

Topic: N151-045

## Cardinal Engineering, LLC

Submarine Component Design Tool to Assess Relative Resistance to High Intensity Loading

Cardinal Engineering, a system survivability and shock qualification engineering firm, has developed a design and qualification software tool that can be used by equipment suppliers or Navy Approval Authorities to evaluate new COLUMBIA Class equipment designs for shock survivability in order to reduce design hours and ensure a new item is capable of achieving shock qualification by extension. The prototype software tool, termed Comparative Design Assessment Tool (CDAT), compares and assesses designs for new equipment relative to designs of equipment that have already achieved shock qualification by guiding the user through shock qualification by extension logic found within MIL-S-901D Interim Change #2. CDAT takes a complicated technical ship specification and turns it into a simple software tool that a non-expert can use.

### Technology Category Alignment:

Survivability

#### Contact:

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**SYSCOM:** NAVSEA

**Contract:** N00024-17-C-4029

**Booth:** 5

**Room:** FST at NAVSEA HQ - Room 1

**Presenting:** Jan 29th at 10:15 AM

 Corporate Brochure: [https://navystp.com/vtm/open\\_file?type=brochure&id=N00024-17-C-4029](https://navystp.com/vtm/open_file?type=brochure&id=N00024-17-C-4029)

# Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2019-0677

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Submarine Component Design Tool to Assess Relative Resistance to High Intensity Loading

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## WHO

**SYSCOM:** NAVSEA

**Sponsoring Program:** PMS397

**Transition Target:** Integration into COLUMBIA Class shock qualification.

**TPOC:**  
(301)227-1600

**Other transition opportunities:**

Integration into the shock qualification process of additional ship classes, for example: CVN, VIRGINIA Class. Specifically, the CVN program has thousands of pieces of equipment to be shock qualified.

**Notes:** The Comparative Design Assessment Tool (CDAT) has been designed using MIL-S-901D Interim Change #2 (including all supplemental documents), but it could be updated to integrate other shock specifications including MIL-S-901D and MIL-S-901E which are used on other ship classes.



<https://www.osti.gov/servlets/purl/1462609>

## WHAT

**Operational Need and Improvement:** Shock qualification can be a costly and time-consuming process, especially for someone unfamiliar with shock qualification requirements. If an equipment owner needs to shock qualify an item, the current methods are to personally evaluate your equipment using the correct shock specification, hire an expert familiar with shock requirements, or reach out and rely upon the Navy. Given that most equipment owners undertake the shock qualification process themselves, designs are not completed correctly and errors are common. Knowledge of shock requirements in the design phase could be beneficial by improving the likelihood that equipment would be shock qualified later. An approved software tool that can determine appropriate test methods and aid in shock extension development could save time and design hours.

**Specifications Required:** CDAT must be correctly programmed to cover the breadth of information, logic, and nuances of the applicable shock specification.

**Technology Developed:** Cardinal Engineering has developed a design and qualification software tool that can evaluate new COLUMBIA Class equipment designs for shock survivability in order to reduce non-recurring engineering (NRE) design hours and ensure a new item is capable of achieving shock qualification by extension. CDAT compares and assesses designs of new equipment relative to designs of equipment that have already achieved shock qualification by guiding the user through shock qualification by extension logic found within MIL-S-901D amended by Interim Change #2. Cardinal has been informally calling CDAT the TurboTax of shock, that is our software takes a complicated technical ship specification and turns it into a simple software tool that a non-expert can use.

**Warfighter Value:** The integration of our software tool could reduce the cost of shock qualification process by helping design specifically for shock (whether the goal is testing or extension), by performing shock test determinations, by aiding in multiple steps of the shock extension process and by aiding in review of both shock extension requests and shock test procedures.

## WHEN

**Contract Number:** N00024-17-C-4029

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase 1 logic tree development	N/A	Accurately model shock test determination logic.	1	TBD
Phase II Shock test and extension logic development	N/A	Verification against specific set of test cases.	2/3	TBD
Phase II v1.0 software development	N/A	Confirm functionality with representative test cases.	4	TBD
Phase II v1.0 alpha trial performed with several users	N/A	Positive reception from alpha trial users.	4	TBD
Phase II v2.0 Test Decision Tool development	Med	Confirm functionality of software logic. Include increased functionality, comprehensiveness, and ease of use.	4	TBD

## HOW

**Projected Business Model:** Cardinal plans to license the software to vendors, shipyards, and equipment designers for use in equipment shock design and shock qualification method determination.

**Company Objectives:** As a company, Cardinal Engineering has extensive shock experience working on both the industry and government side of qualification. This experience allows us to understand the impact of improvements to the process, and how these might be made. Cardinal's main objectives with CDAT include reducing time and money spent during the equipment design and redesign phases, when writing test procedures and shock test extensions, and during shock procedure extension approval. This would increase accuracy and efficiency at every level of the process, and enable vendors, designer, shipyards, and the Navy to always be on the same page. Cardinal will also gain larger recognition in the shock community, which would could open up further collaborative shock qualification efforts.

**Potential Commercial Applications:** None.

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