

# Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2016-0610

Topic # N121-066

Transparent Armored Windows for Ships

Karagozian and Case, Inc.

## WHO

**SYSCOM:** NAVSEA

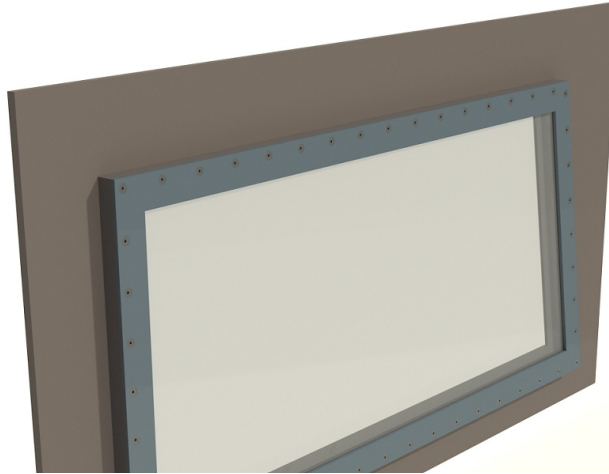
**Sponsoring Program:** Naval Sea Systems Command - PEO Ships - PMS317

**Transition Target:** LPD 17 San Antonio class and LX(R) vessels

**TPOC:**  
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**Other transition opportunities:** US Navy ships with transparent armored windows are additional transition opportunities (e.g. LHDs, CVNs, DDGs, etc.).

**Notes:** The new Karagozian and Case, Inc. (K&C) transparent armored window (TAW) pictured here utilizes innovative manufacturing processes and advancements in materials technology in combination with an iterative, tested, and engineered product design that should extend the life-span of a TAW. The window can be fabricated in the range of sizes used aboard Navy ships and can be integrated in new ship construction as well as retrofitted to ships already in service.



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## WHAT

**Operational Need and Improvement:** There is an expressed need by the US Government to develop a next generation TAW that can be integrated immediately into future projects. Several US Naval ships such as the LPD 17 San Antonio class vessels require TAWs in various topside and internal locations. The current window design has experienced failure (hairline cracks, delamination, crazing) on several ship platforms which can negatively impact visibility. Transparent armored windows are long lead manufacturing material items and cannot be repaired, only replaced. The new K&C TAW design will increase the service life of TAWs and significantly lower replacement costs.

**Specifications Required:** Develop a next generation TAW that improves the life-cycle, increases the resistance to chemical attack and abrasion, and reduces manufacturing lead times of current TAWs. The improved TAW system must meet or exceed all of the applicable ship specifications such as optical qualities, visible light transmittance, electromagnetic interference, shock, vibration, applied static pressures, radar cross-section reduction, night vision goggle compatibility and have the capability to integrate with existing ship service support systems. Applicable specifications include: LPD-17 Class ship specification 625d, 095-625, MIL-PRF 46108C, and MIL-STD-662F.

**Technology Developed:** The K&C TAW is a holistic design that utilizes advancements in materials technology and manufacturing processes to increase TAW service life, chemical and abrasion resistance, and to reduce life cycle costs. The K&C design will also reduce cracking crazing and delamination issues experienced with legacy TAWs. K&C TAWs can be fabricated in the range of sizes used aboard Navy ships and includes configurations equipped with embedded heating elements and radar cross-section reduction treatments. In addition, the design will also improve the frame and mounting systems so that TAW installation/replacement can be accomplished in an efficient and cost effective manner.

**Warfighter Value:** The K&C designed TAW will: 1) increase window longevity/service life, 2) reduce life-cycle costs, 3) enable useage of dry-erase markers and grease pencils, 4) maintain excellent visibility throughout the entire life-cycle, and 5) reduce manufacturing lead times.

## WHEN

**Contract Number:** N00024-16-C-4036 **Ending on:** December 17, 2017

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Preliminary Design of Window Panel and Frame	Med	Theoretically functional and validated for ballistics	4-5	December 2016
Fabricate TAW System Prototype	Low	Completed product	6	January 2017
Specification Testing	Med	Pass all qualification tests	7-8	March 2017
Final Design of Window Panel and Frame	Med	Qualified/Tested Design	8	June 2017
Update installation and maintenance procedure. Plan for shipboard evaluation.	Low	Complete installation and procedure report	8	December 2017

## HOW

**Projected Business Model:** For new ship programs, K&C will transition this technology by licensing the design or by directly supplying TAWs to shipbuilder(s). For retrofit applications, K&C would fabricate and provide the windows directly to the US Navy. K&C is also open to licensing the technology to other fabricators interested in supplying TAWs.

**Company Objectives:** K&C's primary objective is for the new TAW to be the selected as the technology of choice for integration in new ship construction of LPD 17 class ships and future ship classes/projects. Additional objectives include: 1) selection of the TAW for retrofit of existing ships and 2) integration on other US Navy ship classes that require transparent armored windows (e.g. CVNs, LHDs, DDGs, etc.). Through the FSP/STP program, K&C hopes to network with: 1) prime contractors who manufacture new ships such as Huntington Ingalls Industries, 2) Navy shipyard personnel who oversee window replacements, and 3) NAVSEA personnel from the Program Executive Offices for Aircraft Carriers, Littoral Combat Ships, and Ships.

**Potential Commercial Applications:** Commercial applications for this technology includes: US military ships, US military ground vehicles, guard towers, financial institutions (i.e. banks and armored transport vehicles), and protective shields used by space/aerospace labs and corporations.

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