



sound advice

EXPERTS SHARE THEIR RECENT
EXPERIENCES OF CREATING
OPTIMUM SOUND QUALITY
ON BOARD

Words by Marisa Garcia

“Some of the latest consumer trends include more advanced surround sound, wireless audio and voice control”

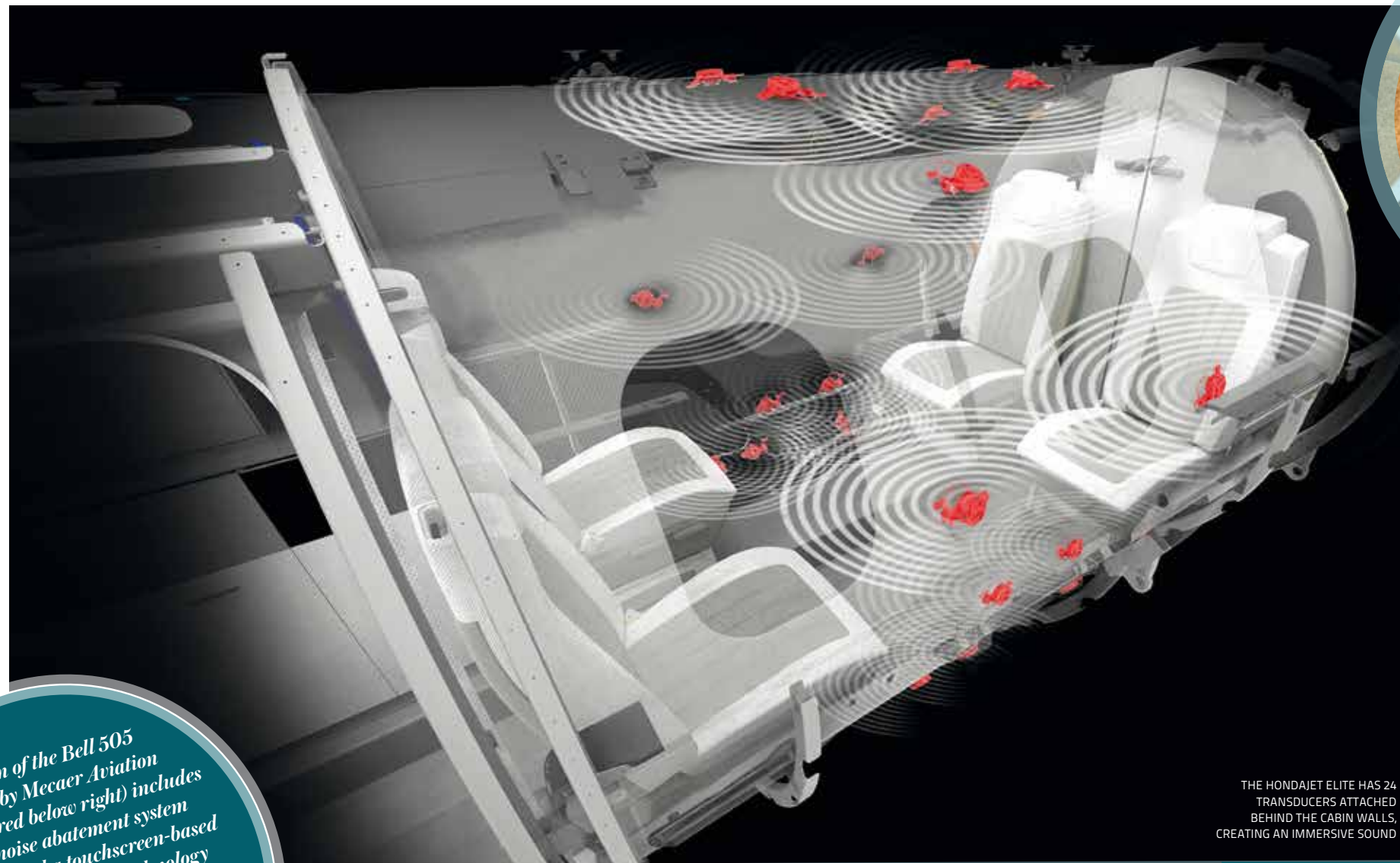
Consumers around the world allow a sizable share of their income to travel and entertainment. In China, for example, consumers now spend as much of their income on this category (14%) as they do on housing, only slightly less than they spend on food (20%), and more than they spend on clothing (9%), according to a recent survey by Credit Suisse. Ratings firm Nielsen describes China as “a music market of enormous potential”. Among the most affluent consumers, 83% listen to music for an average of 16 hours a week. Most of these listeners, 71%, rely on a streaming service. Sound quality is also very important to them, with 24% of all Chinese consumers and 28% of millennial consumers investing in high-end, specialized headphones.

DEDICATED FOLLOWER OF FASHION

Steve Scarlata, vice president of engineering and R&D at Alto Aviation, a specialist in private jet sound systems, sees growing demand. “Some of the latest consumer trends include more advanced surround sound, wireless audio and voice control,” he adds.

However, the biggest trend Alto has seen relates to the use of PEDs. “This is being driven by the widespread adoption of cell phones and tablets as the main source of entertainment,” says Scarlata. “Customers like to support and stream content from these devices, so the sound system needs to provide easy interface and high-quality sound. Alto Aviation has experienced a marked increase in the installation of systems providing full cabin audio with just an auxiliary input panel providing line input, USB charging, Bluetooth audio or HDMI connection. This can eliminate the need for a full, complex CMS.”

A version of the Bell 505 outfitted by Mecaer Aviation Group (pictured below right) includes a passive noise abatement system called Silens, and a touchscreen-based IFEC system. Bluetooth technology enables passengers to listen to music from their PEDs and take phone calls during flight. Bose headsets are powered by the aircraft, so passengers don't have to worry about batteries

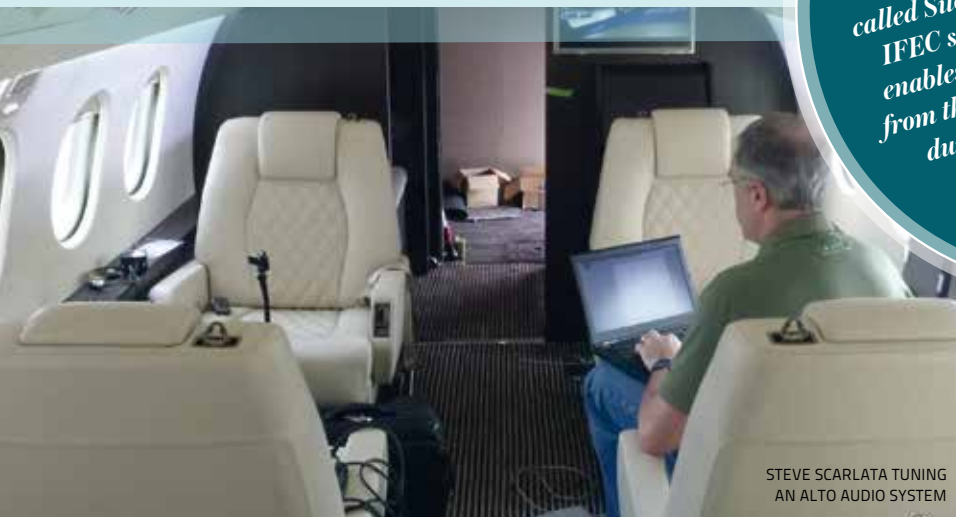


ABOVE: ALTO'S CADENCE SWITCH PANEL FOR BLUETOOTH INPUT SELECT AND VOLUME CONTROL

BELOW: AN ALTO DX-135 INSTALLATION ON A LEARJET 60



THE HONDAJET ELITE HAS 24 TRANSDUCERS ATTACHED BEHIND THE CABIN WALLS, CREATING AN IMMERSIVE SOUND



STEVE SCARLATA TUNING AN ALTO AUDIO SYSTEM



The Alto R&D team has also been challenged to accommodate unique requests several audiophile customers who demanded a system with performance far above the standard offering.

REBEL YELL

Aesthetics are also influencing installations. “We are seeing some avant-garde cabin designs that really deviate from the traditional styling of the above-seat PSU rail,” says Scarlata. “The conventional locations for speakers are often dramatically re-styled or eliminated completely. On a recent project, we worked closely with the MRO to find ways to scale up the installation and optimize the loudspeakers and amplifiers while still meeting all the certifications and weight requirements.”

As technology advances, there are new tools available to deliver high-end, custom sound systems. “Advanced materials such as graphene and composites, when applied to loudspeaker and enclosure design, promise

It's my IFE

The HondaJet Elite cabin features an industry-first Bongiovi Aviation speakerless in-cabin sound system, which is integrated into the interior panel.

The system adapts to various flight conditions and the content being

enjoyed, creating an immersive audio experience throughout the entire cabin.

There are 24 tiny transducers strategically bonded to the backside of the cabin walls, vibrating them to produce “bold, immersive sound”.

For the Global 7500, Bombardier used new acoustic materials and a special layering and assembly method to cut cabin noise

Metal guru

On Embraer's new Phenom 300E, the Lufthansa Technik nice HD CMS/IFE system was engineered to ensure the best sound quality while optimizing cabin design.

"Solid billet aluminum machined to .071 mm of material thickness helped provide a resonating sound in addition to the perforated holes of the speaker," explains a spokesperson from Lufthansa

Technik. "By consolidating redundant systems on each side of the cabin into the backbone of the airframe, we achieved a reduction in parts count and weight, in addition to increasing cabin space with better, reduced packaging."

Phenom 300E customers can also opt for a subwoofer, which is designed to give a bolder and more balanced sound.

"The audio quality and balance is tailored to the configuration of furniture and amenities of the space"

to improve sound quality and acoustic efficiency while reducing weight," says Scarlata. "Advancements in digital signal processing and electronics open many opportunities for enhancements in sound performance and the addition of features."

ON THE ROAD AGAIN

The pursuit of audio excellence is not limited to one-off cabins, it is also a consideration for line-fit models. For its Global 7500, Bombardier challenged itself to deliver a high-end sound system that would match what customers expect in their homes and cars. The OEM turned to new digital technology, cabin soundproofing, and new speaker arrangements.

"The sound system on the Global 7500 is completely new and features digital technology to provide the ultimate audio quality," explains Tim Fagan, manager of industrial design at Bombardier Business Aircraft.

Speakers are placed carefully throughout. "Each cabin suite has a specific arrangement of speakers and software to ensure that the audio quality and balance is tailored to the configuration of furniture and amenities of the space," says Fagan. "These speakers cover a very broad frequency range, to provide crisp and clear sound."

Bombardier created audio zones throughout the aircraft to ensure that the sound quality does not deteriorate even as passengers move around. "Each audio zone is also equipped with its own subwoofer, dedicated to the reproduction of low-pitched sounds," says Fagan.

ABOVE: TO OPTIMIZE AUDIO QUALITY IN THE GLOBAL 7500'S ENTERTAINMENT SUITE, THERE IS A SOUND BAR UNDERNEATH THE TV SCREEN, COMPLEMENTING THE PSU-MOUNTED SPEAKERS

BELOW: GLOBAL 7500 PASSENGERS CAN ADJUST VOLUME THROUGH TACTILE ROTARY CONTROLS

"Located in a bulkhead or under the divan, the subwoofers are equipped with a powerful bass driver as well as three passive drivers for extra depth of sound."

The audio system in the entertainment suite is designed to rival high-end home theater systems. "Depending on the aircraft configuration, this zone features a large TV screen with an opposing divan, complemented by enhanced audio features to provide an exceptional cinematic experience," says Fagan.

Each passenger service unit (PSU) speaker housing is equipped with a mid-





Bombardier's engineers tested the Global 7500's new sound system in a full-scale mock-up on the fourth flight test vehicle, which is dedicated to validating the cabin systems

LEFT: ALTO SAYS TUNING IS THE MOST IMPORTANT PART OF AN AUDIO SYSTEM INSTALLATION

BELOW: ALTO'S VERIFIER MEASUREMENT COMPUTER IN ACTION DURING TUNING

range speaker, a tweeter (a high-frequency loudspeaker) for special effects and percussions, and an additional passive speaker to add extra sound depth. "The PSU speakers feature high-quality acoustical fabric to allow for better sound transmission, while also blending with the aircraft's luxurious environment," says Fagan. "The subwoofer in the entertainment suite has a large resonance chamber for an especially powerful delivery."

A sound bar is placed under the television monitor to act as a center speaker and to complement the PSU-mounted speakers. "The soundbar is inspired by high-end residential systems and rotates with the television to always provide a direct and ideal projection of the sound," says Fagan. "This is especially important for higher-frequency sounds and to ensure that the audio is spatially coherent with the action."

The sound system also features dynamic compression. "This will modulate volume changes that can happen in a movie from one scene to the next, while maintaining nice contrasts and expression," says Fagan.

JIVE TALKIN'

Bombardier has also improved critical communications with the flight deck. "The passenger address speakers, which are used for pilot announcements, were designed to transmit clear messages from the cockpit without distortion," says Fagan. "The passenger address speaker grille openings form a Fibonacci spiral, an elegant pattern that can be seen in sunflowers, but that is also used in high-end automotive audio systems."

These grille openings feature hundreds of perforations milled out of a solid block of aluminum.

The company is not done innovating to improve entertainment on its aircraft. "We are keeping an eye on new trends in cinematic sound and theater experiences," says Fagan. ☒



High-flying bird

A "very sophisticated audiophile" recently contacted Alto Aviation to improve the sound quality in his new late-model Falcon 2000. He also wanted to be able to connect his PEDs to the aircraft's audio system using Bluetooth technology.

After surveying the aircraft and reviewing existing wiring diagrams, Alto designed an audio system that doubled the amount of subwoofers and mid/high speakers in the aircraft. The design also included replacing an existing analog audio amplifier with two new Alto digital amplifiers to provide 12 channels of entertainment audio to speakers dedicated to each channel. Emphasis was placed on speaker location in the forward cabin for optimum sound quality in the club seating area.

To provide an alternate audio source independent from the existing CMS, a Bluetooth receiver was installed and interfaced directly to an Alto DX-135 switching amplifier. A second Alto DA-230DC amplifier was also installed to provide the additional output channels required.

The amplifier was wired to an Alto Cadence switch panel to enable the owner to switch between the audio sources provided from the existing CMS and the newly installed Bluetooth receiver paired to his PED. Volume control and a speaker mute function were also included in the new switch panel.

As with every Alto audio system installation, an Alto engineer traveled to the MRO's facility to tune the system prior to the aircraft being delivered to the customer. The company says tuning is the most important part of the installation. The process includes acoustical mapping of the cabin using proprietary software, the aim being to determine the optimal system configuration. Acoustical engineers then fine-tune the digital equalization (EQ) within the amplifiers to suit the interior. "As speaker positions, the size of cabin, cabin fixtures and density of the carpet vary in every aircraft, it is extremely important to customize the EQ settings to achieve the best audio performance," says Steve Scarlata of Alto Aviation.