‘GREEN’ HORIZONS: THE ‘GREENING’ OF JETLINER CABINS

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Website references, listed separately, are valid as of January 2010

THE ‘GREEN’ SCENE

Although news reports tend to focus on dramatic descriptions of future aero engines powered by hydrogen or solar cells, blended biofuels or blooming algae, it should be noted that aircraft interiors also are going through a period of ‘green’ evolution. Airlines in all parts of the world have announced the implementation of clean ‘green’ cabin initiatives, and while the challenges might seem less exciting technically than the ones confronted in an airframe-production hangar or an engine test house, they are still of vital importance to the future of the industry.

‘GREEN’ CABIN UPGRADES

Over several years, in-flight-magazine articles have heralded the use of recycled paper, natural fabrics, biodegradable plastics, organic replenishable resources and vegetable-based inks for items such as: menu cards, cocktail napkins, beverage cups, motion-sickness bags and amenity kits. A more recent corporate commitment, also described in in-flight-magazine articles, is the development of personal carbon-emissions offset programs. This concept was originally pioneered by British Airways as part of its sustainability philosophy, and a great number of airlines are now running similar CO2 campaigns. During their flights, passengers are offered the facility to calculate the quantity of their own personal CO2 emissions, and to make voluntary financial contributions to selected environmental compensation ventures such as wind farms, energy-saving machinery, forestation renewal and nature conservation.

Alongside these for-posterity projects, airlines have developed and implemented a great number of hands-on ‘green’ upgrades designed to reduce the amount of weight carried inside aircraft and achieve immediate jet-fuel dollar savings. Here are some notable examples: phasing out passenger ticket jackets and paper tickets; operating cashless cabins; using light-weight plastic trays, bottles and catering equipment; recycling in-flight soft-drink cans; installing see-through bungee-elastic seat-back literature pockets that are easy to clean and inspect; hanging thin polyester-type fabric cabin-divider drapes that do not require heavy fixing hardware; flying new-

era seats featuring carbon-fiber-reinforced components within the outer surfaces; storing life vests in slim-line pouches; substituting composite-material oxygen cylinders for the old-style steel containers; filling seat cushions with air (instead of dense foam inserts); and providing under-seat suspended hammock-style nets (to replace the traditional front- or back-projecting metal foot bars) where economy-class passengers can comfortably rest their feet and stretch their legs.

‘GREEN’ TEAMS FLY INTO ACTION

While in-flight weight-saving and eco-advances like those mentioned above can capture the attention of the general flying public, the key to the future health of airline fleet renewal lies in being able to develop and implement a continuing cycle of effective ‘green’ cabin-upgrade policies that will ensure jet-fuel savings. At Continental Airlines the subject has been studied in great detail.

‘It is essential to focus on aircraft-interior weight-saving programs that are commodity based, because the potential long-term payoff for the airline can be enormous,’ says Vern Alg, who for twenty years led the interior engineering team at Continental and participated as a member of the customer group advising on the development of cabin treatments for the Boeing B787 Dreamliner.

But how does an airline get started on a ‘green’ cabin-upgrade program?

Vern Alg explains: ‘At Continental we sat down in a group. We said, “Let’s examine the high-quantity and like commodities: How can we better specify materials? And how can we better dispose of materials? One of our main target areas was the aircraft seat. Using our “green” criteria we worked on the seat structure — the frame, cushions and covers — to achieve performance improvements. Similarly, we developed our aircraft carpet. We wanted to make it more lightweight, recyclable and longer lasting. We knew that if we could reduce weight by a fraction in each commodity unit the total could add up to a major saving for Continental in fuel-cost dollars.’

Asked about other major areas of study, Vern Alg describes a less visible program:

‘We examined the amount of water placed in our aircraft tanks. Were we buying fuel to carry more water than we actually needed? Traditionally, airlines have used the “fill to overflow” approach, but is this really the best measurement for on-board water provisioning? As with our precise catering counts for uplift of food and beverage, shouldn’t we try to carry just the right amount of water for the number of passengers on board a particular flight?

On the subject of airlines downgrading food-and-beverage service and removing cabin-accessory items as a way to save weight, Vern Alg comments:

‘We did not want to reduce our customer-service standards at Continental because of the need to achieve weight savings, so we carried on serving free meals at mealtimes and offering pillows and blankets. We wanted to achieve our weight savings in ways that our customers would not perceive as adversely affecting their flying comfort or well-being in the air.’

HOW ‘GREEN’ IS YOUR DNA?

Corporate sustainability was singled out as the current key driver of innovation in a recent study published by the Harvard Business Review. ‘By treating sustainability as a goal today,’ state the coauthors, ‘early movers will develop competencies that rivals will be hard-pressed to match.’ Citing companies that have developed smart ‘green’ business models, including Clorox, Hewlett-Packard and Walmart (the biggest employer in the world), the article explains how growth and product-development cycles can be accelerated by building sustainability into the design of the products, and incorporating after-use design and execution into the DNA of the enterprise.

Lofty goals indeed! But the guidance is of particular relevance to the aviation sector, where industry figures show approximately 3.3 billion passenger seats available on approximately 30 million scheduled flights annually — and some 81,000 flights per day worldwide.

‘GREEN’ IN-FLIGHT PRODUCT DEVELOPMENT

Despite the effects of the global recession, the emerging ‘green’ revolution offers creative selling opportunities for forward-looking aircraft manufacturers, aviation vendors and suppliers: Industry analysts are still forecasting that more than 24,000 new aircraft of more than 100 seats will be required by the world’s airlines by 2028! High-tech aircraft-interior products, materials and techniques now being brought to market will be suitable for use for both new-delivery aircraft and the retrofitting of existing fleets.

ECO-DECO IN THE AIR: FLYING ‘GREEN’

Here are some examples of innovative aviation-grade product development programs.

Cabin lighting

LIGHT-EMITTING DIODES (LED)

In the last few years, one of the most exciting ‘green’ developments in cabin design has been the increased use of LED technology inside the aircraft: It provides reduced weight and power consumption, greatly improved performance, and approximately 10 times the life cycle of the old-style white-light incandescent or fluorescent lighting systems. Experts advise that the best time to install LED systems is during the construction of the aircraft, and both the Airbus A380 and Boeing B787 Dreamliner make extensive use of the new technology for general illumination throughout the cabin and to display an evocative range of ‘mood’ lighting programs. LED systems such as the ones developed by Diehl Aerospace can be used for individual passenger reading lights, for interior ‘wash’ lighting and to create special effects. Customer-survey reports indicate that LED mood-lighting programs can help passengers feel more relaxed during the flight and more refreshed on arrival at their destination — and this can help them overcome a sense of jet lag.

EMERGENCY ESCAPE-PATH LIGHTING

It is necessary to use environmentally unfriendly solvents to remove thick layers of grease and grime that can accumulate from the daily tramping of thousands of passenger shoes over emergency escape-path signal lights that are positioned facing upward along the floor of the aisle of the cabin. In new installations, however, such as those supplied by Luminator, escape-path lights can be located on the vertical edges of the side panels of seat rows. These are less likely to suffer damage and can easily be cleaned with a simple wipe-over process.

Cabin windows

ELECTRIC WINDOW SHADES

The basic design of traditional pull-down/push-up window shades has remained unchanged for decades, but the sliding panel with its projecting handle can be susceptible to fingerprints, soiling and damage. It is frequently necessary to install replacement panels at short notice, and this work can be costly and time-consuming.

By contrast, electrically operated 'power shades', as developed by Aerospace Technologies Group, provide a completely different approach: In each window there are two ultra-thin shades fitted into a slim cassette that is mounted on a removable frame. The inner shade is made of a pleated translucent fabric that blocks about a third of exterior light. The outer shade blocks out all light. Change-out of the frame container takes only a few seconds — a pop-out/pop-in arrangement.

Electric-powered window shades can now be operated at the touch of a button by individual passengers or controlled centrally by flight attendants, depending on operational requirements.

HIGH-TECH WINDOW SHADES

As developed by Research Frontiers Inc., SPD (suspended particle device) smart window shades use a thin film that can be adjusted from fully clear to blocking more than 99.5 per cent of incoming light, and to any level of tint in between.

With a simple dial, switch or photo sensor, passengers can now instantly and precisely control the amount of light, glare and heat coming into the aircraft cabin.

'This is a patented film technology: The light-absorbing microscopic particles align and randomize to act as a "light valve",' says Joseph Harary, the President and CEO at Research Frontiers Inc. 'This is not an electromechanical shade and there are no moving parts. SPD-Smart windows can also block out 99.9 per cent of harmful UV radiation and this will help to prevent damage to textiles and furniture in the aircraft cabin. Protecting these items reduces the need to replace them, and this helps preserve valuable resources.'

Managing the light and heat entering an aircraft, both in the air and on the ground, has historically been a challenge.

‘The SPD-Smart system is made with weight-saving polycarbonate,’ explains Joseph Harary. ‘It helps optimize cabin-light levels and cooling requirements by adjusting light in response to environmental conditions, passenger preference and operator requirements. Cabin heat buildup is minimized when aircraft are on the ground because the windows revert to their darkest state without using any power. Thus, less jet fuel is consumed when in flight, and less cooling energy is consumed when the aircraft is on the ground. These advanced light-control techniques will help airlines to improve operating efficiency, protect scarce resources and enhance the flying experience for airline passengers.’

Seat covers

COMPOSITION LEATHER

Leather connotes the ultimate cachet of sophistication and luxury on board aircraft. However, when natural hides are used to make aircraft seat covers, there is a wastage rate of approximately 40 per cent — the result of unevenness and variability from unpredictable blemishes, bald patches and the unusable sections at the hides’ extreme outer edges.

New machinery-made products, such as E-Leather, are being developed to offer all the advantages associated with traditional leather hides. ‘Constructed using recycled leather fiber from tannery waste and a textile core, E-Leather seat covers weigh about half as much as those made from natural hides: This weight saving greatly reduces airline fuel burn and, consequently, represents major potential operating-cost savings,’ says Tim Bell, the Head of Sales at E-Leather Ltd.

“When we use E-leather to make an aircraft seat cover — typically requiring approximately three square meters of material — the wastage rate is only about 5 to 10 per cent, and this represents a significant saving on landfill. E-Leather is available in all colors and can be wiped clean on the aircraft — eliminating the need for a chemical-based off-the-aircraft cleaning cycle and associated re-treatments. Color consistency, thickness, tear strength, graining patterns and fire resistance are all “engineered-in”, and a seat cover made with this composite product will not sag or bag — hence the new-installation appearance can be maintained without difficulty.’

SYNTHETIC FABRICS

Nonwoven, microfiber composition fabrics have become very popular in recent years — not just for residential upholstery applications and airport lounges, but also for seat covers and headrest panels in aircraft cabins. Manufactured in a dazzling array of colors, these stain-resistant, machine-washable, spot-cleanable fabrics are sufficiently pliable to be used to cover ‘difficult’ surfaces inside the aircraft like curved seat surrounds, indented shell and pod constructions, and contoured dado and sidewall panels. Artificial suede, like that produced by Tapis Corporation, can be embossed, debossed, embroidered, ‘pearlized’ or otherwise customized, to meet individual

client requirements — it is advertised as being made of 100-per-cent high-purity recycled polyester, which reduces its carbon footprint. The company's artificial leather, infused with silver ion anti-microbial technology, is also classed as environmentally friendly because it does not contain plasticizers, heavy metals or stabilizers and it is 100-per-cent free of volatile organic compounds (VOCs) and formaldehyde.

Cabin floors

CARPET

Airlines buy miles of carpet per year and, traditionally, the throw-away rate is extremely high because of the soiling that is typical near doorways, galleys and lavatories. It is estimated that about 70 per cent of aircraft carpet is thrown away because of staining, and the remaining 30 per cent because the carpet is actually worn out. New stain-proofed nylon carpets, as developed by Mohawk Aviation Carpet, can last approximately six times longer than wool aircraft carpet, resulting in fewer new resources being utilized and less carpet consigned to landfills. The proper placement of the carpet's direction during installation (i.e., the warp-weft and forward-aft layout) can greatly help reduce wear-and-tear replacements, thereby providing cost savings for the airlines. Recent recycling programs have routed reconstituted aviation carpet to domestic and commercial applications.

NON-TEXTILE FLOOR COVERINGS

Installed in doorways, lavatories, galleys and other working areas where personal safety is of paramount importance, non-textile floor coverings (NTF) are specially treated to provide a non-slippery, anti-skid surface.

Batiflex, a product developed by Gerflor Transport Flooring, is advertised as the lightest weight in its category. 'This enables airlines to lower their fuel consumption and reduce transport pollution emitted by the aircraft,' says Juliette de la Feronniere, the company's Aviation Market Manager. 'Our PVC (polyvinyl chloride)-based products are recyclable — whereas silicone-based products are not recyclable. Some of our NTF floor coverings have been designed to create the look of carpet-type floor coverings: These can be used as a substitute for traditional wool or nylon carpeting, providing considerably increased durability — and thus significantly reducing throw-away rates. We manufacture only environmentally sustainable products and we assess the life cycles of all our aircraft floor coverings — to reduce the ecological impact. We strive for very low water and energy consumption during the manufacturing stages; 95 per cent of our post-manufacturing wastes are recycled, and we utilize packaging made out of recycled material. When the Gerflor PVC products are recycled, they are routed to subsequent domestic applications.'

'GREEN' CABIN COMPLETIONS

The acceleration of ‘green’ policies at government and regulatory levels and events such as the United Nations climate change summit in Copenhagen in 2009 will push the pace of development across all industrial sectors, and it is inevitable that work programs will evolve in new directions. ‘Zero emissions, zero waste’ (a sustainability mantra) no longer represents just an intriguing intellectual conundrum, but, instead, constitutes *the* clarion call of our generation, summoning not only the ecologically faithful but all industry participants — and every concerned individual — to advance to the front lines of their sectors’ environmental battlefields. After all, as emphasized by Darwinian scientists, the race for survival does not depend on being the fastest, biggest or strongest — but on being the most adaptable.

In the fitting out of aircraft passenger cabins in recent years there have been significant changes both in methods and materials and in the manufacturing and installation processes. For example, to handle the repair of ever-larger aircraft parts made of composite materials, Lufthansa Technik, AG, has expanded its workshop premises in Hamburg, Germany, to accommodate a new autoclave oven with an interior diameter of five meters.

And airlines can now use electronic applications and interactive animation to visualize various cabin scenarios, instead of producing display boards or 3D scale models or physical mock-ups, as was customary in earlier decades.

WELCOME TO THE VIRTUAL — AND VIRTUOUS — NEW WORLD OF AIRCRAFT INTERIORS!

‘We use finite element modeling (FEM) to design, adjust and even test cabin layouts or cabin furniture such as seats and galleys,’ explains Jeff Luedeke, Vice President, Sales and Marketing, at TIMCO Aerosystems, a division of TIMCO Aviation Services.

‘Computer-based FEM allows cabin designers to do in a virtual world what once had to be done by hand. This approach saves time and offers a greater likelihood of producing solutions that will reduce waste and weight and save fuel cost. Engineers can use FEM technology to identify optimal materials and construction methods to meet a range of criteria, including environmental impact. Knowing that our airline customers are being driven to reduce the size of their carbon footprint, we include in our electronic models the calculus to produce a design that not only meets all regulatory, safety and cost-savings requirements, but one that produces a lower-weight solution than previous designs. The designer can remove a little weight here, replace with new material there and test an innovative way of binding two structures without additional parts — all within a virtual world that combines creativity with speed and processing power.’

And what about new materials?

‘Composite construction now makes great use of advanced adhesives instead of two-part binding agents or other forms of attachment,’ Jeff Luedeke replies. ‘Earlier wasteful and messy processes required first mixing activating material with a binding agent, applying the mixture to the parts and then using often harmful solvents to clean up overlay and waste. Today, state-of-the-art adhesive taping is widely used in the manufacture of seats, galleys, lavatories and other interior

monuments throughout the aircraft. The new taping process produces the same or an even better outcome with minimal waste, the use of no hazardous materials and within a reduced application time.'

Asked about related waste-management and landfill processes, Jeff Luedeke comments:

'In the past, interior panels or structural elements were often cut by hand or using small electric tools. This resulted in significant cut-away waste and lack of precision that could rob valuable space or produce added cost through a need for later retrofit. Furthermore, an entire structural element was often cut from the same heavy material to be sure there was a critical mass at key load-bearing points or bracing corners. Quite a few cabin furniture items ended up being a lot heavier than they really needed to be!'

How can these problems be solved?

Jeff Luedeke responds: 'We have found that computer numerical controlled (CNC) machines have changed production and assembly dramatically. They can be programmed to be highly precise and to eliminate waste. As for meeting the needs of critical-support areas and braces, the heavier metals — which are less 'green' in terms of environmental usage — can be cut to exactness, to fit just the specific areas needed. Lighter materials such as special foams can then be precise-cut using the same CNC machine technology to fit the build area. The result: far less material use and a much lighter galley or stowage bin.'

And customer reactions?

'We completely overhauled the TIMCO interiors-product portfolio using the innovative design techniques and new composite materials I have described, and our customers are telling us that the weight savings greatly help them to reduce jet-fuel burn. The new products have been appropriately branded the "FeatherWeight™" line.'

FUTURE 'GREEN' AVIATION

There is a time-honored Scottish proverb dating from before the days of air travel and beloved by parents and schoolteachers: 'Mony a mickle maks a muckle' — an English translation would be: 'Many micro-things make a macro-thing.' Let us hope that the many cabin initiatives now being implemented will succeed in generating the necessary 'green DNA' to make a significant contribution to the long-term advancement of world aviation!

And could the future be closer than we think?

A new 'green plane' program at Southwest Airlines has designated one Boeing B737-700 aircraft (Southwest operates more than 500 B737 aircraft in 68 cities) to serve as a flying test environment for eco-friendly products such as:

- carpet pieces that are eventually 100-per-cent recyclable via a manufacturing process that is carbon neutral;

- aluminum ‘bump’ or ‘rub’ strips — typically positioned on seat side panels or the walls of aisle corridors to protect surfaces that could get damaged when passengers move through the aircraft carrying briefcases, strollers, sports equipment, etc.; this metal treatment is more durable than the traditional plastic material used in the past;
- two high-tech, long-life, lightweight, leather-derivative seat-cover fabrics; and
- canvas life-vest holders, replacing the classic metal containers and offering a weight saving of one pound per passenger.

A recently formed industry group, the Aircraft Fleet Recycling Association (AFRA), cofounded by the Boeing Company, Rolls-Royce, Europe Aviation and other leading organizations, is now working to ensure sustainable management, recycling standards and the reuse of aircraft parts.

And, in the academic field, at Cranfield University in the U.K., there is an aerospace-vehicle design program that covers several ecologically friendly projects: One is entitled the Greenliner, an environmentally benign aircraft.

Sages say that design is the management of change, and perhaps we can now look forward to a rapid ‘green’ liftoff. The motto of the British Royal Air Force is ‘*Per ardua ad astra*’ — a modern translation would be ‘Work through hardships; fly to the stars’. With the current emphasis on the urgent need to protect the planet, the key question is: How long will it take the aviation sector to reach out and touch the ‘green’ horizons of our aeronautical environmental dreams?

END

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