

TECHNICAL INSIGHTS

AEROSPACE & DEFENSE

TECHNOLOGY ALERT



LIGHTING TOMORROW'S FRIGATES

Trieste, Italy-based shipbuilder Fincantieri (fincantieri.it) is building 10 "Fregata Europea Multi-Missione" or FREMM antisubmarine warfare and general purpose frigates for the Italian Navy (fincantieri.it/cms/data/prodotti/000027.aspx). A key subsystem on these next-generation naval vessels will be the fiber optic remote source lighting systems designed by RSL Fiber Systems of East Hartford, Connecticut. RSL is a division of Skyler Technologies Group that designs and supplies advanced lighting solutions and integrated illumination systems for military and commercial applications. RSL's fiber optic lighting technology is used to illuminate US Navy warships, including the LPD 17 class, the experimental craft "Sea Fighter," and the Navy's newest advanced destroyer, the DDG 1000, currently under construction. The Connecticut company is also developing illumination systems and solutions for such diverse commercial applications as mining, refineries, offshore oil exploration, first responders/homeland security, shipbuilding, and renewable energy.

The FREMM contract is RSL's first non-US Navy agreement for its fiber optic remote source lighting (RSL) technology. When RSL Fiber Systems began developing the technology almost 10 years ago, the company faced two primary initial challenges: developing a fiber optic cable that would minimize the light loss and the shift in chromaticity, allowing the Luminaire (light diffusers) to be placed at distances originally upwards of 200 meters or more from the Illuminator and meet the specified navigation lights' color standards; and being able to couple sufficient light volume into the end of the small fiber optic cable to provide adequate intensity from the Luminaires, according to Giovanni Tomasi, CEO and CTO of RSL Fiber Systems. Other challenges consisted of managing the heat generated within the Illuminator, making the Luminaires resilient to mechanical and environmental stresses, and making the system easy to install and maintain, added Tomasi.

The RSL chief executive said that his company achieved its goals by designing and developing a special fiber in collaboration with one of USA's premier specialty fibers manufacturers. "This fiber was cabled by a major producer of high-quality marine and shipboard cables, and tested extensively at RSL to ensure compatibility with other RSL system components," explained

Tomasi. The outcome was a fiber optic illumination cable that, unlike commercial grade cables (that can only transport light efficiently at 15 meters to 20 meters), can transport light energy, with virtually no shift in chromaticity, upwards of 300 meters. The development was partially funded through a grant from the US Navy's Office of Naval Research (ONR) through the Penn State Electro-Optics Center, noted Peter Gladis, director of marketing at RSL.

RSL Fiber Systems' exclusive core technology, 'remote source lighting,' consists of a set of illumination system components utilizing high-performance, low-loss, optical fiber to deliver light nonelectrically to a passive, nonelectrical illuminator where it is vitally required. This technology is optimized by RSL into a system that produces light at one location from the illuminator, and then couple it directly into optical fiber for transmission over a long distance to a specially designed reflecting mechanism called a luminaire at the application point.

"Electrical lighting distribution systems and electrical light fixtures can be a spark source, can produce considerable heat, and give off electromagnetic and radio frequency interference (EMI/RFI), and under some circumstances can cause electrocution," remarked Tomasi. "RSL's optical fiber-based light delivery system and passive illuminators have none of these concerns."

Gladis noted that in locations where the lighting application point is difficult to access, or is otherwise unsafe and remote, traditional lighting fixtures are difficult to implement, hard to service, expensive, and even sometimes hazardous to replace. "RSL's systems appreciably decrease maintenance and downtime, while improving safety by removing the requirement for repair and maintenance workers to get to lighting locations that are remote or risky to access," said Gladis.

"Remote source lighting can be a life-saver where light is required in locations that have a potential for volatile gaseous vapors or liquids being present, because the light transport and illumination method is nonelectrical--the fiber optic cable and the luminaires carry no electricity, they do not spark and they generate very little heat," explained Tomasi.

Fincantieri will use the RSL fiber optic remote source lighting system for navigation and signaling applications on the FREMM vessels. The shipbuilders will install RSL Luminaires in areas that are nearly impossible to reach for

maintenance once the ship enters service. These advanced lighting devices will be virtually maintenance-free with repairs only required at the Illuminator unit--that is installed in an easily accessible location within the ship.

In addition, a number of Luminaires will be installed in the vicinity of highly sensitive electronic equipment, where conventional electrical lights would emit EMI/RFI that could interfere with the electronic equipment. By contrast, the RSL Luminaires are passive nonelectrical devices, with minimal metal components, providing no interference to the electronic equipment.

In response to being asked what trends he sees in the development of remote lighting systems for aerospace and defense applications, Tomasi replied, "We are developing smaller, lighter, more efficient Illuminators, cables, and Luminaires. Through a new grant from the US Navy's Office of Naval Research, in collaboration with Penn State Electro-Optics Center, we are developing an LED-based light source that will be used for new RSL systems, and can be retrofitted into existing systems. However, the most significant paradigm-changing development that will result from this effort will be the integration of visible lasers in a fiber illumination system. This will allow for a single fiber cable approximately 3 mm in diameter, and Luminaires the size of a thimble, to be easily integrated into any air, land, or marine craft."

The RSL chief executive reported that initial prototypes utilizing lasers as light sources are already producing over twice the light intensity his company currently achieves with the best gas discharge lamps available. "For instance, it is not too farfetched to speculate that in five years an aircraft will have a number of centralized laser-based Illuminators providing light throughout and outside the aircraft via a fiber optic illumination network," Tomasi predicted. Similar applications will be available for land vehicles, ships, and fixed installations--as well as for many potential commercial applications.

Several of the key technological components that will make up the RSL system of the future will come from other industries besides illumination, in Gladis' opinion. "RSL Fiber Systems will adapt and modify as necessary to meet the needs of the specific illumination application. It is very important to always monitor and be aware of the technology development trends in related, but separate industries. We cannot underestimate the applicability of technologies across industry borders," stressed the executive. For example, the visible lasers

that RSL Fiber Systems is evaluating for illumination are being developed primarily for the entertainment industry. With this approach, RSL will be able to extend the developments and cost benefits from one industry (entertainment) into the defense and commercial sectors including short time to market and large economies of scale.

In addition to naval military applications, RSL's unique illumination technology has applications benefitting other key industries, such as petrochemical, offshore drilling, mining, commercial shipbuilding and yachts, towers, homeland security/first responders, refineries, and others. In particular, the US coal mining industry has expressed significant interest in RSL's technology as it has the promise of increasing safety--but also increasing productivity and lowering costs.

In addition, RSL Fiber Systems is prepared to work with other companies and organizations to advance its technology and product developments. They are also interested in identifying marketplace partners. RSL is willing to discuss licensing for jointly advantageous opportunities.

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