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## Bright, Battery-Operated Portable Light Source Used in Endoscopy

By Anne Fischer, Managing Editor, *Novus Light Technologies Today*



Biomedical applications including optogenetics, two-photon microscopy and vitreoretinal surgery are performed using small diameter optical fibers. Previously the light sources used for endoscopic procedures were bench-top systems with a xenon or LED light. Now medical professionals are finding that laser diodes that produce white light are meeting the need for very high-quality light with easily variable intensity for illumination in endoscopic

procedures. These fiber-based surgeries require extremely bright light coupled into optical fibers to facilitate smaller incisions, as well improve the surgeon's vision with bright illumination. Acera is an endoscopic lighting specialist that has developed the battery-operated Handheld Light Source that combines patented optics with a semipolar GaN laser diode based light source, SLD LaserLight from SLD Laser Inc.

LaserLight is an enabling technology that, due to its high illuminance, allows certain applications that currently use conventional light sources like LEDs and xenon, to go further. The development of the Acera Light Source started with Laser Components' ALBALUX white light: a suite of technology where different core size fibers are available for different applications in medical and machine vision. ALBALUX integrates the SLD LaserLight, which is a small 450 nm diode laser, pumping a phosphor that produces brilliant, broad-spectrum, incoherent white light that achieves much brighter light than traditional LEDs. Acera took the ALBALUX and coupled it with even smaller core fibers for medical endoscopic applications.

### ALBALUX features:

- Up to 100x the intensity of the white light LED
- Precise beam control and illumination
- Typical >150 lumens fiber output
- Correlated color temperature 6000 K, Color rendering index 70

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The advantage of the SLD LaserLight is that, due to its small spot size, this light is easier to funnel into a fiber while also delivering high optical brightness. Additionally, Acera develops its own lens, which delivers about 90% of the light generated by the light source to the endoscope.



*Acera's patented LED lenses*

This allows for a high amount of light and high CRI (color rendering index) to see more endoscopic detail.

#### **How the endoscopic Light Source works**

The Acera Light Source works with leading endoscopes and borescopes, replacing the light guide tether with a variable intensity LED or LaserLight light source that provides both the brightness and color rendering index needed in medical procedures. According to Thomas Root, President and CEO at Acera, the company developed an optic that allowed them to capture light more efficiently and match its exit angle with the entrance angle of the fiber. "Fiber optic light is tricky," he said, because in order to get light into the fiber, "the light has to enter at the correct angle in order to maximize the output".

#### **From office procedures to complex surgeries**

Acera initially designed the Light Source for office-based endoscopy procedures where affordability, cost and the ability to move quickly between one patient and the next is important. Because a premium is placed on portability, Acera initially created a battery-operated LED light source, which was able to retain a high color rendering index, which is important in medical procedures. Now Acera is looking into developing light sources to be used in the operating room, which will need to offer better cooling by way of conduction and convection. Other considerations include simplicity, as well as knowing just how much light is needed in a given procedure. Not just endoscopy, Root said, but

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trans-illumination, which is used when a medical professional wants to find the position of something in the body, such as a catheter. “Rather than imaging, we use a fiber to illuminate the area of interest,” said Root.

The handheld battery is critical to the overall design and use. In office settings, for example, endoscopes are often used very intermittently with a maximum of 10 minutes. The battery for this system uses aluminum heat sinks and convection cooled LEDs. On the other hand, systems used in the operating room are often left on for a long time—sometimes as long as four hours or more. For this use Acera developed a conductive cooling system that uses copper instead of aluminum.

### Testing in endoscopy applications

The Acera Light Source was recently approved for use in retinal surgery, and development is underway for using it to provide coagulation. One of big challenges that has to be overcome is that of heat dissipation. It generates a lot of energy (15 Watts), which can't be dissipated by way of conduction or convection, but must be done with a fan. The problem with the device heating up too much is that the amount of light output goes down precipitously. Use of any type of light source is very application dependent, and while still in its infancy, the Acera Light Source is already the preferred device for a range of procedures.

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**Germany & Other Countries**

Laser Components Germany GmbH  
Tel: +49 8142 2864 - 0  
Fax: +49 8142 2864 - 11  
info@lasercomponents.com  
[www.lasercomponents.com](http://www.lasercomponents.com)

**France**

Laser Components S.A.S.  
Tel: +33 1 39 59 52 25  
Fax: +33 1 39 59 53 50  
info@lasercomponents.fr  
[www.lasercomponents.fr](http://www.lasercomponents.fr)

**United Kingdom**

Laser Components (UK) Ltd.  
Tel: +44 1245 491 499  
Fax: +44 1245 491 801  
info@lasercomponents.co.uk  
[www.lasercomponents.co.uk](http://www.lasercomponents.co.uk)

**Nordic Countries**

Laser Components Nordic AB  
Tel: +46 31 703 71 73  
Fax: +46 31 703 71 01  
info@lasercomponents.se  
[www.lasercomponents.se](http://www.lasercomponents.se)

**USA**

Laser Components USA, Inc.  
Tel: +1 603 821 - 7040  
Fax: +1 603 821 - 7041  
info@laser-components.com  
[www.laser-components.com](http://www.laser-components.com)