A new LED aircraft cabin lighting system is capable of outsmarting current LED technology

Light was among the first things mentioned in the Biblical story of creation, but its evolution is not yet complete. Since the beginning of time, humans have been searching for ways to provide light and extend the day. Candles replaced open fire, incandescent light bulbs replaced candles, and light bulbs are now being replaced by other systems. LEDs became a mainstream technology at the beginning of this millennium, and now are becoming a favored technology for aircraft cabin lighting, replacing older fluorescent tubes. While some people claim that OLEDs (organic LEDs) will be the next big breakthrough in lighting, others strongly believe that will depend on the adoption of smart LED technology and that conventional LEDs will continue to be more reliable in harsh airborne environments.

SAS will soon be the first airline to feature the new HelioJet SpectrumCC LED lighting systems, as it is equipping seven Airbus A330s and A340s with the systems as part of a comprehensive cabin modification program. “We are excited to be presenting our new long-haul cabin for SAS customers in the beginning of 2015, and to be the launch customer for the HelioJet LED lighting system. We always have the frequent traveler in mind, and the innovative HelioJet LED lighting system will be an important feature of our new long-haul experience,” said Snorre Andresen, vice president of product management at SAS.

The requirements for state-of-the-art lighting solutions have increased substantially. A study conducted on behalf of Schott Aviation reveals that 89% of the surveyed representatives from airlines, completion centers, lighting manufacturers and design offices stated that lighting is “very important” or “important” for aircraft cabin design. Several airlines stated that they would like to invest in LED cabin lighting but still think that there is no suitable LED system currently available for aviation. They also believe that cabin lighting increasingly addresses aesthetic and emotional aspects – how passengers perceive the cabin. How well does light set the stage in the cabin? And how well can it be used to adapt to circumstances and individual preferences?

The answers to these questions are heavily dependent on the ability to master the performance phenomena of LEDs. The following are issues that come forth with a closer look at LEDs. First, all LEDs show different characteristics as soon as they leave the production line – even as they are sorted into bins they show differences in brightness up to ±10%. Second, colors vary depending on the amount of power used to produce light, and the effects are quite substantial (see Figure 4). Third, and most importantly, LEDs age differently. This unavoidable transformation, known as lumen depreciation, causes visible effects that typically have a dramatic influence on the perceived quality of the environment. After approximately
1,000 operating hours, LEDs start to visibly age. In this transformation process they lose intensity and their color drifts away from the original. This effect is most distinctive in the red spectrum, where the light can be pushed into the invisible infrared zone. The visible outcome is a greenish color as blue starts to dominate.

“Of course that offsets all efforts spent in implementing a nicely balanced cabin interior atmosphere,” says Jan Schmidt, sales executive at Lufthansa Technik. “It is like illuminating a masterpiece with a torch.” Thanks to German engineering, there is a way now to avoid frustration caused by changing LEDs. The magic product is HelioJet SpectrumCC with sensor color control.

**TRUE COLOR SENSOR** The human eye is very sensitive to color differences and can distinguish one million color impressions. Even though nobody can explicitly calibrate color tones, everyone has a natural sense for what is ‘low-end’ and what is ‘high-quality’ lighting. Brightness, homogeneity and color fidelity define the quality of light. But how can we spot a certain color at all? You may have heard someone say “Marine blue is so yesterday” or “This papaya whip goes well with the carpet.” Since there are only three basic colors (red, green and blue) but almost endless shades, designers turn into poets when giving colors names.

For scientists, however, life is easier. They refer to a standard color system that enables a color to be precisely defined by arithmetical coordinates. The human eye recognizes certain chromaticity coordinates (see Figure 4) as identical. These areas have the form of an ellipse, called a MacAdam ellipse after the researcher who originated the hypothesis. On a scale from 0 to 1, the
The diameter of an ellipse is in the order of 0.001. This demonstrates how precisely one has to manage light in order not to show visible color shifts. The challenge becomes even greater when one realizes that the difference between running a light source at 10% and 100% intensity is a color shift of approximately 0.1 on the CIE (International Commission on Illumination) scale. State-of-the-art light management relies on so-called true color sensors.

“They not only translate a light impression into the basic colors, but they can also detect shifts in wavelength,” explains Dr Bernd Wolfling, head of light source development at Schott Aviation. “This enables management of changes in light intensity and in the physical phenomenon by which different color LEDs lose color intensity differently when they are heated. For example, blue LEDs lose 5% brightness when heated from 20°C to 80°C, whereas red LEDs lose 40%.

“To secure light homogeneity and color stability, it is insufficient to control only a subset of LEDs. HelioJet technology is unique because all LEDs are measured and controlled. We feed in light from both sides into an optical light converter – a rod that consists of grade A glass – using fiber optic characteristics that enable unimpeded light distribution within the length of the element. In this way, we operate with up to 80% fewer LEDs than conventional lighting strips, where LEDs are placed quite close to each other in a row. Sometimes less is more because we generate better light output with fewer LEDs.

“We have eliminated the effect of ‘LED spots’, which cause inhomogeneous light. We also have a higher mean time between failures and our ecologically friendly solution has low maintenance costs. Finally, and above all, we can manage 100% of all LEDs involved with our color control sensor technology to secure homogeneous light output over the entire operating period. That is LED lighting 2.0,” adds Wolfling.

Of course this is not the end of the evolution in lighting. But certainly, from today’s perspective, we are looking at a technological benchmark that enables visibility like no other lighting system ever did. Is it evolution or revolution? Time will tell.
Keep up with the Evolution of Lighting

Is there anything more basic than light? People have been working on how to most effectively leverage light for thousands of years. And we have certainly come a long way since the invention of the candle. More recently, aircraft lighting transitioned to simple LED technology. Today, we are offering a more advanced LED lighting system. HelioJet Spectrum™ (Color Control) provides homogeneous LED light and precise color stability that will perform reliably over time. Unlike existing LED stripes, with HelioJet each individual LED is monitored and controlled by a patented sensor system. It prevents color shifts, an inherent weakness of LEDs, that leads to color changes as the LED ages. Don’t accept compromises when it comes to ensuring maximum comfort on board. HelioJet Spectrum™ – the cutting edge in aircraft cabin lighting!

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