

INTERACTIVE SYNOPSIS

Enhanced Rescue Hoist Glove Operational Field Assessment

Engaging with Industry to Solve
Homeland Security Challenges

VIEW FULL REPORT



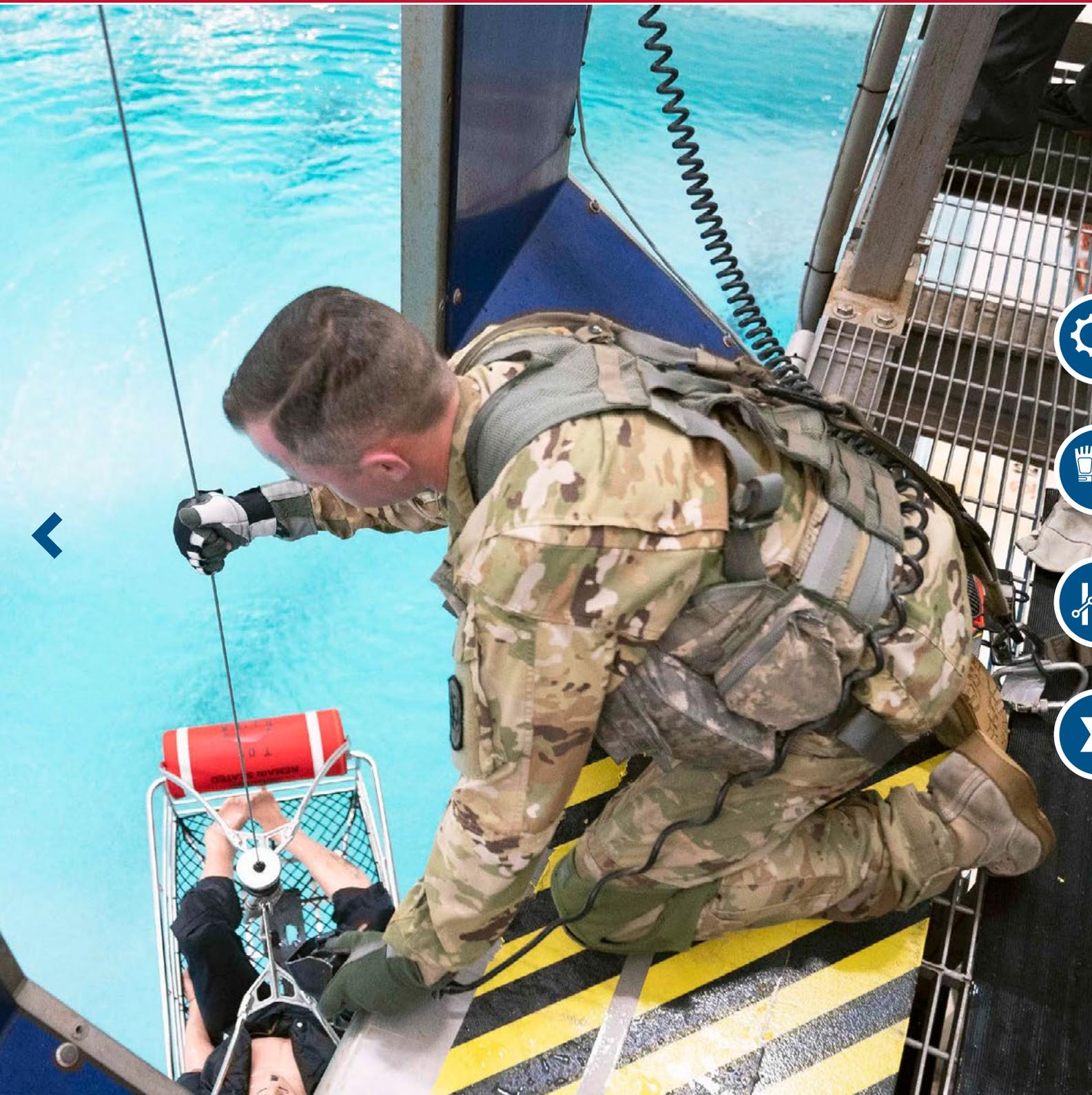
Enhanced Rescue Hoist Glove

Operational Field Assessment Report

September 2020



ENTER 



Capability Gap



Operational Field Assessment



Results



Next Steps



CAPABILITY GAP



Rescue hoist gloves protect emergency responders' hands during specialized helicopter hoist rescue operations. Responders performing these specialized rescue operations wear the hoist glove primarily to protect the palm side of the hand that manually guides a steel hoist cable during descents and ascents. Responders have found that these gloves degrade quickly due to friction with the cable. In addition to the loss of hand protection, fragments of material from a damaged glove—typically leather—can get caught between strands of the hoist cable and may shorten the useable life of the cable or hoist system.

OPERATIONAL FIELD ASSESSMENT



**TECHNOLOGY
OVERVIEW**



SCENARIOS



VENUE



EVALUATORS

OFA Overview

Rescue hoist gloves protect the hands of emergency responders who perform specialized helicopter hoist rescue operations. To improve the durability and performance of these gloves, the U.S. Department of Homeland Security (DHS) Science and Technology Directorate (S&T) First Responders and Detection, Office of Mission Capability and Support sponsored the research and development of abrasion-resistant glove materials and alternative glove designs. This effort resulted in two prototype fingerless glove designs.

DHS S&T's National Urban Security Technology Laboratory (NUSTL) conducted an operational field assessment (OFA) where five responders from fire services and members of the uniformed services evaluated the gloves at the U.S. Coast Guard's Aviation Technical Training Center located in Elizabeth City, North Carolina. To replicate manual tasks typically associated with rescue missions, the evaluators used hoist platforms equipped with safety harnesses, rescue gurneys holding weighted mannequins, stationary helicopters, carabiner



and various other gear. Equipment at the training center was able to mechanically generate wind and rain to simulate conditions encountered during hoist rescue operations. As development nears completion, NUSTL conducts an OFA to ensure the prototypes are designed to meet capability requirements identified by first responders. The OFA allows first responders to operationally assess emerging technologies and provide real-time, critical feedback to the technology developer.



OPERATIONAL FIELD ASSESSMENT



**TECHNOLOGY
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Prototypes Assessed

The two gloves, denoted Glove B and Glove C, are made from a “SuperFabric” material coated with resin to create abrasion-resistant dots. While both gloves use the resin-coated fabric on the palm and a stretchable fabric on the back, other design elements differed. Glove B incorporates a second layer of finer-grained material to provide additional abrasion resistance and a wear-indicator feature on the palm, a rubber pad on the heel of the hand, and reflective fabric at the wrist cuff and closures. Glove C has an additional padded layer over the pulcritude—the area between the thumb and index finger—and part of the palm region, with leather on the fingers and wrist area. Both gloves have Velcro straps and a loop at the wrist as well as leather finger pulls.

GLOVE B



GLOVE C



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Simulated Rescue Operation Scenarios

Five evaluators from fire and uniformed services assessed the gloves' durability, functionality, dexterity, usability, compatibility with other equipment and the protection provided in simulated rescue hoist scenarios, identified below. Evaluators were grouped into teams and data collectors from NUSTL were assigned to each team. The data collectors facilitated the test activities, recorded observations and comments during each activity and used a questionnaire to gather feedback from each evaluator following the completion of each activity station. Following the completion of all activities, additional feedback was solicited from the evaluators during a group debrief session.



DONNING AND DOFFING

Donned and doffed gloves in wet and dry conditions following a specified sequence to gauge fit, flexibility and grip



DEXTERITY

Performed manual tasks requiring motor skills and/or grip (i.e., carabiners, opening and closing latches or buckles with wet and dry gloves)



CALM HOIST

Lowered a gurney (or carriage) to the water's surface while wearing dry gloves, and hoisted the gurney back to the starting point



RAIN AND WIND HOIST

Lowered a gurney (or carriage) with a mannequin into the water while wearing wet gloves with rain and wind generators turned on, and hoisted the gurney back to the starting point

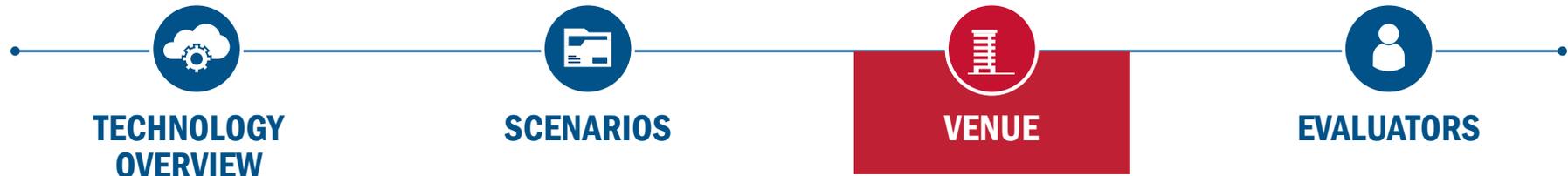


DEGRADATION TESTING

Guided a weighted hoist cable continuously for at least one minute



OPERATIONAL FIELD ASSESSMENT



U.S. Coast Guard's Aviation Technical Training Center

ELIZABETH CITY, NC

Identifying a venue equipped with infrastructure and equipment allowing for simulation of conditions encountered during rescue missions is crucial for executing a successful OFA. Key features of the U.S. Coast Guard's Aviation Technical Training Center that contributed to this success are highlighted below.



HOIST TOWER WITH SIMULATED WATER CONDITIONS



HELICOPTERS



POOLS



OPERATIONAL FIELD ASSESSMENT



**TECHNOLOGY
OVERVIEW**



SCENARIOS



VENUE



EVALUATORS

National First Responder Community

NUSTL works side-by-side with members of all first responder disciplines—law enforcement, fire services, emergency medical services and emergency management—from jurisdictions across the United States to test and evaluate homeland security technologies.

■ EVALUATORS

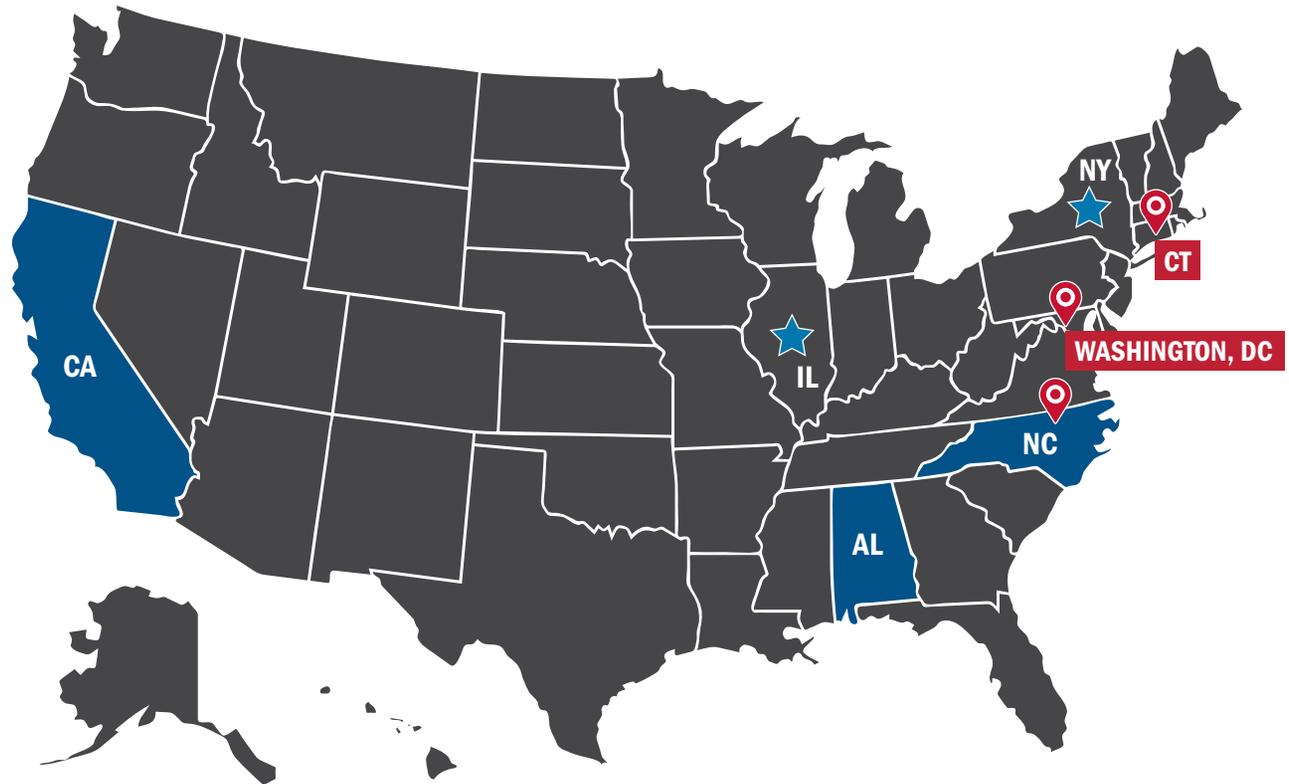
Alabama, California, North Carolina

📍 OBSERVERS

Connecticut, North Carolina, Washington DC

★ PROJECT TEAM

Illinois, New York



RESULTS



FIT AND COMFORT



FUNCTIONALITY



PROTECTION



DURABILITY

Full Report Overview

NUSTL data collectors gathered evaluator feedback through questionnaires and facilitated group discussions. The results presented here cover overarching feedback that pertains to and compares both prototypes, and feedback specific to Glove B and Glove C, respectively. Additionally, the results are organized into sections on fit and comfort, functionality, protection and durability.

The full Enhanced Rescue Hoist Glove Operational Field Assessment Report includes further details about the OFA including, project requirements, test activities, and results specific to each prototype including feedback and opportunities for improvement from the evaluators.



RESULTS



FIT AND COMFORT



FUNCTIONALITY



PROTECTION



DURABILITY

Fit and comfort testing was conducted to determine if the gloves designs would be compatible with standard duty uniforms and to gauge overall feel while conducting operational tasks.

Overall Feel

- Excess fabric in the palm area decreases the ability to feel the cable and extend fingers during manual tasks, potentially affecting safety during hoist operations

PPE / Uniform Compatibility

- Cuff lengths were too long and would interfere with dry suits and potentially with operations

➤ [FIND OUR COMPLETE COMPARISON RESULTS IN THE FULL REPORT](#)



RESULTS



Functionality testing was conducted as it's imperative that the enhanced rescue hoist gloves do not impede operational duties. This testing included the overall design, features and usability.

Pull Loop

- All evaluators pointed out usefulness
- Did not interfere with uniform
- One evaluator found it useful for donning
- Two evaluators preferred the pull loop on Glove C as it was lower profile and minimized snag hazard

Finger Length

- Some evaluators found the finger length to be too long on both Glove B and Glove C
- Could potentially interfere with operations

[➤ FIND OUR COMPLETE COMPARISON RESULTS IN THE FULL REPORT](#)

SuperFabric

- Flow friction material would fundamentally change the way hoist operators would handle hoist cables
- Controlling the cable was significantly smoother with both gloves compared to their current leather glove options
- Lack of friction from the SuperFabric negatively affected other aspects of flight operations

Grip

- Glove C did not offer sufficient grip when holding handles, door panels and maneuvering on the floor of a helicopter compared to Glove B
- Two evaluators noted slickness of the gloves, particularly when wet, deeming this a safety concern
- They found it difficult to grip wet equipment during assessment operations

RESULTS



FIT AND COMFORT



FUNCTIONALITY



PROTECTION



DURABILITY

Protection testing, focused on three specific aspects identified below, was essential for determining if the prototype gloves would protect the hands of hoist operators.

Heat Protection

- Four evaluators noticed heat transfer from the cable to their hand while wearing Glove B and two while wearing Glove C

Friction Transfer

- Four evaluators felt more friction transfer from the cable to their skin while wearing Glove B which was attributed to the lack of extra padding in the palm and pulcruc compared to Glove C

Pulcruc Coverage

- Three evaluators were concerned that the pulcruc coverage in Glove B was inadequate for hoist operation and two did so for Glove C

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FUNCTIONALITY



PROTECTION

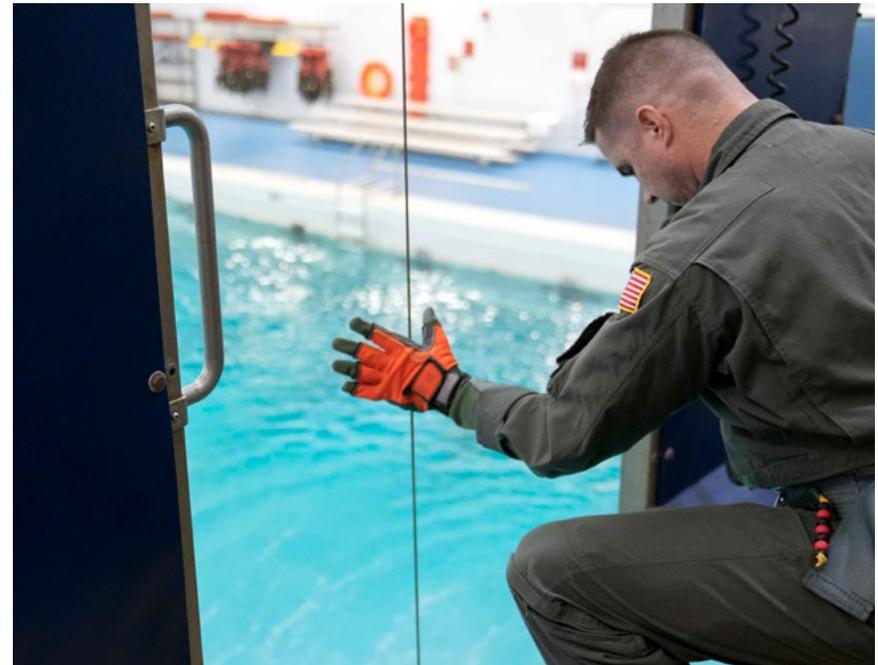


DURABILITY

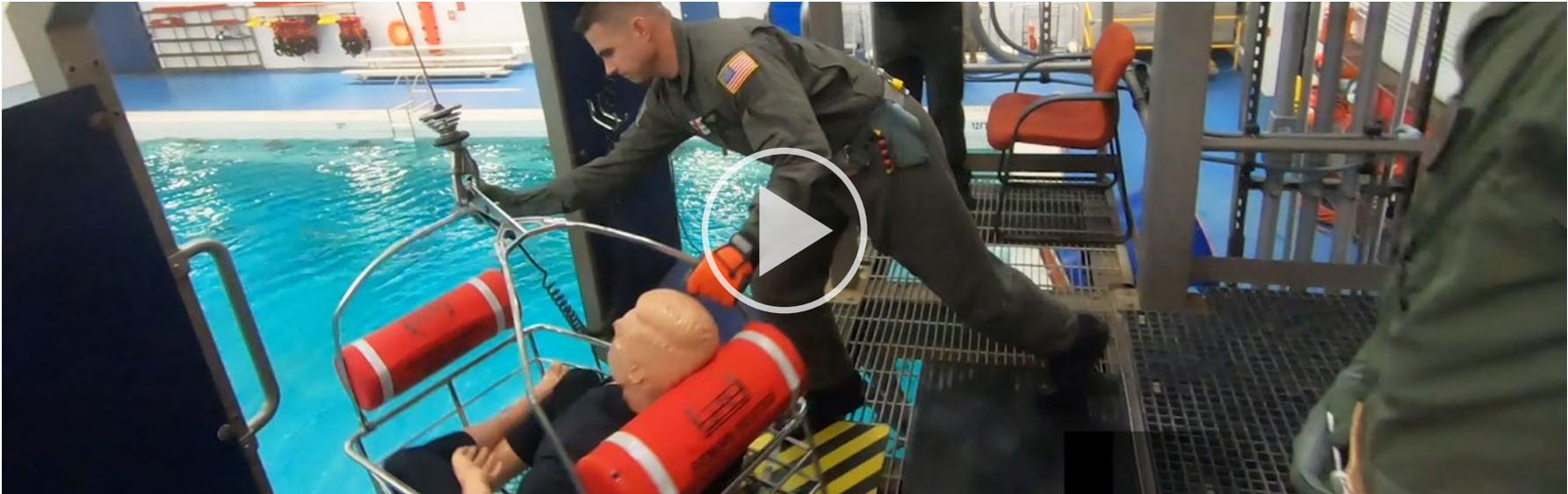
Durability testing was conducted to determine if the prototype glove could withstand repeated use without degradation or fragment shedding to mitigate the risk of damaging the hoist itself, while also protecting the hoist operator.

- All evaluators either agreed or strongly agreed that both Glove B and Glove C provided sufficient durability during assessment activities
- At least three to four days of additional testing with 10 to 12 hoists per day, would be needed to truly gauge their long-term durability
- No significant degradation was observed that would require the gloves to be replaced during the simulated operations conducted

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RESULTS



Overall, the evaluators concluded that both prototype gloves provided sufficient durability during the assessment activities. There was no significant degradation observed that would require the gloves to be replaced, however, they did indicate that both gloves were not tested long enough to truly gauge their long-term durability.

- ✓ Sufficient durability during the assessment activities
- ✓ No significant degradation observed that would require the gloves to be replaced



The results of NUSTL's OFAs identify strengths and weaknesses of the product, with a focus on the functionality for first responders. Everything we assess is to increase their safety and effectiveness on the job. ”



KRIS DOOLEY

OFA Lead, National Urban Security Technology Laboratory



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Homeland
Security

Science and Technology



Approved for Public Release

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To read more on the design, fit and comfort, functionality, protection, dexterity and suggested enhancements to each individual prototype, download NUSTL's full OFA report on the DHS Website.

[VIEW FULL OFA REPORT](#)



RESULTS

Value Added

NUSTL plans and executes OFAs to ensure emerging technologies are assessed through operational scenarios that best simulate the environment in which the technology will be used. Locations and scenarios vary with testing requirements and first responders from throughout the country serve as evaluators. OFAs are typically conducted in a single day and include hands-on operational activities. NUSTL collects feedback from first responders on the prototype's usability, capability and suitability to verify and document that developmental goals are met. The technology developers receive direct feedback from the responder community to enhance their technology products prior to commercialization.

“ We are excited to bring to market a rescue hoist glove with increased dexterity and flexibility, to include a wear indicator. This enhanced glove will provide first responders the protection needed when conducting specialized aerial rescues. ”



KIMBERLI JONES-HOLT
Program Manager, DHS Science
and Technology Directorate



NEXT STEPS

HDM, the technology developer, utilized feedback from first responders to help determine which hoist glove would be commercialized. Additionally, they incorporated enhancements identified by the first responder evaluators to make the glove more appropriate for operational use. In the images below, you'll see the current iteration of Glove B – finger length has been shortened, finger pulls have been relocated to the middle and ring finger – now affixed at the top of the hand and the closure at the wrist has been replaced with a formfitting, lower profile elastic band. These elements will be included in the final product before it is commercialized in 2021.

- ▶ Feedback provided by first responders is being incorporated into the design
- ▶ Commercialization of an enhanced rescue hoist glove will occur in 2021



LEARN MORE ABOUT NUSTL AND DHS S&T



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