooking Asian dishes."

TRAY CROW

We worked closely with our customer advisory board and advanced technology customer advisory team in designing the G500 and G600 galleys, to identify the options needed. We have focused on flexibility by providing options for storage and equipment placement. The refrigerator can be placed beneath the countertop or above it, and there are also options for where to place ice and waste storage.

TIM FAGAN

In our latest galleys, we introduced a new coffee maker that offers single-cup servings using multiple capsule brands. We are introducing a multimode oven on the Global 7000 and Global 8000. We worked extensively with our customer flight attendants, holding workshops and building full-scale mock-ups to ascertain the right balance of layout, storage and working space. Ergonomics have also been improved. We have optimized work flow by relocating the oven and other appliances to the best height, grouped appliances that serve similar purposes, and maximized work surfaces by either relocating elements or taking advantage of more compact elements.

What work have you done recently in this area?

GALLEY EQUIPMENT

STEVE DASCHEL

We have developed certified modifications to existing galleys and installed new, custom galleys to optimize layout and equipment for each customer. For example, Crystal AirCruises' B777-200LR will serve gourmet meals to a higher number of passengers than is typical for a VIP or executive aircraft. Therefore, the galleys were outfitted with ample oven, chilling and storage capacity, and the aircraft also has a custom wine chiller. We engage with suppliers continuously to find new technologies.

DARON DRYER

We have been working to optimize space and equipment stowage so there is more room for diverse meal preparation items to accommodate multiple tastes and cultures.



049

DARON DRYER

I'd like to see a less industrial look and form factor, with more choice in terms of colors and finishes, and the ability to plate trim pieces without excessive modification or certification. More interesting surface geometries, for example, convex or concave front surfaces, could be achieved via modular panels.

STEVE DASCHEL

A dream galley would enable fresh food to be prepared by professional chefs. It would feature certified professionalquality appliances, along with full-size sinks, infrared heat lamps, ample refrigerator/freezer capacity, multiple warming ovens and abundant dry storage. There would be high-grade finishes, stainless-steel work surfaces and plated hardware. The challenges of such a galley would be to secure utensils and hot food during turbulence and contain odors. Equipment must be qualified to stringent safety requirements and fit into compact spaces.

What opportunities remain for improvement?

TRAY CROW

We are always looking for new ways to enhance the cabin experience, and the galley is no different. As expectations for the inflight experience evolve, the galley will need to meet those expectations as well.

TIM FAGAN

We find ways to build a better galley with each new interior program. As new materials and appliances appear in the market, we evaluate how to incorporate them into our product.

OFFERING MORE CHOICE

A new coffee maker, designed to offer greater versatility, was unveiled at Aircraft Interiors Expo in April 2017. It is the latest development from inflight coffee expert Aerolux.

"We have been manufacturing galley equipment for 30 years," says Jane Robinson, director at the company. "Our reputation for quality was gained primarily with the tremendously popular Nespresso coffee maker. More than 3,000 units are still in daily use in the first and business class galleys of major airlines, and of course, on private and corporate jets. A couple of years ago we thought it was time to reconsider its place in the market; we thought: developing its new machine. "The capsule is 'Let's see if we can do better!" being challenged by the pod as the means of

Discussions with numerous companies led to the conclusion that people didn't want to be tied to one coffee brand. "Everyone wants choice – not just the end user, but also the designers and engineers who select and install these devices," says Robinson. "The coffee market has seen tremendous growth over the past 20 years. Today, everyone's a coffee connoisseur, and there isn't one brand that satisfies every taste."

Aerolux prioritized offering choice – of the delivery system and the coffee supplier – in

developing its new machine. "The capsule is being challenged by the pod as the means of delivery, and our new machine will be able to handle both systems," says Robinson.

She adds that the new product has received great feedback. "The interest is high and we're talking to several coffee companies about introducing their products to the airlines, along with our new, more versatile, coffee maker," she adds. "Maybe some coffee aficionados would even like to drink their own personal blend. Offering choice is important to us; bespoke solutions have always been our core business.





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TWO EXCITING NEW LIGHTING TECHNOLOGIES ARE COMING TO STEAL THE LIMELIGHT FROM LEDS Words by Rob Coppinger



A recent Markets and Markets report projects the overall cabin lighting market to grow at a CAGR of 5.08% between 2016 and 2021, from US\$1.89bn to US\$1.89bn to US\$2.43bn

"A single RGB LED can produce a wide variety of colors, by mixing the intensity of its red, green and blue light sources"



MAIN: AIM ALTITUDE'S AUTONOMOUS LIGHTING DIMMER

ABOVE: THIS WINDOWLESS CABIN CONCEPT BY TECHNICON DESIGN IS ANOTHER TO USE OLED PANELS n terms of VIP aircraft cabin lighting, the top end has been dominated by LEDs for some time. The industry has been moving away from fluorescent bulbs because of their inferior light quality, higher power consumption and the difficulty of controlling their output for subtle cabin illumination – unlike LEDs which are basically a form of easily controlled diode. However, the main reason for ditching fluorescent bulbs is that they require high-voltage transformers and can place quite a load on the aircraft's electrical system.

LEDs, meanwhile, provide more subtle shades of color, starting with whites that can range from warm to cool. A single RGB LED can produce a wide variety of colors, by mixing the intensity of its red, green and blue light sources using pulse width modulation. Crew members or passengers can often control brightness and color through the CMS, or select from predefined scenarios. Advances in brightness have even led to LEDs being used for external lights.

SMART LIGHTS

AIM Altitude has developed an interesting product to complement mood lighting, which is in airline service. Its Autonomous Lighting Dimmer (ALD) ensures that monochrome LED lights integrated within monuments brighten or dim autonomously, in line with the ambient cabin light level, without any connection to aircraft data protocols or input from crew.

The first generation has been in service since November 2012, and a second generation entered service with AeroMexico in late 2016. The updates ensure the product meets Boeing 787 lightning strike requirements, and enables switched input for multiple zones. Each unit can control approximately 10m of linear LEDs.

Another example of smarter products is Zodiac's Heliott reading light, which adjusts automatically to the passenger's movements so that they don't have to adjust the beam when they shift in the seat.







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WE DESIGN, ENGINEER AND MANUFACTURE THE ULTIMATE AEROSPACE READING LIGHTS.

"As light technology changes, designers can be more creative and utilize light in new ways," says Steve Daschel, senior director of engineering at Greenpoint Technologies. "Examples include colored accent and wash lighting with programmable scenes, and artwork with integrated lighting, such as etched Lexan panels with illuminated edges. LEDs are also integrated into decorative features for purposeful illumination. LED fiber-optic light effects are also employed in conjunction with new laser projectors that simulate light scenes, such as clouds or starry skies."

However, despite RGB LEDs' popularity with those seeking to create dramatic mood-lighting scenarios, Innotech Aviation reports that the technology is still not common in business jets.

PANELS OF LIGHT

One of the new technologies that could replace LEDs for some applications is electroluminescent (EL) material. Layers of the material are formed into panels that emit light when electricity passes through them.

EL panels are very thin, so can be glued to other materials in the cabin. The panels are also flexible, cold to the touch when switched on, and come in different colors. But as each panel is one color, multiple panels are needed to display multiple colors.

At NBAA 2015, Aircelle announced EL variable display lighting for engine nacelles or the fuselage. It

provides a glowing effect for a corporate logo or other branding, using about 7W of power. The most likely applications for EL panels are to decorate or provide accent lighting on cabinetry, bulkheads, ceilings, countertops and sideledges. They could also be used for floor emergency lighting and exterior effects.

However, Gesse Sciacca, director of new products at Innotech Aviation, believes that EL panels will, like fluorescent bulbs, suffer from their reliance on high-frequency AC power. He says that technologies that use DC power



BELOW: MOOD LIGHTING AND BACKLIGHTING CREATE STRIKING FEATURES IN THESE CONCEPTS BY AIRJET DESIGNS



25% Automatic dimming
25% EL panels
50% OLED panels



EL PANELS

An electroluminescent (EL) device consists of a material that produces light when electricity passes through it. This makes it like a laser, but it requires far less power and does not produce a beam of light.

EL devices have been used for lamps and backlights in the consumer market. They are made up of a series of layers – typically six. The first layer is a usually a rigid insulator like glass, the second a conductor, the third an insulator, the fourth a layer of phosphors, the fifth an insulator, and the sixth another conductor. The insulation layer is to stop the two conducting layers creating a short circuit, stopping the device from working. The phosphor layer generates the light.

"OLED panel technology is used in the building, automotive and design industries, but hasn't found its way into aviation yet"

ABOVE AND RIGHT: A BACKLIT MIRROR PARTITION ON A DASSAULT FALCON 2000, INSTALLED BY JET AVIATION BASEL

> LEFT: IMAGE PROJECTORS ARE A KEY PART OF PAGANI'S ACJ319NEO CONCEPT

 such as LEDs and organic LED (OLED) panels – will be more practical to use in aircraft applications.

ORGANIC LIGHTS

OLED panels are very thin and flexible, with low power demands. Innotech Aviation has been experimenting with OLED panels that provide enough brightness for lighting and can generate colors while being less than 1mm thick. The company envisages the ceiling or sidewalls being

covered with a series of OLED panels that can be used to light the cabin or, with more complicated electronics, display a starry sky or whatever imagery the owner wants.

WINDOWLESS CABINS

The technology is key to several windowless cabin concepts, including those proposed by Technicon Design and Pierrejean Design Studio.

> Sciacca says OLED panel technology could gain certification within 12 months. "It is used in the building, automotive and design industries, but hasn't found its way into aviation yet," he says.

> The future of lighting in the private aircraft cabin then is that it will be subtle, its point of origin difficult to discern, while the overall effect will be more natural. Uneven illumination and obvious spotlights will go, and instead passengers will enjoy a sunset or sunrise for a lot longer, in the wrong direction and with a richness of colors more akin to a Hollywood movie.

ORGANIC LEDS

With OLEDs, the word 'organic' refers to the fact that the material used consists in part of carbon.

OLED pixels consist of layers, two of which are a cathode and an anode. Electricity passes between these like in a battery. Between the cathode and anode are two organic layers – the light-emitting layer and the transporting layer, which allows photons to pass through to the anode. This sandwich of cathode, emitting layer, transporting layer and anode sits on a glass layer, through which the light is seen.

OLED technology is used for televisions and the light can be a picture. Glass is not needed and OLEDs can be flexible and rollable. However, the layers must be enclosed as they are susceptible to moisture. OLEDs can be printed, making production low cost.



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FLYING COLOURS CORP REVEALS ALL ABOUT THE FIRST REFURBISHMENT TO COMBINE CUSTOM ELEMENTS WITH PRE-ENGINEERED COMPONENTS FROM INAIRVATION Words by Izzy Kington

TTTTTT

a contraction



"The client benefits from incorporating an off-theshelf solution that has already been through rigorous design, testing and development" The aircraft is privately owned and will be flown for business and pleasure, mainly in North America

TIMELINE

APRIL 2016 Client tasks FCC with extensive overhaul of Global Express incorporating Inairvation components

> JULY 2016 Design freeze; design engineering begins

NOVEMBER 2016 Interior and paint work begins

FEBRUARY 2017 nairvation components delivered

MARCH 2017 Aircraft redelivered

ABOVE: THE AIRCRAFT'S EXTERIOR WAS REPAINTED DURING THE REFURBISHMENT DOWNTIME

RIGHT: KATE AHRENS, HEAD OF DESIGN AT FCC he first aircraft to incorporate a pre-engineered retrofit package from Inairvation – the 50/50 joint venture between Lufthansa Technik and F/List – has now been delivered. The classic 2003 Global Express was refurbished by Flying Colours Corp (FCC) in Peterborough, Ontario, Canada. Custom fittings designed by the completion center were combined with Inairvation components including sideledges with integrated control panels for Lufthansa Technik's nice HD IFE/CMS, as well as granite countertops and stone flooring from F/List.

Kate Ahrens, who led the design for FCC, explains that the approach saved the client time and money while still enabling customization. "The Inairvation package has been carefully designed to ensure it will work with all Global 6000 floorplans," she says. "The client benefits from incorporating an offthe-shelf solution that has already been through rigorous design, testing and development; he doesn't have to pay for the process again. However, the interior is designed to his specification too."

> FCC has worked with this customer on various projects over the past decade, and he was also already a fan of F/List's stone products, having chosen them for previous aircraft. This cabin was honed over the course of three major design sessions with the client. "He

UPHOLSTERY

The refurbished Global Express features some eye-catching materials besides its carbon fiber. The seats feature three types of leather from Townsend Leathers. From the front, they offer a mix of Classic cowhide in pale beige and an insert featuring a Cardamom-color cowhide embossed with an American alligator pattern. The back of each seats is covered with Aniline Gaufrage, an embossed and hand-rubbed cowhide. The contrasting look is completed with piping in Kelly Green.

The lower sidewalls and sideledges around the seats emulate the alligator look, but also incorporate a chain-link pattern to reflect the intricate double twill pattern of the carbon fiber.

Hermes and Kravet Couture fabrics were also used to add refined details.



requested an elegant, but comfortable, stylish cabin interior using a cream and green palette," says Ahrens.

COMPLETE REFIT

Nearly every aspect of the aircraft has been refurbished or modified. Tony Barrett, vice president of completions and modifications at FCC, reports that the company had to design the integration of the CMS/IFE components - in addition to a new multicolored LED mood lighting system from B/E Aerospace - into the cabin monuments. "The galley, bulkheads, PSUs and so on all required significant modifications to accept the new components," he says.

ABOVE: THE 2003 GLOBAL EXPRESS PRIOR TO THE REFURBISHMENT

ABOVE: THE FINAL CABIN, WHICH TOOK FIVE MONTHS TO INSTALL AND CERTIFY

The sidewalls have also been completely

refurbished

RIGHT: TONY BARRETT, VP OF COMPLETIONS AND MODIFICATIONS AT FCC

Other new components include a Gogo ATG 5000 system for improved connectivity across North America, and seats based on the new Global 6000 frame from B/E Aerospace.

The main cabin has two seating areas – the first with four reclining seats and the second with a club-four plus one seat placed in front of a custom-made work desk in carbon fiber. The aft cabin has a three-seat divan and two more seats – which can be made into a double bed. There is a lavatory at each end of the cabin, plus an aft galley.

CARBON CHALLENGE

The carbon-fiber veneer – used for all major monuments, tables, sideledges and lavatory vanities – was probably the biggest challenge for FCC. "Our team has conducted a lot of research and testing to make sure we understand the true capability of this material," says Ahrens.

"The presence of so much carbon fiber is unusual," says Sean Gillespie, executive vice president at FCC. "The material is more fragile than wood veneer so requires careful handling. However, we have used it in several interiors so we know how to use it to its best effect."

"Where matching flammability coupons couldn't be sourced, we had to generate representative coupons and have them approved"

The key challenge was lining up the complex pattern, particularly in areas where numerous surfaces meet – for example, in the galley and around the work desk. "Wood always has a distinctive grain but it is not uniform," says Gillespie. "Strangely, it was even harder to align the carbon-fiber pattern correctly. An area like the club-seat configuration has so many different parts – including tables, sideledges, PED holders and other small sections – that it requires painstaking attention to detail to ensure a homogeneous pattern." A certified material was used, so there were no further certification tests. "However, composite burn testing was completed for each of the build-ups," says Gillespie. "All the modifications, new surfaces and system updates required testing."

HOT TOPIC

Barrett says flammability certification was a challenge on this refurbishment – more than 90 flammability tests were conducted. "Many of the monuments, sidewalls and other cabin elements on this model are made from materials that are not readily available today," he explains. "Where matching flammability coupons couldn't be sourced, we had to generate representative coupons and have them approved. In addition, the Inairvation sideledges have many new features, accounting for 40 of the flammability tests."

The installation of the wi-fi system on an aircraft that previously had none necessitated a Testing Personal Electronic

The IFE/CMS includes a wireless interface for iOS and integration and a integration and a Hollywood studio content service



LEFT: POWER OUTLETS ARE HIDDEN INSIDE THE SIDELEDGE COMPARTMENTS





BELOW: THE AIRCRAFT'S ORIGINAL LAYOUT WAS MAINTAINED



LEFT: FCC ADDED UPHOLSTERY TO NEW SEAT FRAMES SUPPLIED BY B/E AEROSPACE

Devices (T-PED) plan. "Although we've installed these systems on many other aircraft, it was a first for this model, so we had to certify it and perform a T-PED test," says Gillespie. "This ensures that the addition of a new electronic system doesn't

negatively affect existing systems. The test confirms that the aircraft systems are immune to the frequencies used by the PEDs that passengers will carry on board."

T-PED TESTING

A third-party specialist performed the testing to FCC's plan. "For a T-PED test, the aircraft is tested in its finished configuration, so much time is spent beforehand to ensure the interior is protected from damage, and in setting up the equipment, which is extensive," says Gillespie. "The test involves subjecting the aircraft to various specific frequencies, in an attempt to cause interference. In this case, the test was conducted in one very long shift exceeding 12 hours."



INAIRVATION'S APPROACH

In the July 2014 issue of this publication, Philip von Schroeter and Werner Kartner, the co-CEOs of Inairvation, explained that the 50/50 joint venture between Lufthansa Technik and F/List (also partnering with Schott for lighting and Design Q for design) was established to enable major component vendors to partner as tables and flooring with integrated lighting) and the most efficient engineering/installation process

The new livery

includes a carbon-

fiber pattern and

honeycomb design

possible, with no fighting over aspects

The company is targeting OEMs and completion centers for baseline designs - and in November 2015 it signed up to the Aerion AS2 supersonic jet project. In addition, Inairvation has expanded its portfolio by launching a retrofit program for Bombardier Global and Challenger types, as well as the Gulfstream G450 and G550. versatile VIP and business jet seating product, to its portfolio.

The final step was a functionality test flight. "This flight is conducted to make sure that all the systems work to the customer's expectations, and to make any final tweaks as necessary," says Gillespie.

The aircraft was delivered on time, and

LEAN AND LINES

BELOW AND TOP INSET: INAIRVATION'S SIDELEDGES, WHICH ARE SUPPLIED WITH THE LUFTHANSA TECHNIK NICE HD IFE/ CMS ALREADY INTEGRATED

CENTER INSET: SEAN GILLESPIE, EXECUTIVE VICE PRESIDENT AT FCC

BOTTOM INSET: MOST OF THE MONUMENT SURFACES FEATURE CARBON-FIBER VENEER, ACCENTED BY A DARK EBONY WOOD Gillespie partly credits its success to FCC's lean methodology. "For a refurbishment as intense as this, the ability to tightly manage the project is essential," he explains. "Lean manufacturing kept us on schedule as we could run various elements in parallel – for example, while the cabinetry team modified the cabinets, the upholsterers worked on the seats, the avionics experts worked on the Gogo ATG 5000 system, and the paint team planned their activity."

A key factor was maintaining open lines of communication

Tony Barrett of FCC says only minor design tweaks (regarding design tweaks (regarding component placement) component placement) were made during the were made during the installation, thanks to a installation, thanks to a installation, thanks to detailed onboard audit detailed onboard audit during the design phase

with Inairvation. "Working so closely with a European partner was very new for us as we pride ourselves in having all required skills in-house," says Gillespie. "However, Inairvation was great to work with and by talking regularly we could make sure that the new CMS/IFE system and customized sideledges worked with the existing aircraft systems and airframe."

"When such an innovative project as this takes place, involving many new elements and new partners, it is important to ensure that everybody has a common understanding of what is happening," adds Barrett. "The cooperation has benefited the project by ensuring we can fulfill the customer's expectations within the timescale and budget requested." @

PAST GLORIES

The owner of this Global Express has been a regular client of FCC's for a decade. "We have completed a number of projects for him, the most notable being the conversion of an S92 helicopter cabin into a corporate configuration a couple of years ago," says Sean Gillespie of FCC. "The main theme of this striking refurbishment is an electric blue color. The project also included F/List's stone veneer flooring."



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CONNECTING FLIGHT

Following three years of intensive research and development, a new system is arriving that will enable passengers on any business jet, commercial aircraft or VIP wide-body to experience full cabin control

he latest version of SELA's Clematis system will be fully qualified by the end of 2017, the company reports.

"This is no common CMS, but also a gateway for new cabin technologies, which will be announced in the coming weeks," comments Frédéric Relea, sales and marketing manager at SELA.

Clematis will enable passengers and crew to control cabin lighting and other equipment using a smartphone, tablet or other electronic device – an approach that SELA believes cuts down on wiring and weight as well as simplifying use.

CUSTOM INSTALLATIONS

The software can be customized to suit the cabin configuration. The application does not require uploads or updates, cutting management costs. The software, located in a master unit controller, can be accessed by operators and maintenance staff using a web address. Additionally, SELA can access the software remotely, for maintenance purposes, wherever the aircraft is located in the world.

"Already used in several ACJs to manage lighting, Clematis is now being developed so that it can be configured for new cabin installations or retrofits very



TOP: THE SYSTEM WILL ENABLE GREAT CONTROL OVER MOOD LIGHTING COLORS

ABOVE: THE SOFTWARE IS CUSTOMIZED TO REFLECT EACH AIRCRAFT'S LAYOUT

BELOW: THE CMS PORTAL



easily and quickly," explains Relea. "It is being developed with a design-to-cost target, particularly bearing in mind the needs of the cabin retrofit market. A standalone installation is the proposed solution for retrofit projects, because it makes the cabin modification easier."

A first issue of the new documentation is now available. It explains the system philosophy and principles of management in great detail.

In conjunction with sister company Bigorre Aerospace, SELA will display a demonstrator system at NBAA 2017, which will be held in Las Vegas, Nevada, on October 10-12, 2017. 🗞

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LEADING LIGHTS

The aircraft interiors lighting market is an innovative sector that is always striving for new developments and technologies – not only to improve the customer experience, but also to facilitate easier installation and maintenance



THE MONO CS FIXED-POSITION LIGHT, LAUNCHED IN APRIL 2017. HAS AN 11MM-DEEP PROFILE

abin lighting design has evolved dramatically over the past 10 years, according to Gina Amies, director at Beadlight Aerospace. "Lights are used to create atmospheres, define zones and even promote branding - all of which helps cabin designers to create a more comfortable environment for customers," she notes.

Using lighting to create an atmospheric, personal zone within an area helps enable a space to be used more effectively, argues Amies. "The development of LEDs has aided this," she adds. "For example, a reading light has a defined light cone, creating a task light that is controlled within an area. This defined use of LEDs has almost completely removed unwanted light pollution in the cabin."

THE VORTEX READING LIGHT IS MADE FROM ALUMINUM AND AVAILABLE IN A VARIETY OF FINISHES

Beadlight Aerospace works with customers to ensure the correct light intensity and cone for their application, applying different mechanical and optical techniques to ensure the optimum result.

Beadlight products are available for

Airbus and

Boeing aircraft

types

Qualification testing is planned and managed by the company's in-house certification engineers, in line with Airbus or Boeing standards.

AMBIENT LIGHTING

Meanwhile, Amies says ambient lights are becoming increasing popular in the market. "They are used to help create a more comfortable, homely and relaxed feel," she says.

Beadlight has designed ambient lights featuring up to six switching levels to allow passengers or crew to set the required level.



BEADLIGHT HAS ALSO DEVELOPED TABLE LIGHTS, INCLUDING THIS OVAL DESIGN

While creating the optimum lighting for the end user is the most important factor for Beadlight, it is also important that the installation is efficient. The company works with interior designers to ensure that the lights can be integrated into the design easily, offering front- and rear-fix options.

"When considering the cabin lighting design, it is important to assess your requirements early on in the design process," advises Amies. "This way you can take advantage of exciting new technologies to create a truly first-class environment on board." 🔊

FREE READER INQUIRY SERVICE To request more details from Beadlight Aerospace, visit www.ukimediaevents.com/info/aimbj
COOL OPERATOR

The tried-and-tested wine chiller from Aerolux can satisfy VIPs' champagne cravings rapidly

The Aerolux Wine Chiller was originally designed for use in the first-class cabin for prestigious airlines including Etihad, Singapore and Qatar.

The trays were made so that champagne bottles fit perfectly while allowing air to circulate, chilling the drink to the perfect temperature and keeping it there. The product features an automatic rapid pull-down time as standard, to ensure the drinks are chilled quickly.

"As there are only around 10-20 passengers in an airline's first class cabin, the Aerolux Wine Chiller is ideal for business jets, where a similar number of passengers must be catered for," comments Jane Robinson, director at Aerolux. "A galley insert like this makes a statement and goes part of the way to delivering the service that business jet owners demand."

While being designed to deliver champagne, the unit can be adapted to suit any wine, and the temperature settings can be adjusted accordingly.

Aerolux is also happy to discuss making a wine chiller or other refrigerator as a bespoke item to meet a client's particular needs, whether that involves modifying the unit's internal configuration or its external design and controls. The company has worked as a supplier to aircraft OEMs and completion centers for 30 years, and continues to supply them with individually designed and finished products. ©



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INDEX TO ADVERTISERS

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Air Cabin Engineering Inc.	55
Aircraft Lighting Internati	onal59
AMAC Aerospace Switzer	land
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Beadlight Ltd	

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DPI Labs	Outside Back Cover
Garrett Leather	
HighTech Finishing	
IDAIR GmbH	3
Innovative Advantage	51

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NBAA	32
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TrueNorth Avionics	5
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THE NAUTICAL WORLD AND ART DECO INFORMED THIS OPULENT DESIGN FOR A KNIGHTSBRIDGE PENTHOUSE

The interior of this 7,500ft² penthouse in London's exclusive Knightsbridge area is the work of Winch Design, a familiar name in the aircraft and yacht industries.

In fact, inspirations for this project include nautical design and the art deco period. The latter is evident in the oversized moldings, timber paneling, marble floors and glasswork.

The interior makes dramatic use of color, particularly when it comes to the structural concrete columns, which are wrapped with curved, interlocking gold tiles made from glass.

The entrance and hallway were designed as a gallery to display the client's artwork. One highlight is the foyer's orchid-motif marble panel, which is lit by 96 etched-glass cylinders.

The apartment also features a dining room, living areas and four bedrooms, each of which has an en-suite bathroom and dressing area.

A distinction was made between formal and family areas. Winch Design reconfigured the layout of the apartment so that all of the formal spaces would face London's Hyde Park.





OTHER EYE-CATCHING DESIGNS FROM VARIOUS INDUSTRIES...



This is the McLaren 720S supercar with an interior highlighted by Jet Black and Xenon Yellow leather. Carbon fiber was used for the roof panel, rear bumper, door sills, bonnet inlets, mirror casings, rear fender air intakes and front splitter.



This 41.4m superyacht, Ability, was previously owned by famous fashion designer Roberto Cavalli. When it came to refurbishment, Designer Touches created a design featuring couture-inspired colors, animal prints and natural fabrics.



The Sweptail, a custom version of the Rolls-Royce 103EX, features a minimalist and modern interior with two big surprises – a mechanism in the center console that deploys a champagne bottle and two crystal flutes, and hidden panniers for matching attaché cases.

two of a kind





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