

# highrise

Pie in the sky or inevitable long-haul product development conclusion? A new generation of tiered seating and sleeping schemes aim to turn headroom into bedroom

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Both Airbus, on the A350, and Boeing, on the 747 and longer range 777s, have exploited the space in the crown of their aircraft fuselages, above the cabin ceiling, to provide crew rest areas. When it first revealed its overhead crew rest options, Boeing calculated that they would save up to four passenger seats and four cargo containers on the 777-200ER/LR, while the -300ER would save as many as seven seats and six cargo containers. Even in 2003, when Boeing revealed the scheme, that represented estimated savings of US\$4.9 million to US\$11.25 million over 20 years.

Boeing subsequently offered a SkyLoft option on the 747-8 Intercontinental, suggesting that the space in the crown to the rear of the aircraft could be used for first-, business- or even economy-class suites, additional main deck seats, a lounge, exercise area, galley or crew rest. The galley option, which made room for 12 more seats on the main deck, was the only one to find favour with potential airline customers, though some private buyers of 747-8s have opted to use the space – all 75m<sup>2</sup> of it – for berths and lounges.

However, a growing number of innovators are proposing to exploit the only unused volume left on a wide-body airliner – the overhead space available within the cabin itself. Approaches range from using small steps to squeeze a few more flat beds into business class through



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to a new generation of two-tier sleeping accommodation that could provide A380 economy-class passengers with their own beds.

**HOME FRONT** Sicma Aero Seat started working on its Make Yourself At Home (MYAH) arrangement of seats and beds as a concept demonstrator for this year's Aircraft Interiors Expo in Hamburg. "We wanted to show what the future could be," says marketing and innovation director Laurent Stritter. "And the more we worked on it the more we realised it was something feasible."

MYAH overcomes what Stritter says is a fundamental problem – the impossibility of making a seat that is equally comfortable in the upright, reclined and flat-out positions. It does so by combining a seat optimised for sitting with a dedicated bed located alongside the seat. And to avoid compromising the seating density, it staggers the beds vertically (using a series of platforms) so that they overlap.

The concept went down well in Hamburg, Stritter says, with three or four airlines asking for follow-up studies. He foresees no certification problems. "It's very straightforward in terms of dynamic testing," he says. "The passenger will be sitting on the seat for take-off and landing, so the innovation with the bed doesn't impact the dynamic certification."

In fact, he says, the only area where further work is required is to ensure that there is adequate airflow for proper ventilation of the beds: "It's really a matter of optimising the space vertically. So it could turn into reality quicker than we expected."

**THIRD DIMENSION** Aviointeriors has sought to increase the density of flat-bed business class seats while maintaining the same level of comfort. Compared with existing arrangements, whether conventional or staggered, Swiss-style, opposed, facing or herringbone, the company reckons to be able to fit more of its new Third Dimension seats: 21 in a cabin length of 187in, for example – five more than can be accommodated in an opposed or herringbone configuration and nine more than is possible with a staggered arrangement.

Technical director Gaetano Perugini says the motive is to provide a fully flat sleeping position without increasing seat pitch. In a conventional cabin configuration a fully flat

01. Sicma Aero Seat's MYAH provides a separate seat and bed

02. Aviointeriors' Third Dimension staggers seats vertically to deliver a flat bed at a competitive pitch

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bed suitable for a 95th percentile occupant requires a 77in pitch, he says, and other variations compromise density or privacy.

The Third Dimension seat combines forward-facing, aft-facing and elevated seats to enable the seats to overlap at different heights when fully reclined. The result, says Perugini, is that a bed equivalent to that available in a first-class seat with an 80in pitch can be provided in seats pitched at 63-67in. The seat's weight is comparable to that of a current full flat seat, with the same comfort solutions, a length of 78in and a width in the shoulder area of 25in.

The manufacturer had completed preliminary definition of the seat design and installation by the time of the Hamburg Expo. By June, Aviointeriors was finalising the specification of the necessary customised actuators with two potential suppliers. A static demonstrator mock-up was due for completion by mid-July, and an initial prototype by September.

For certification, the company adds, the standard forward-facing seat is comparable to a current seat and the standard aft-facing seat will have to satisfy established criteria for such seats. The central seat, which is about six inches higher than the others, presents higher floor track interface loads, but they will be neutralised by increased distance between the front and rear studs along with an adequate energy absorber.

**DOUBLE UP** Mexico City-based Airborne Hotel Systems (ABH) brought a full-scale mock-up of its 'abh' sleeper concept to Hamburg, with six seat-beds in four modules representing part of a premium-economy installation on the upper deck of an Airbus A380.

ABH traces the idea of two-tier passenger beds back 75 years to the Douglas Sleeper Transport, a variant of the



THE DESIGN ENABLES MULTIPLE ANCHOR POINTS TO BE USED RATHER THAN A SINGLE FLOOR ATTACHMENT



DC-3 whose 14 seats converted to seven beds while another seven bunks were folded down from the cabin's upper sidewall. Its own take on the concept is optimised for the A380 cabin.

The design enables multiple anchor points to be used rather than a single floor attachment so that the structure can be of lighter materials: each two-tier module is claimed to weigh the same as a conventional seat. Detailed three-class configurations developed for the A380 accommodate up to 580 passengers and the three aisles that are integral to the concept increase aisle space by 50% and mean 70% of economy-class seats would be next to an aisle. An ergonomically designed four-rung ladder provides access to the upper level without obtruding into the aisle, and each module incorporates its own baggage bin behind the video screen.

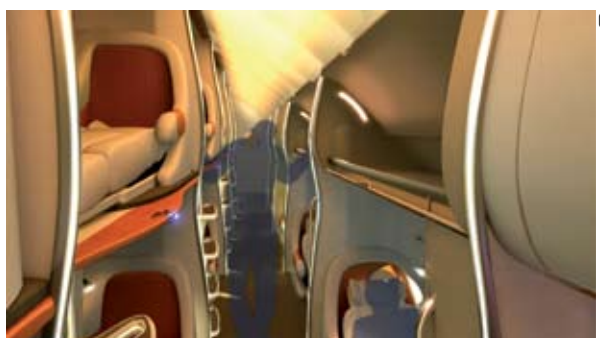
The company was formed in 2005, but the principals have been working on the concept since 1996 and patented it in 2002. Company president Carlos Martinez-Celis says visitors' reactions to the replica cabin section were generally favourable and enthusiastic.

Contrary to expectations, he says, "not one person mentioned feeling confined or ill-at-ease with their surroundings. Instead, they welcomed the prospect of having a certain degree of privacy." Opinions on specific

03-04 The Airborne Hotel sleeper concept features an ergonomically designed ladder



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“BI-LEVEL CONFIGURATIONS OFFER FAR MORE EFFICIENT USE OF SPACE, WHILE ENHANCING THE PASSENGER EXPERIENCE”

- 06. The abh concept includes single seat units next to the windows
- 07. MmilleenniumM Group's AirSleeper concept

parts of the overall design, such as video screen and service table location and premium-economy/business-class differentiation, will help with fine-tuning of the design's features and technical details, he says.

Martinez-Celis adds that Airborne Hotel Systems has also built and evaluated modules designed for economy-class cabins, and that the design can be adapted for other wide-body airliners from both Airbus and Boeing. The company anticipates that floor-level seats, which account for over 50% of the accommodation, would be designated as preferential seating for the elderly and handicapped.

Certification of any bi-level seating system is likely to pose a demanding challenge, Martinez-Celis accepts, but “we are also confident that careful designing and engineering will ultimately produce technical solutions that can overcome this issue,” he says. In practical terms, he says, bi-level configurations offer far more efficient utilisation of the available space within commercial aircraft passenger cabins, while enhancing the passenger experience.

**HUMAN FACTOR** US-based MmilleenniumM Group has set itself the ambitious goal of developing two-tier sleeping accommodation that will provide flat beds at between two

and three times the density of existing business-class seats and the same density as regular seating in economy and premium economy. Moreover, it aims to certify its patented AirSleeper for take-off and landing in any position, from fully reclined to upright.

MmilleenniumM's starting position is the view that an increasingly efficient infrastructure for business jets will drive the top tier of commercial air travellers towards fractionally owned private aircraft as airport congestion becomes a factor in their choice over the next 20 years. Consequently, the company believes, the mainstream commercial airline industry will focus more on the value segment. At the same time, says MmilleenniumM Group founder, chairman and chief executive Dr Arjuna I. Rajasingham, accommodation of human factors is lagging the long-haul performance of aircraft.

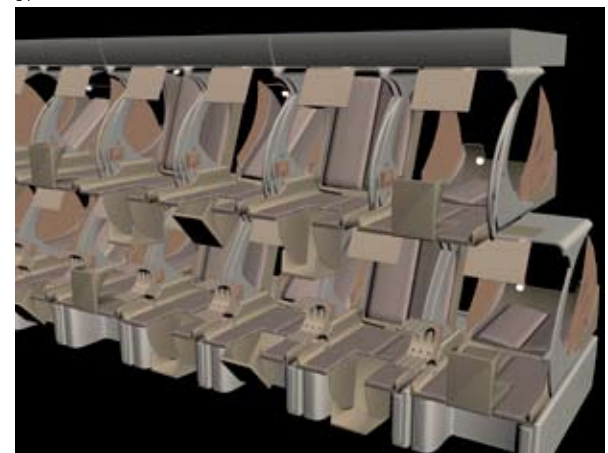
The AirSleeper aims to respond to those trends by offering the same comfort in a smaller volume so that passenger density can be increased, and by providing a new value attribute it terms ‘on-call sleep’. There's no requirement for modification to the aircraft, and the modular structure allows rapid redeployment of alternative architectures to allow a single aircraft to service diverse markets without significant down time, according to Rajasingham.

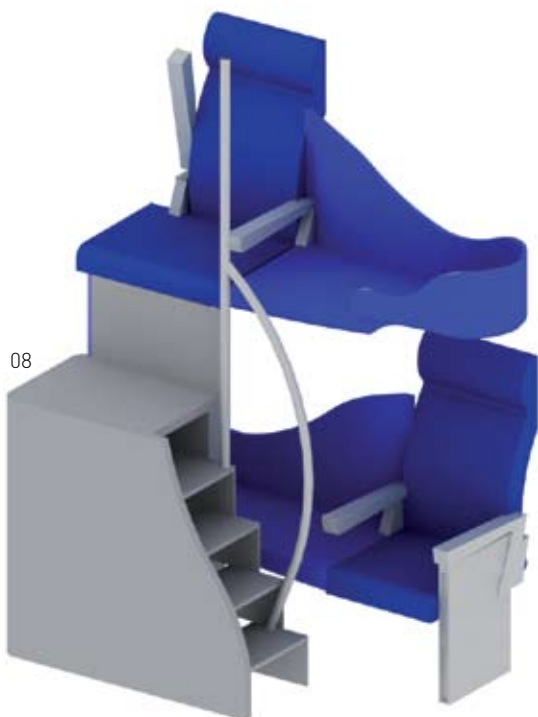
The design also addresses the ergonomic needs of cabin crew, he says, by optimising hearing proximity and reach for service at both levels. Most important, he stresses, is the fact that the AirSleeper is designed for safety, with a structure designed to withstand crash loads using standard seat tracks. All passengers would have immediate aisle access, making evacuation possible within the required 90 seconds.

**STEP UP** When Boston-based inventor Emil Jacob of Jacob-Innovations decided it was time to do something about the sleep deprivation he had suffered as an airline passenger, one of his first moves was to review existing ideas. He found patents going back decades, he says. “But none of them used steps.”

That, he believes, is the obvious way to provide access to above-the-floor passenger accommodation: “There are dozens of schemes that use ladders,” he says. “But to me

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THE BOTTOM LINE IS IT INCREASES DENSITY WHILE MAINTAINING A GOOD SET OF PASSENGER FEATURES



the simplest thing is just to step up in the same way you do in daily life.”

Three years on he has developed a suite of variations on the theme. His Flex-Seat, which uses cabin height to its fullest advantage, has a full upper tier of seats cum fully flat beds, each accessed via its own flight of five steps. The arrangement promises enhanced privacy, provides additional lateral space for laptop, papers or even baby-changing, and could include space for hold-size baggage.

“Each person will have a private space of their own,” says Jacob of the Flex-Seat, “which is why I say it’s superior to the business-class seat of today.” Better still, from the airline point of view, “the density would be about double a typical business class with fully reclining seats.”

Jacob’s Business-Flex1, which raises alternate rows of seats two steps so that the passengers sitting at floor level can extend their legs under the seat in front when fully reclined, increases density to a lesser extent but may pose less of a technical and certification challenge. Business-Flex2 – developed for an airline client who wanted 2m-long beds – combines the first two ideas, with two complete tiers down the centre of the cabin and alternate raised seats in the window columns. Another variation accommodates the same length of bed on the upper deck of a Boeing 747.

Designs that Jacob has developed for economy class include the Economy-Comfort, which raises alternate rows a single step of about 7in and enables seats to be reclined 45° while maintaining typical economy pitch. “This model is superior to premium economy designs in terms of recline,” he says. “But it offers the same density as regular economy.”

**STACKED SLEEPER** London-based design firm James Park Associates (JPA) came up with its stacked sleeper design, which effectively elevates alternate rows of seats so that they are above and slightly forward of the rows on the floor, in 2001. “It was originally done in conjunction with a client,” says JPA’s senior designer Ben Orson. “It’s not something we’ve developed much further for production,

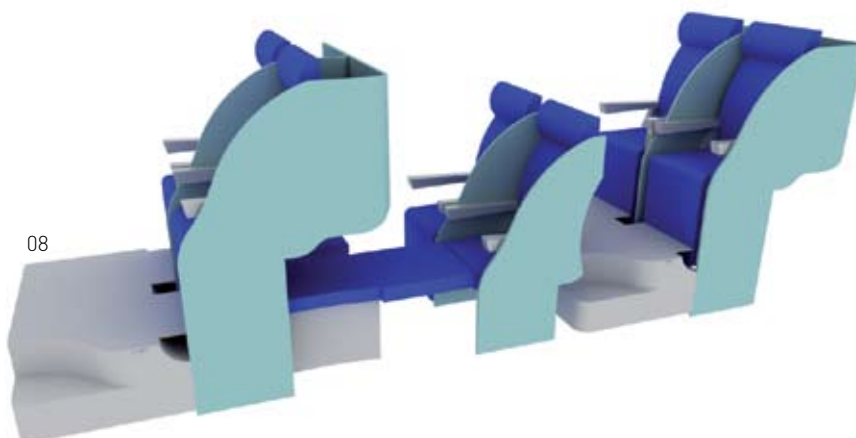
but it seems to be gathering more interest and momentum at the moment.”

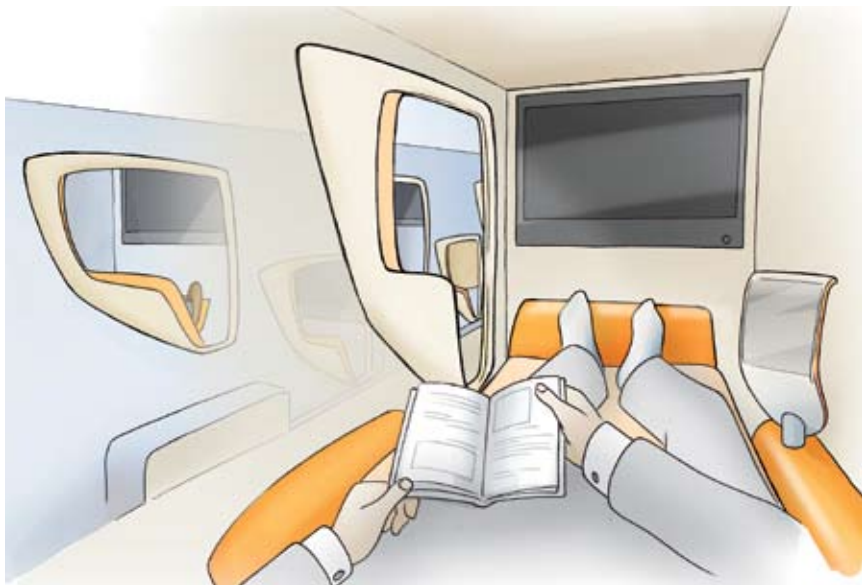
Stacking the pods or compartments, which individually mimic the function of a standard business-class seat, “allows you to effectively compress the rows longitudinally,” Orson says. “It gives you a very dense arrangement of fully functional seats, it gives the passenger a unique and nicely controlled environment to spend their time in. The bottom line is it increases density while maintaining a good set of passenger features.”

One advantage of the stacked sleeper is that it gives passengers a familiar environment, Orson says: “They’re not being asked to sit in a different position or have a peculiar view of the cabin, and I think some of the other concepts out there are compromised in that respect. If you look at the space available it’s reminiscent of a luxury car, with a relatively close ceiling and a screen in front of you, although it’s a TV rather than a windscreen.”

Turning the concept into in-service hardware would require some impetus from a customer with enough influence to persuade the airframers to consider it, Orson believes. “Getting this sort of thing certified and attached

08. Jacob Innovations’ Flex-Seat uses steps to reach the upper level  
09. BusinessFlex1 raises alternate rows of seats





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WE'VE TAKEN THIS TO A REASONABLY DEVELOPED LEVEL AND WE'VE NOT HAD ANY SIGNIFICANT SHOWSTOPPER FEEDBACK

10-11 James Park Associates began exploring the idea of stacked sleeper seats back in 2001

to the aircraft would be quite a big challenge.” Certification aside, though, “we’ve taken this to a reasonably developed level now and we’ve not had any significant showstopper-style feedback from any of the airlines we’ve spoken to.” Any installation would probably be on a forward fit basis, he considers. “If you look at how you’d engineer it, ideally you’d be looking at not just attaching it to the floor of the aircraft,” he says. And that might be too radical to be achievable as a retrofit.

**NO SEAT?** Another radical scheme, one that has recently attracted the attention of Ryanair chief executive Michael O’Leary and consequently of designers such as JPA, is the standing seat. Unlike the others considered here, this would exploit the more limited vertical space in a narrow-body airliner, and would invite passengers to trade comfort for lower fares.

“Again, you’re asking passengers to do something unfamiliar, and people on aircraft like to be in familiar surroundings,” Orson says. But it is certainly feasible, he believes: “It’s a perch seat with a backrest. It takes the bulk of the weight off your legs and allows you to support your back as well to make a short flight bearable. It’s actually a



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lot more akin to a traditional economy-class seat than the stacked sleeper is to anything else, so from the technological perspective I can’t really see any significant challenges in terms of making the seat itself.”

More problematic, he thinks, might be reinforcing the seat track attachments to cope with the additional crash load imposed by an increased number of passengers with their centre of gravity at a higher level. But such a design might actually make it easier to meet the constraints of head injury criteria: “With a conventional seat you’re only restrained at the waist and your head’s free to travel forward about 25in into the thing that eventually stops it. If you move that thing in front of you closer, you’re giving the head less chance to accelerate during a crash and it would probably reduce the potential damage from that seatback. You’d have to make the seat back sympathetic to being head-butted, but it might actually improve that situation.” ☒

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