NSRP National Shipbuilding Research Program

Advanced Topside Lighting System 2020 ELECTRICAL PANEL PROJECT 2019-477-002

Project Review 2021 NSRP All Panel Meeting

March 23, 2021



Data Category B: GOVERNMENT PURPOSE RIGHTS Approved for public release: distribution unlimited.

TABLE OF CONTENTS

- Problem Statement
- Team Members and Tasks
- Deliverables
- Findings

Cinema Laser Projectors - Adaptation to Lighting

- System Configuration
- ROI

PROBLEM(s) STATEMENT

- Corrosion: #1 problem.
- High Maintenance.
- Large Size / Weight / RCS.
- EMI / RFI.
- Multiple control panels required.
- No "One size Fits All" solution.

SOLUTION

• Utilize <u>Commercially available</u> advanced solid-state based lighting systems.

BENEFITS / ROI

- 1. Extend reliable service lifetime.
- 2. Reduce TOC.
- 3. Small size/weight Reduced RCS.
- 4. Blueprint for multiple ships' classes.
- 5. Parts commonality and interchangeability.



TEAM:

RSL Fiber Systems | Signal Mate, PSU EOC, Austal, NNS, Ingalls, NAVSEA 05Z33

TASKS:

- 1. Identify, catalog and prioritize issues.
- 2. Define optimal requirements.
- 3. Identify and evaluate new lighting devices.
 - Reliability.
 - Compliance to 72 COLREGS.
 - Control system requirements.
- 4. Define blueprint for optimal configuration.
- 5. Estimate costs and timelines for qualification of a complete system.
- 6. <u>Add-On:</u> Identify <u>mature products</u> using advanced lighting technologies and <u>adapt</u> them for ready implementation on naval combatants.

DELIVERABLES

- 1. Kick-Off / Project plan and schedule;
- 2. Report 1 with outline of issues with topside lighting;
- 3. Report 2 with functional requirements for lighting;
- 4. Report 3 with new lighting devices and technologies;
- 5. Final report with:
 - Lighting system blueprint;
 - Methods to verify compliance to COLREGS;
 - Estimates for ROI, qualification costs, and timelines.
- 6. Add-On Report with new findings related to laser diodes.

TECHNOLOGY TRANSFER

- Briefing at the NSRP Electrical Panel meetings;
- Virtual presentations at SNAME 2020 and NSRP Day at NAVSEA.
- ManTech proposal planned for submission in 2021.

(2/6/2020) (3/31/2020) (6/30/2020) (8/31/2020) (12/31/2020)

(4/2/2021)

KEY FINDINGS

- **1. Water gets into everything** *especially when parts are opened for maintenance* \rightarrow reduce/eliminate maintenance. Hermetically seal topside equipment.
- 2. All metals corrode even 316 stainless steel → Reduce use of metals topside.
- **3.** All electrical parts exposed to the weather corrode → place electrical parts internal to the ship.
- **4. Smaller and lighter is better** → ease of installation, low RCS, low topside weight.
- 5. Damage is inevitable \rightarrow Ease of field repairs and modular constructions.

Other Issues / Concerns

- 6. Damage due to location.
- 7. Effect of EMI/RFI on LED lights.
- 8. De-Icing.
- 9. NVIS Compatibility.

10.Legacy control panels incompatible with LED upgrades.





Photos Courtesy of Austal USA

DISTRIBUTION STATEMENT A. Approved for public release: distribution unlimited.

SYSTEM OUTLINE

1) Solid state sources – LEDs and Laser Diodes:

- High reliability.
- Long life.
- Mature technologies.

2) Laser based fiber optic remote source lighting:

- Eliminate topside metallic parts.
- Reduce size & weight.
- Drastically reduce cost of the RSL technology.

3) LED Luminaires:

- Accessible locations.
- <u>Self monitoring</u>.

4) Lights controlled by:

- Integrated bridge system for New Constructions.
- Legacy control panels for In-Service upgrades.

CHARACTERISTIC	2016	2020
LED Module Cost	100%	55.3%
LED Module Output	100%	250%









COLREGS COMPLIANCE

CONSIDERATIONS

- Incandescent:
 - 100% intensity to 0 (failure).
 - Control panel detects open circuit.
- LED & Laser Diodes:
 - Slow decay in intensity to end of life.
 - Affected by drive current / environment / temperature.
 - May fall below COLREGS requirements before stated hours.
 - No open circuit to be detected by Control panel.

SOLUTION

- Monitor intensity.
- Trigger "Open" circuit if below COLREGS.



LASER ILLUMINATION

Adapt **RGB** Laser modules from Digital Cinema Projectors:

- <u>Mature, multi-source</u> supply chain.
- Optimized for <u>reliable</u>, <u>extended operating lifetimes</u>.
 - Over 50 Billion RGB laser device hours logged.
 - 20 years device/10 years commercial system reliability data.
 - Up to 50,000 hours (> 22 years Navigation Lights).
- Designed for Human Visual System (HVS) perception.
- Active Safety systems developed.

Topside Lighting Applications:

- Modular, scalable with "common platform".
 - COLREGS Compliance:
 - \circ Single Color
 - **RGB** controllable white (or any color).
 - \circ Continuous monitoring \rightarrow Intensity & Chromaticity.
 - M85045 4 channel fiber cable (same construction / larger fiber sizes).
 - Supports **RGB/NIR** illumination, monitoring, de-icing and future applications.





30,000 lm Laser Cinema Projector

SYSTEM ARCHITECTURE

CONSIDERATIONS

- Redundancy.
- Safety Crew and Hardware.
- Ease of installation.
- Flexible / reconfigurable / upgradable.

SOLUTION

- Multiple, localized DC networks with redundant AC/DC power supplies.
- Compatible with LED and laser diode sources.
- UPS providing (TBD) hrs of back-up.
- < 30 VDC power distribution.
- Emergency laser shut off if system integrity compromised.
- RGB laser illuminators configurable to multiple lighting functions (masthead, sidelights, task...).



RETURN ON INVESTMENT

Expedited ROI, expedited qualification cycle, and lower costs by leveraging Laser Cinema systems.

NAVIGATION AND SIGNALING [16 LIGHTS]

DESCRIPTION	ESTIMATED (FINAL REPORT)	REVISED (WITH CINEMA LASER)
ROI from Installation	≤ 3 Years	< 3 Years
TOC Savings in 5 Years	25%	30%
Annual Savings: Full U.S. Fleet	~ \$ 6.5 Million	~ \$ 6.5 Million
Qualification Testing Cost	\$ 1.1 Million	\$ 700K - \$ 800K
Qualification Testing Time	14 Months	≤ 12 Months

Questions? Please Contact

Giovanni Tomasi gptomasi@rslfibersystems.com

