



Chasing 'the Holy Grail'

Designers have suggested ways tanneries can improve the leathers they offer. But reducing weight and adding flame resistance while maintaining performance is no easy task.

As part of The International Air Transport Association (IATA)'s Vision 2050 set forth in 2010, airlines have targeted an annual 1.5% improvement in fuel efficiency until 2020, when CO₂-neutral growth should be achieved. By 2050, it is estimated that 16 billion passengers and 400 million tonnes of cargo will be flown annually, and by that time the goal is that aviation's net CO₂ emissions are reduced by half compared with 2005 – a tall order but one which many airlines have committed to.

This poses a dilemma: lighter seats and fittings offer savings in terms of fuel, but leather often offers more desirable properties than synthetics. "Tanneries need to work at ways of reducing weight but maintaining quality – the Holy Grail," says Adrian Berry, founder of Factorydesign, which has designed interiors for airlines including Etihad and JetBlue. "How can you embed technology to help save weight or something similar? It would be good to see some sensible but smart pro-active thinking."

US-based retanning and finishing specialist Townsend Leather supplies commercial-grade aviation leather to airlines but its main business is in the corporate and VIP segment. "Several years back there was a lot of conversation about weight reduction and reducing the thickness of the leather to achieve this," says Bob Snell, the tannery's technical director. "Overall, the upholstery standard of 1.0 to 1.2mm is the most requested thickness requirement, but we do have some customers specifying slightly higher and slightly lower thicknesses based on the application."

"Some of the physical properties which make leather a unique and valuable material for upholstery purposes are high tensile strength, resistance to tearing and resistance to puncturing, but as the thickness of leather is decreased so are those physical properties decreased. The strength of leather comes from the intertwined network of fibres that make up the corium layer of the leather; the more of the corium layer you remove the more the fibre structure is affected. Up to this point it has been our

experience that those that have chosen to have the thickness of the leather reduced to the point of achieving 600 grams per square-metre have experienced some of the above mentioned strength reductions. It gets to the point of what is or isn't tolerable by each individual specifier."

Strength and weight

Tannery of the Year 2014 winner Wollsdorf developed a lightweight leather three years ago. Its CEO, Andreas Kindermann, says it was presented to both the automotive and aviation industry at the time of launch, and it was the aviation industry that was first to select it. "The main reason was that a lot of the decision-makers are airline industries as they are paying the operation costs," he explains. "So they benefit from the lower weight in terms of operation costs; it's not just a reduction in CO₂ that they can use for marketing, but it also translates into money that they are saving. They have a return on their investment."

From its tannery in a small town near Graz in Austria, it processes around 2,300 hides a day, with about 10% of sales now coming from the aviation sector. Japan Airlines (JAL) chose its lightweight Amba Eco in early 2014 and has made "not insignificant savings", according to Mr Kindermann.

JAL is fitting the product to seats in all cabins of the Boeing 737, 767 and 777 aircraft that make up its domestic fleet. "We have been very successful with the Japan Airlines project," adds Mr Kindermann. "It's easy to reduce the weight by reducing the thickness but you still need to meet the technical specifications, touch and softness – we need all this even though the leather's very thin. You could make it thinner but then it's easy to rip, but our leather is thin and strong. That's one of the main differences if you compare it to man-made 'leather', PVC for example – usually the weight of leather is higher, but with our leather we are almost the same as man-made 'leather' but our leather lasts much longer."



Swiss, which transported 3.5m passengers in Q1 2015, is feeling the benefits of lighter leather.

CREDIT: SWISS INTERNATIONAL AIRLINES



Reducing fuel and CO₂

Air transport accounts for 2% of global man-made CO₂ emissions, according to IATA. In 2013, flights worldwide produced 705 million tonnes of CO₂; globally, human activities produced more than 36 billion tonnes. Between 1990 and 2009, the energy efficiency of air transport improved by 30% compared with 16% for cars and 5% for rail. For each 10kg reduction, 4 tonnes of CO₂ can be avoided in one year, says the association.

The big airlines have all undertaken weight-saving initiatives as part of Vision 2050. An employee-led project by British Airways in 2012 resulted in an annual £20 million saving in fuel costs on its Boeing 747 and 777 fleets. Similarly, Lufthansa focused on weight reduction in 2011 as part of its drive to increase fuel efficiency after working out that one kilo less on all its aircraft saves 30 tonnes of kerosene per year. Austrian Airlines introduced lighter seats which weighed 5 kilos compared with 6.5 kilos and annual fuel consumption fell by 1,650 tonnes of kerosene, while Virgin Atlantic estimates that shaving 0.5 kilos off all the planes in its fleet could save 440 tonnes of fuel per year.

Chemicals aimed at addressing these factors include EasyWhite Tan, now produced by Stahl, and Lanxess's X-Lite. Tanning agent Granofin Easy F-90 and EasyWhite Tan work off the basis that a reduction of 0.2 mm in thickness could generate up to 150 grams of weight reduction per metre-squared of leather. It requires only one control to establish the temperature and float levels and just one more at the end. The number of chemicals is reduced from the usual six to just two and the resulting leather has flame-resistant properties, physical strength and additional tear and stitch tear strength.

X-Lite is comprised of microcapsules that have a thermoplastic shell containing a hydrocarbon propellant. After an initial milling, the microcapsules in the crust leather are thermo-expanded by steam to form microspheres with up to 40 times increased volume. This expansion exerts pressure on the fibres and leads to a thickness increase back to the standard substance, resulting in leather with a lower density and reduced weight but the same thickness.

Durability and maintainance

Leather's ability to wipe clean means it is often specified on short haul, where it is important to clean the seats and turn the plane around quickly, and the disadvantage of slippery seats is not as important when customers are only in the air for a couple of hours. Wollsdorf uses an SPS (surface protection system) to repel dust and add durability, and has had its lightweight leather selected for short haul by carriers including Lufthansa, Austrian Airlines and Swiss Airlines.

Similarly, British Airways last summer embarked on a radical overhaul of the interiors for short-haul flights, which will be fitted out until May. They include charcoal grey seats made with leather from Scotland-based Andrew Muirhead as well as inlaid leather mats for drinks and personal devices in its 'Club Europe'. Bahrain's Gulf Air also chose Muirhead leather and burns \$200,000 less fuel per year in the A320 fleet, it says.

"Leather is traditionally viewed as a more premium material than fabric and also has maintenance benefits, especially for surfaces where the cover material cannot be easily removed for dry cleaning. A fabric economy seat will require much more frequent cleaning than a leather one," says Matthew Fiddimore, an associate at Factorydesign.

The UK-based design house worked on the Four Seasons Private Jet Experience, the hotel industry's first fully-branded jet, which has 52 seats and includes flatbed leather seats. However,



Reaching for the skies at the Aircraft Interiors Expo

At the largest Hamburg Aircraft Interiors Expo yet, held in the German city in mid-April, buyers, designers and representatives from scheduled, regional and charter airlines gathered to meet suppliers and view their latest products and services.

More than 13,800 attended the show – the most important of its kind in the world – visiting 530 companies from 30 countries, in an exhibition space that was 8% larger than last year.

Among exhibitors were tanneries Wollsdorf, Andrew Muirhead, Boxmark, Max Gimmel, Perrone and Cihan Deri Sanayi from Turkey as well as leather dealers and seat makers such as Borlis, Aeristo and Schauenburg. "The topic of passenger experience has never been higher on the agenda for the aircraft interiors industry," said event director Katie Murphy.

Battling against requests from airlines, designers and seating companies for varying specifications can be difficult for tanneries. Wollsdorf has found that one way to set itself apart from competitors is to offer cut-and-sew capabilities – something it has introduced in the past year. "This is an important benefit for our customers, as they will receive the sewn seat cover from one company, reducing the number of suppliers," said its CEO, Andreas Kindermann. "This is particularly important during the development process, as it reduces the development time." It also translates into a high value add for the company, which tans from the raw hide stage.

US-based Boxmark took its Xlight and Xtreme leather to the show, and presented a new leather floor for VIP aircraft and business planes as well as ready-made seat covers, while Scotland-based Andrew Muirhead showcased a new digital print capability.

lie-flat seats are often specified with a more breathable fabric material rather than leather "as this more accurately mimics the comfort of a domestic bed". The most exposed areas – headrests and arm rests – can be dressed in leather due to its hard-wear properties. "Vertical and other surfaces can also be leather clad and provide hard-wearing surfaces in high-wear areas, while keeping the more premium aspects of a cabin zone that may be required," he adds.

Reducing cost of ownership

Rather than all the emphasis on durability being laid at the tannery door, new options to extend wear life are starting to appear on the market. UK-based laminator Sabeti Wain is among providers that have begun to offer a way of moulding the foam directly onto leather, then laminating and heat sealing it

**Panel I: Test Reports and Specifications for Aviation Leathers****(1a) 12 sec. ignition vertical test according to:**

- 14 CFR Part 25 §25.853 (a) and Appendix F Part I, Amdt. 116
- JAR 25 §25.853 (a) and Appendix F Part I para. (a)(1)(ii), Change 15
- EASA CS-25.853 (a) and Appendix F Part I (a)(1)(ii), Amdt.6
- ABD0031 Chapter 7.1.2, Issue F and Test Method AITM 2.0002A
- D6-51377 Chapter 4.1, Issue F and Test Method BSS 7230

✓ Test passed
No after flame time
zero drips

Vertical:

Sample No.	Ignition Time in (Sec)	Total Burn Time in (Sec)	After Flame Time in (Sec)	Number of Drippings	Drippings Burn Time (Sec)	Burn Lengths in (mm)
leather 1	12	12	0	0	0	15
leather 2	12	12	0	0	0	15
leather 3	12	12	0	0	0	15
leather 4	12	12	0	0	0	20
leather 5	12	12	0	0	0	10
Average	12	12	0	0	0	15
Limits			15		5	203

(1b) Smoke density according to:

- 14 CFR / JAR / CS Part 25 §25.853 (d) and Appendix F Part V(b), Amdt.116
- ABD0031 Chapter 7.3.1., Issue F and Test Method AITM 2.0007A
- D6-51377 Chapter 4.1, Issue F and Test Method BSS 7238

✓ Test passed
Smoke development
below the maximum
after 4 min

Non Flaming (NF)
Density Smoke at (min)

Sample No.	1 min	2 min	3 min	4 min	5 min	6 min	DS max up to 4 min
leather 1	1	7	30	100	136	176	100
leather 2	1	7	49	116	160	196	116
leather 3	1	8	58	123	169	211	123
Average	1	7	46	113	155	194	
Max	1	8	58	123	169	211	

(1c) Smoke density according to:

- 14 CFR / JAR / CS Part 25 §25.853 (d) and Appendix F Part V(b), Amdt.116
- ABD0031 Chapter 7.3.1., Issue F and Test Method AITM 2.0007A
- D6-51377 Chapter 4.1, Issue F and Test Method BSS 7238

✓ Test passed
Smoke development
below the maximum
after 4 min

Flaming (F)
Density Smoke at (min)

Sample No.	1 min	2 min	3 min	4 min	5 min	6 min	DS max up to 4 min
leather 1	5	40	95	139	163	174	139
leather 2	11	46	116	164	200	214	164
leather 3	6	20	45	88	114	124	88
Average	7	35	85	130	159	170	
Max	11	46	116	164	200	214	

(1d) Toxicity according to:

- ABD0031 Chapter 7.4, Issue F and Test Method AITM 3.0005
- D6- 51377 Chapter 4.1, Issue F and Test Method BSS 7239

✓ Test passed
All gas development
during test are far
below the maximum limits

Gas	Gas Limit After 4 min in ppm	Non Flaming (NF)		Flaming (F)	
		Sample Number		Sample Number	
Hydrogen Cyanide HCN	150 ppm	1 2 3	0 0 0	1 2 3	0 0 0
		Average	0	Average	0
Carbon Monoxide CO	1000 ppm	1 2 3	1 1 1	1 2 3	5 5 5
		Average	1	Average	5
Nitrous Gases NO-NO2	100 ppm	1 2 3	0 0 0	1 2 3	1 1 1
		Average	0	Average	1
Sulfur Dioxide Hydrogen Sulfide SO2 – H2S	100 ppm	1 2 3	0 0 0	1 2 3	0 0 0
		Average	0	Average	0
Hydrogen Fluoride HF	100 ppm	1 2 3	0 0 0	1 2 3	0 0 0
		Average	0	Average	0
Hydrogen Chloride HCL	100 ppm	1 2 3	0 0 0	1 2 3	0 0 0
		Average	0	Average	0

Panel shows test results using Stahl's product, EasyWhite Tan.

CREDIT: STAHL

to create a chair with inherent structure.

"It means you can't crease the leather, so you get much more durable dress covers that almost have a structural rigidity of their own, without needing to be stretched over the foam," says Acumen Design Associates' Anthony Harcup, who designed the seats and leather work on the recently launched Etihad fleet. "It's almost like an intelligent dress cover that has pre-formed shape into it. Designers are really starting to catch on to this, and it's really lifting the appearance of the leather as you can press finishes or logos into it and make it part of the signature while increasing the durability."

Airlines factor this in as cost of ownership: how much it costs to own the product over 10 years; how many times the dress covers have to be replaced. "So it not only makes them look better, it decreases the cost of ownership," he adds.

Flame resistance

As it turns out, The Holy Grail is not the same for all designers. For Mr Harcup, it is leather's versatility that he wishes was improved. Aviation leathers have to adhere to strict flame retardancy tests, which include burning time, smoke density, flame extinguishment, heat release and emissions.

Tanneries can treat the leather with flame retardant products normally used at the end of the retanning and fatliquoring stages, and physically deposited within the leather fibres and spaces in-between the fibres. While airline seats are certified through an oil burner test, for other parts of the furniture and cabinetry the materials have to be tested for smoke toxicity, heat release and vertical burn – something which leather's thickness does not always allow.

"The Holy Grail would be to get leather that passes all of the



The competition: E-leather and bonded leathers

Sadly for tanners, competition from alternatives is ever-present. While its characteristics are far removed from textiles, E-leather, Izit Leather and other bonded leather manufacturers are winning some market share by claiming they offer the same benefits.

Adrian Berry, founder of design agency Factorydesign, comments, "Materials that mimic leather, such as E-leather, are getting increasingly good and more widely used, and will become a strong challenger to 'pure' leather seating covers. The main, and increasingly important, benefit of E-leather is weight reduction which reduces fuel consumption – and the fact that, to the passenger, they are actually leather." E-leather is made from leather off-cuts and shavings that are bonded using a process of hydroentanglement that interlinks the fibres. Its UK-based manufacturer claims that compared with traditional leather, E-Leather can save airlines up to \$50,000 per year per aircraft through weight savings.

US-based Southwest Airlines, one of the world's largest carriers, last year chose to test Izit Leather and E-Leather for the interiors of its Evolve aircraft, using them on separate sides of the aisles, in a working durability test. It 'upcycled' its old leather seats into bags and balls through a community project in Kenya. Its systems engineer Geoffrey Buschur commented that because hides are unique they have to be hand cut and hand sewn. "This all-by-hand process leads to inconsistent yields, performance and final product making it impossible to properly manage and control a fleet of 75,000 passenger seats. By selecting E-Leather's rolled stock we get a consistent raw material with predictable performance."

How can the leather industry respond in the face of such claims?

"Leather's durability is twice as long," comments Andreas Kinderman, CEO of Wollsdorf. Tanners work hard to produce uniform performance across the leathers and would disagree that the final products are inconsistent.

While the battle to promote its selection over alternatives looks set to continue, a word of warning to airlines from Townsend Leather's technical director, Bob Snell: "In our experience, sacrificing strength to achieve weight savings does not come without risk. A few of our customers have tried using some of the lightweight leathers on the market and have experienced catastrophic failures due to reduced strength – in a very short period of time."

certification requirements in order to go on normal cabinetry that matches the seat – so pass smoke and toxicity, vertical burn and heat release. If we could do that, we could have leather on other areas of the suite, we could surround the occupant," he says.

Combining materials

Wollsdorf's main income stream comes from leather for steering wheel covers, and peers such as Boxmark which offer aviation leathers are also rooted strongly in automotive, where there are a number of similarities. Mr Berry wishes there could be more. "Leather manufacturers need to continue to look at the latest techniques of manufacture and production, maybe even from other industries such as automotive," he suggests, "and look at the provision of combinations of materials that actually allow the designer to create different solutions. Automotive seats appear more sophisticated in terms of finish and specification – maybe it's because they talk to other material manufacturers to investigate options."

His company, Factorydesign, has chosen leather for numerous projects including the final refit of Concorde, but selected fabrics for Aer Lingus' new business class. "The combination of foams, cushions and technology mean that the leather has to work alongside other items and some thoughts about this integration – rather than just covering things – would be good," he adds.

Airlines have been buoyed by the falling price of oil, which more than halved in the second half of last year. IATA has forecast a combined \$25 billion in 2015 net profit for airlines, up from \$19.9 billion estimated profit last year, mainly driven by these lower fuel costs. For an industry with a surprisingly low profit margin (on average, 1%), these figures will be pleasing, and it will be heartening to tanners to hear they select leather

over alternatives where possible.

"The unique properties of leather make it a highly durable, luxurious product," concludes Kevin Kucel, director of aviation sales at Townsend Leather. "With proper care and maintenance, leather can last a lifetime." ●



JAL's award-winning new interiors feature Amba Echo from Wollsdorf.

CREDIT: JAPAN AIRLINES