Fire Resistant Watertight Structural Doors

NSRP BP & SDMT Meeting

September 15, 2021

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NSRP
NATIONAL SHIPBUILDING RESEARCH PROGRAM
Taking Shipbuilding and Repair to the Next Level
Proudly Celebrating 30 Years of Innovation

Ingalls Shipbuilding
A Division of Huntington Ingalls Industries

Agenda

1. Project Background/Overview
2. Project Management
3. Phase I Description
4. Phase II Preparation
5. Technology Transition

Ingalls Shipbuilding

- Building four classes of ships simultaneously—11 ships currently under construction
- Sole builder of the *San Antonio*-class (LPD 17) amphibious transport docks and the *America*-class (LHA 6) amphibious assault ships
- One of two builders of DDG 51 *Arleigh Burke*-class destroyers
- Sole builder of the *Legend*-class National Security Cutters for the U.S. Coast Guard
- Largest private manufacturing employer in Mississippi – over 11,000 employees

LPD 17 Class Amphibious Transport

DDG 51 Surface Combatants

LHA 6 Amphibious Assault Ship

USCG National Security Cutter

Fire Resistant Watertight Structural Doors

The need

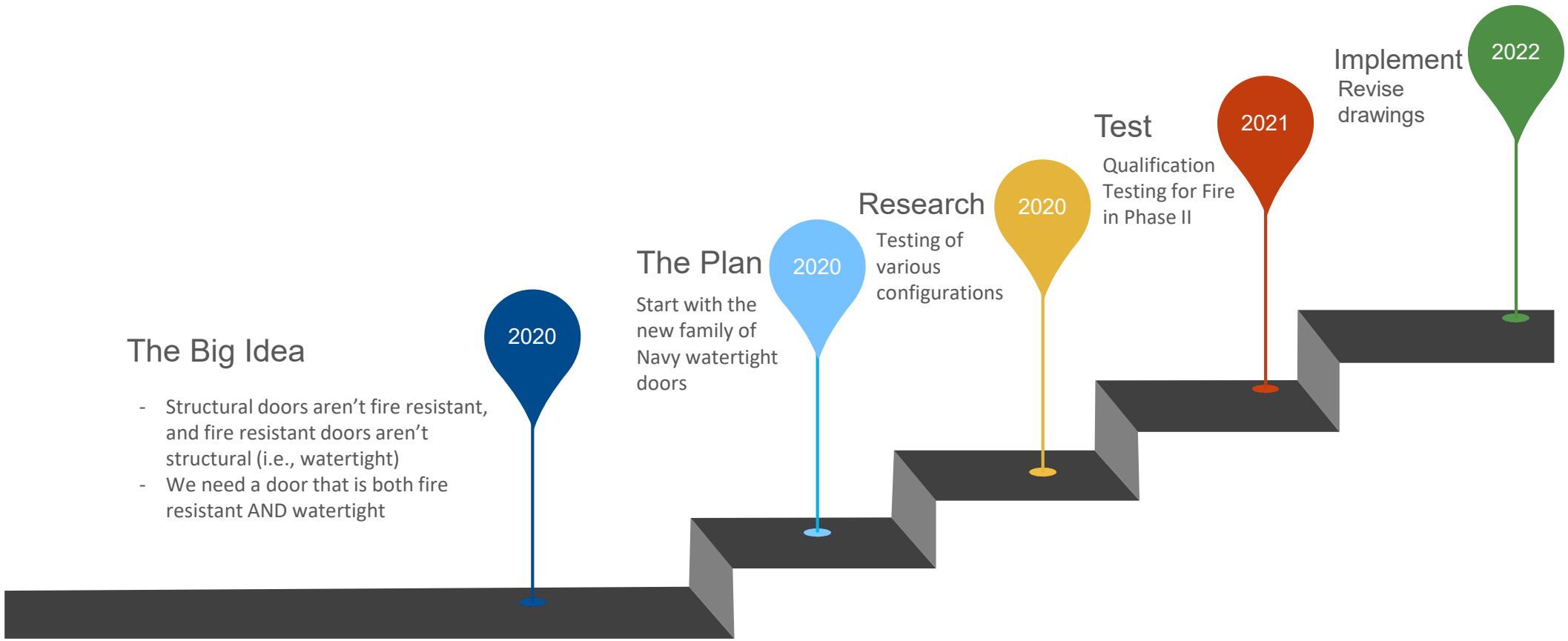
- Structural doors aren't fire resistant, and fire resistant doors aren't structural (i.e., watertight)
- We need a door that is both fire resistant AND watertight

Inside the charred amphibious warship HSS Bonhomme Richard by Dailymail.com and Associated Press

USCG Cutter Waesche Suffers Stack Fire at Sea by The Maritime Executive

Overview

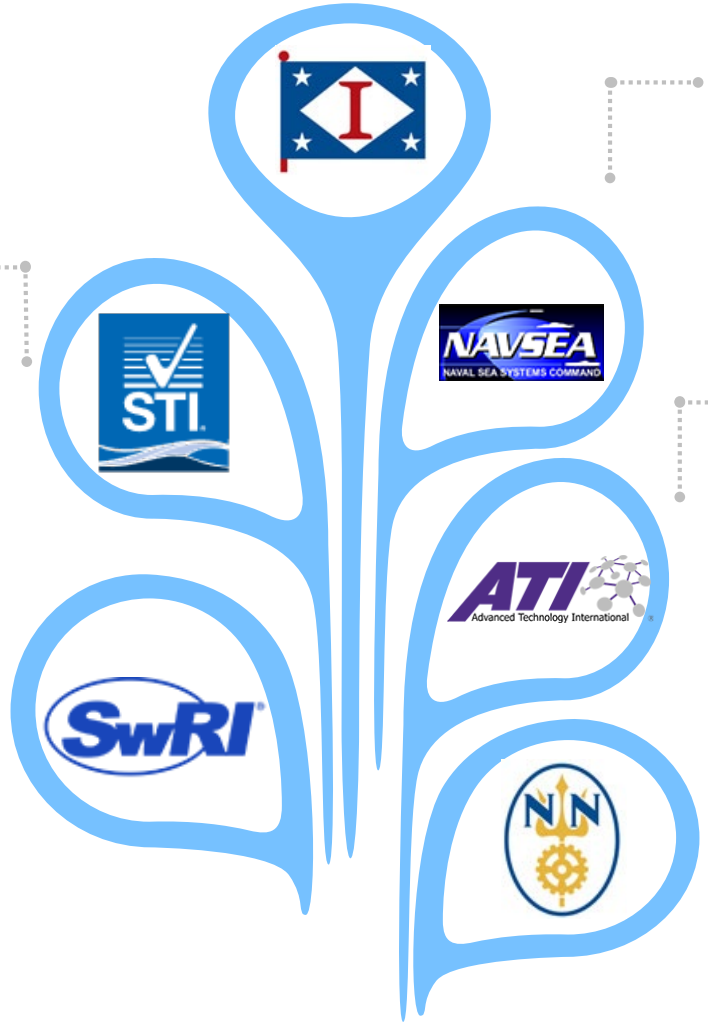
Fire Resistant Watertight Structural Doors



The Team

Ingalls Shipbuilding

Parisa Ghandehari, John Walks,
Michael Thompson, Tim Gates



NAVSEA/NSWC

Usman Sorathia, NSWCCD Code 612
Brian Griffin, NAVSEA 05
Kurt Hartsough, NAVSEA Philadelphia Code 333

STI Marine

Terry Mannion
Julio Lopes

ATI

Jim House, NSRP Project Manager

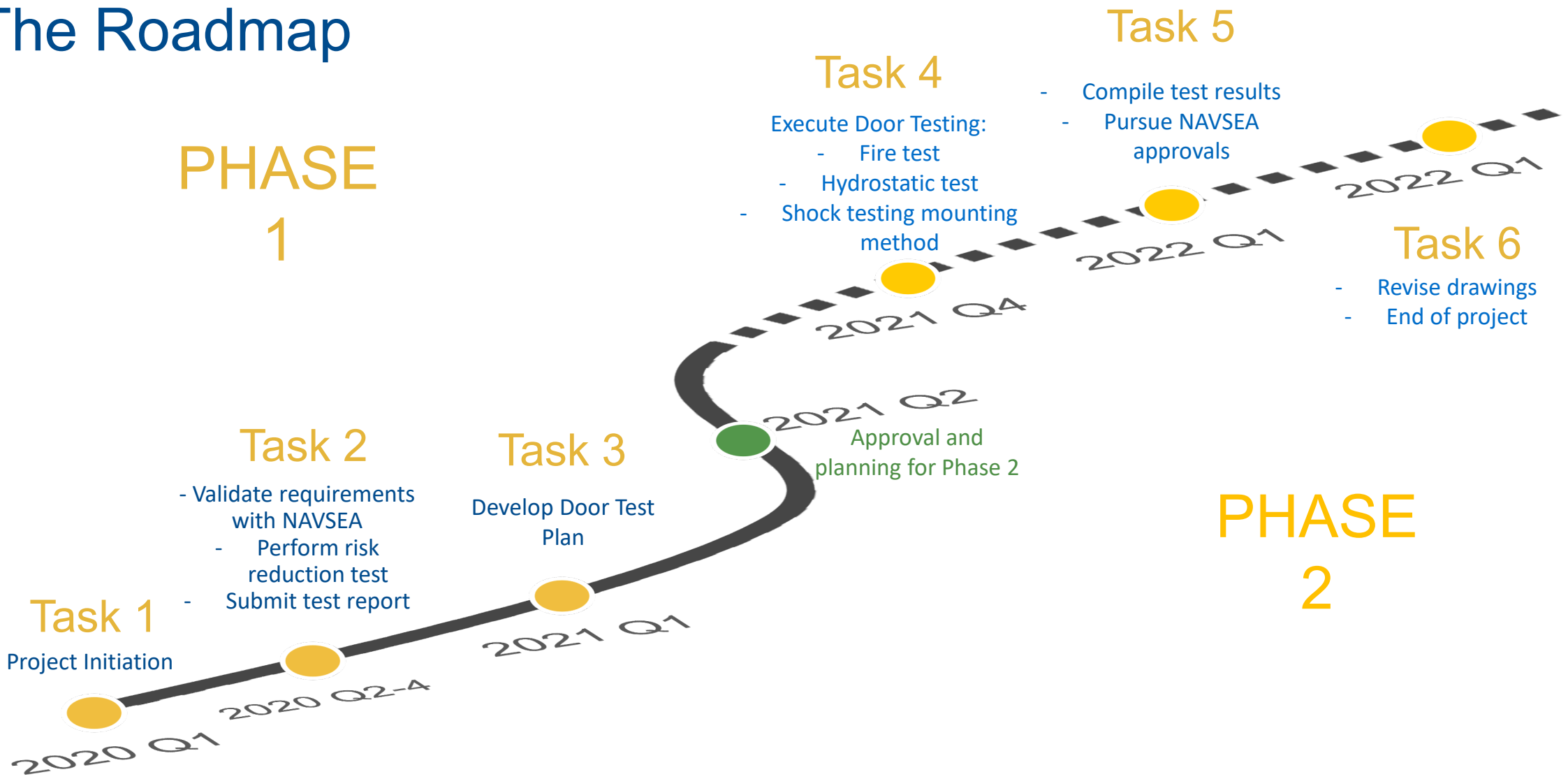
Southwest Research Institute

Karen Carpenter
Kyle Fernandez

Newport News Shipbuilding

Alicia D'Aurora Harmon, Program Technical Representative

The Roadmap


PHASE 1
Task 1
Project Initiation
2020 Q1
Task 2
- Validate requirements with NAVSEA
- Perform risk reduction test
- Submit test report
2020 Q2-4
Task 3
Develop Door Test Plan
2021 Q1
2021 Q2
Approval and planning for Phase 2
PHASE 2
Task 4
Execute Door Testing:
- Fire test
- Hydrostatic test
- Shock testing mounting method
2021 Q4
Task 5
- Compile test results
- Pursue NAVSEA approvals
2022 Q1
Task 6
- Revise drawings
- End of project
2022 Q1

Phase 1

Project Initiation

Material Selection

Fire testing of materials at component level, intumescent expansion

E-Wrap Marine

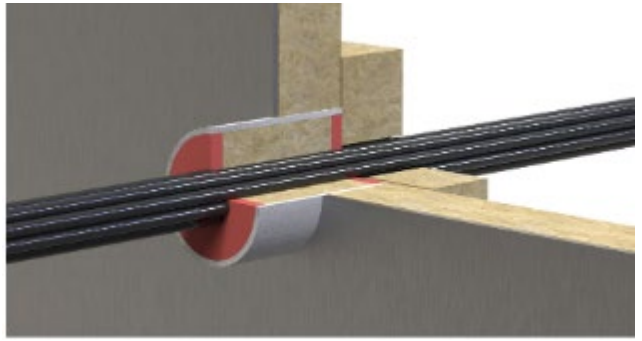
- Flexible material - easy to install, even on small diameter cable bundles
- Compact - few layers required for protection
- Endothermic - releases chemically bound water to have a cooling effect
- Low Density - weighs less than competing wraps
- Tested to ASTM E1725 for circuit integrity
- Performance Criteria - Circuit Integrity Protection
- Standards - ASTM E1725
- Values - 1 and 2 hour ratings

MWS Marine Wrap Strip

- Provides rapid intumescent expansion
- Forms flexible, water-resistant seals

MFS - Marine Firestop Sealant

- Provides rapid intumescent expansion
- Forms flexible, water-resistant seals



Preparation

Exploratory fire testing of materials at door level at STI Marine

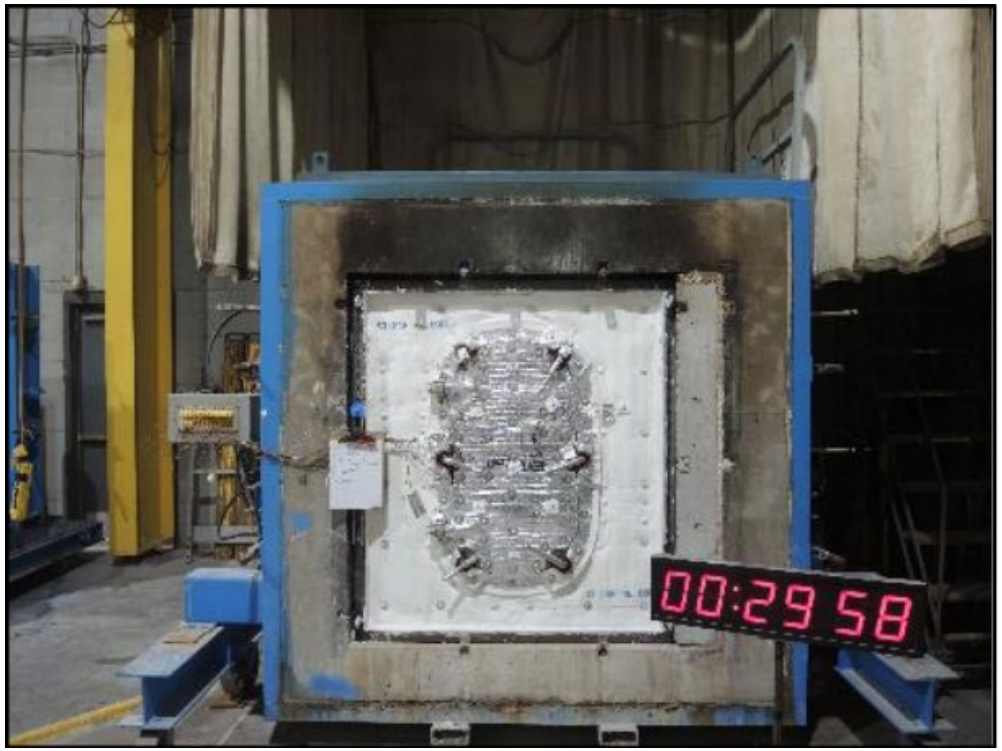
18x36 Pre-delivery

E-Wrap pin welded to steel

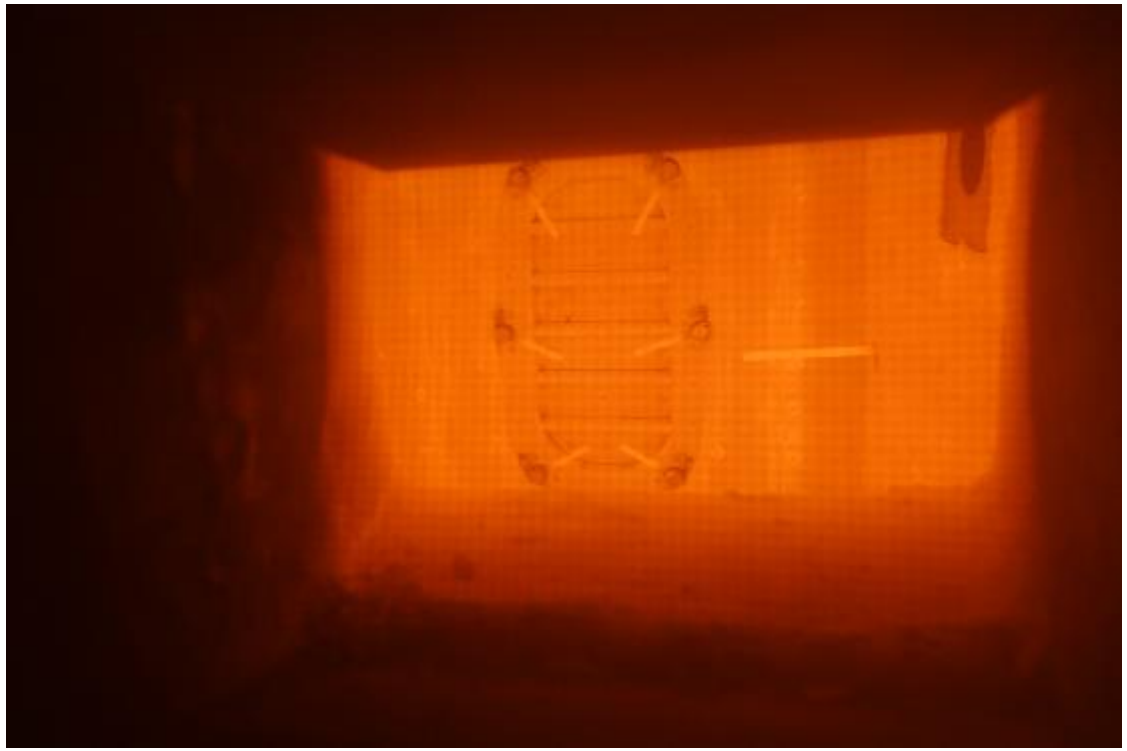
Fire Testing

Exploratory fire testing of materials at door level at STI Marine

30 Minutes into fire test – unexposed side

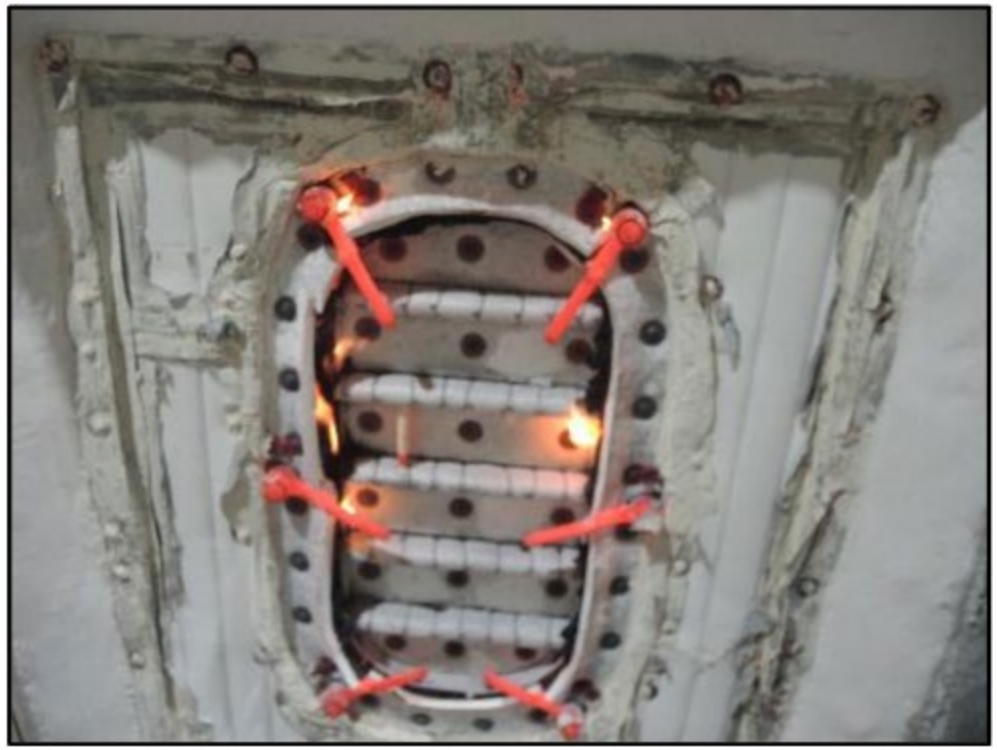


View of door inside



Observations

Post test - fire side



Door opened from non-fire side

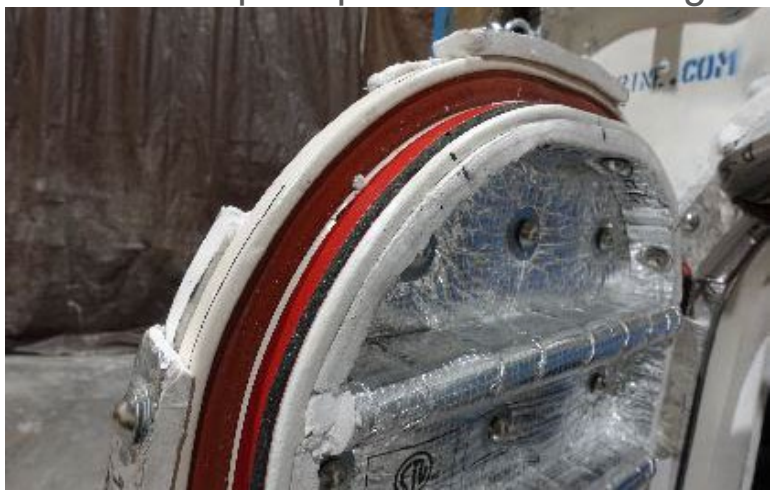
Observations

MWS Wrap Strip around door flange

Wrap Strip Expansion & Dog

MFS Sealant around Hinges

BEFORE

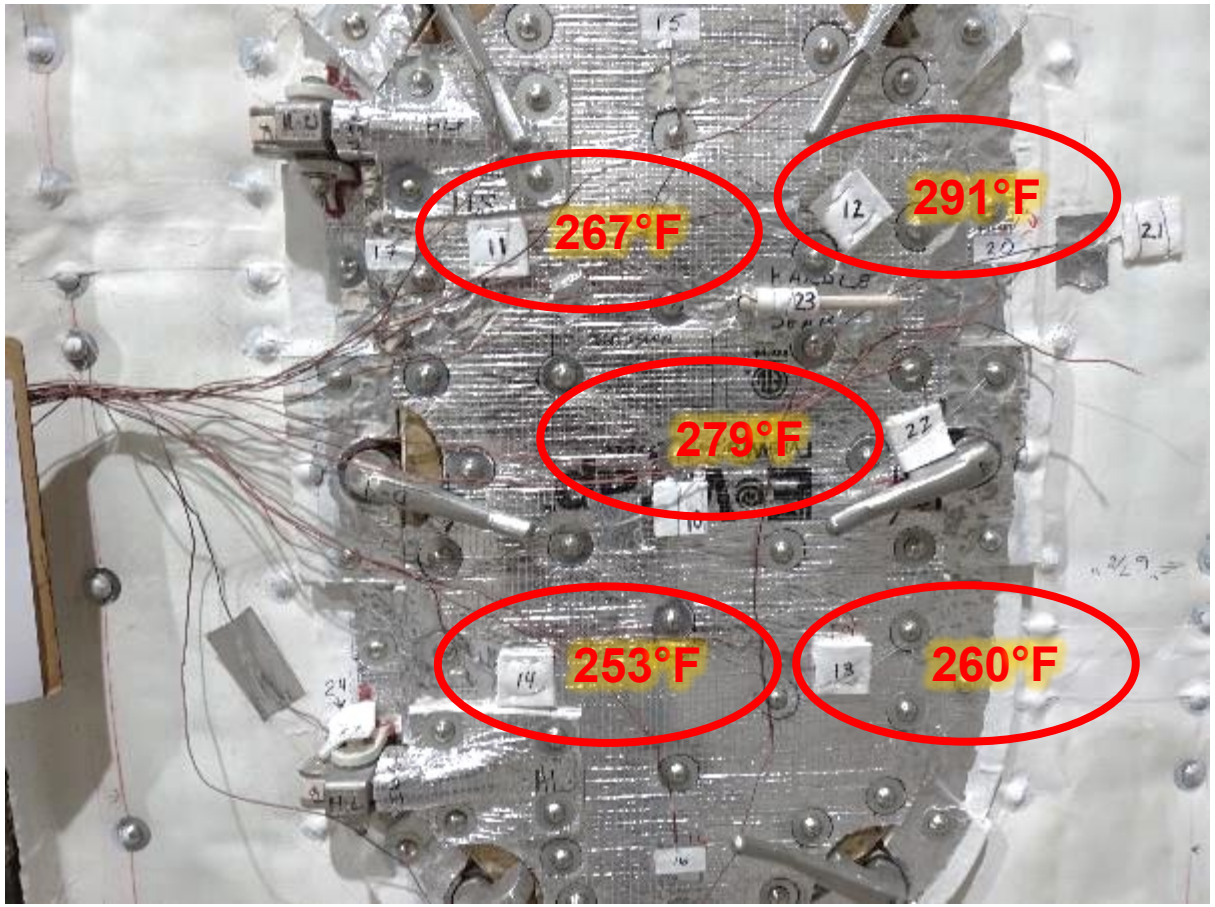


AFTER

Thermocouples Readings

MIL-STD-3020

Transmission of heat shall not raise any individual temperature measurements 181°C (325 °F) above the initial temperature. The average temperature rise is not relevant.



Final Test Plan

Test plan developed and approved

Figure 1. SwRI's Large-Vertical Furnace.

Phase 2

Approval and planning for Phase 2

Qualification Tests

Shock test

- Doors already shock qualified
- A small scale shock test will be performed on the mounting method of fire resistant material on the door

Fire test

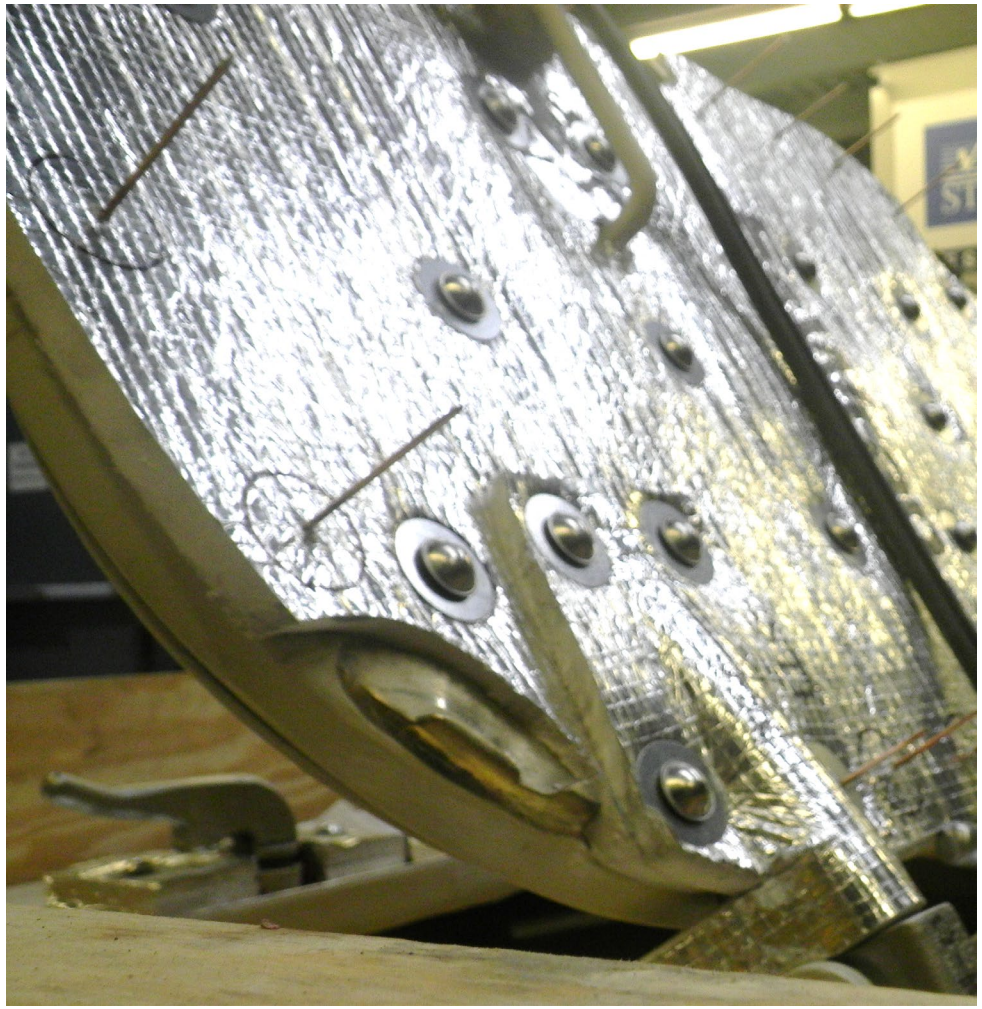
- Performed a risk reduction test on a small door
- Fire tests will be performed based on MIL-STD-3020

Hydrostatic test

- Doors already passed hydrostatic testing
- A hydrostatic test will be performed after fire exposure
- Acceptance criteria is not clear

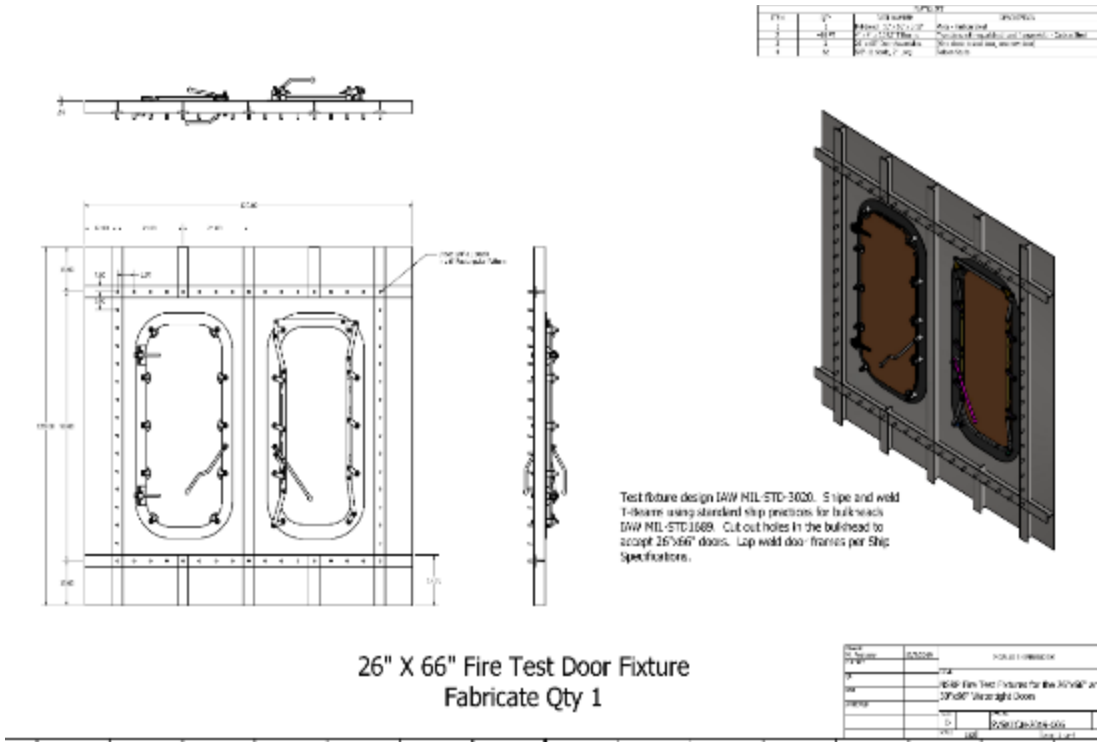
Shock Test

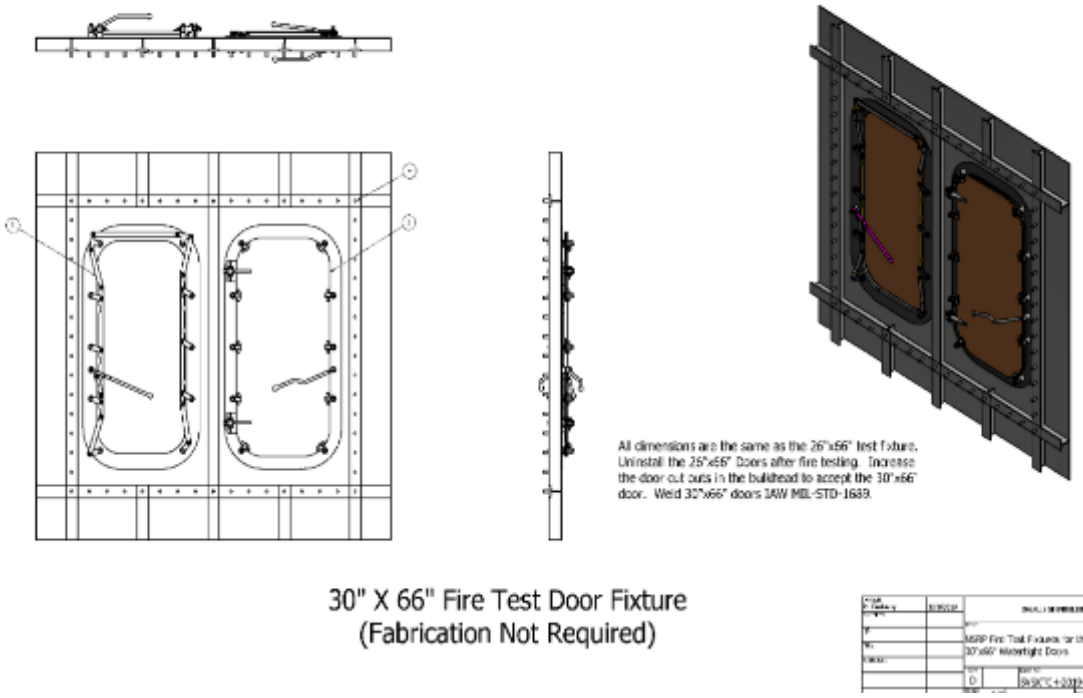
Developing lightweight shock test procedure



Developing Test Fixture

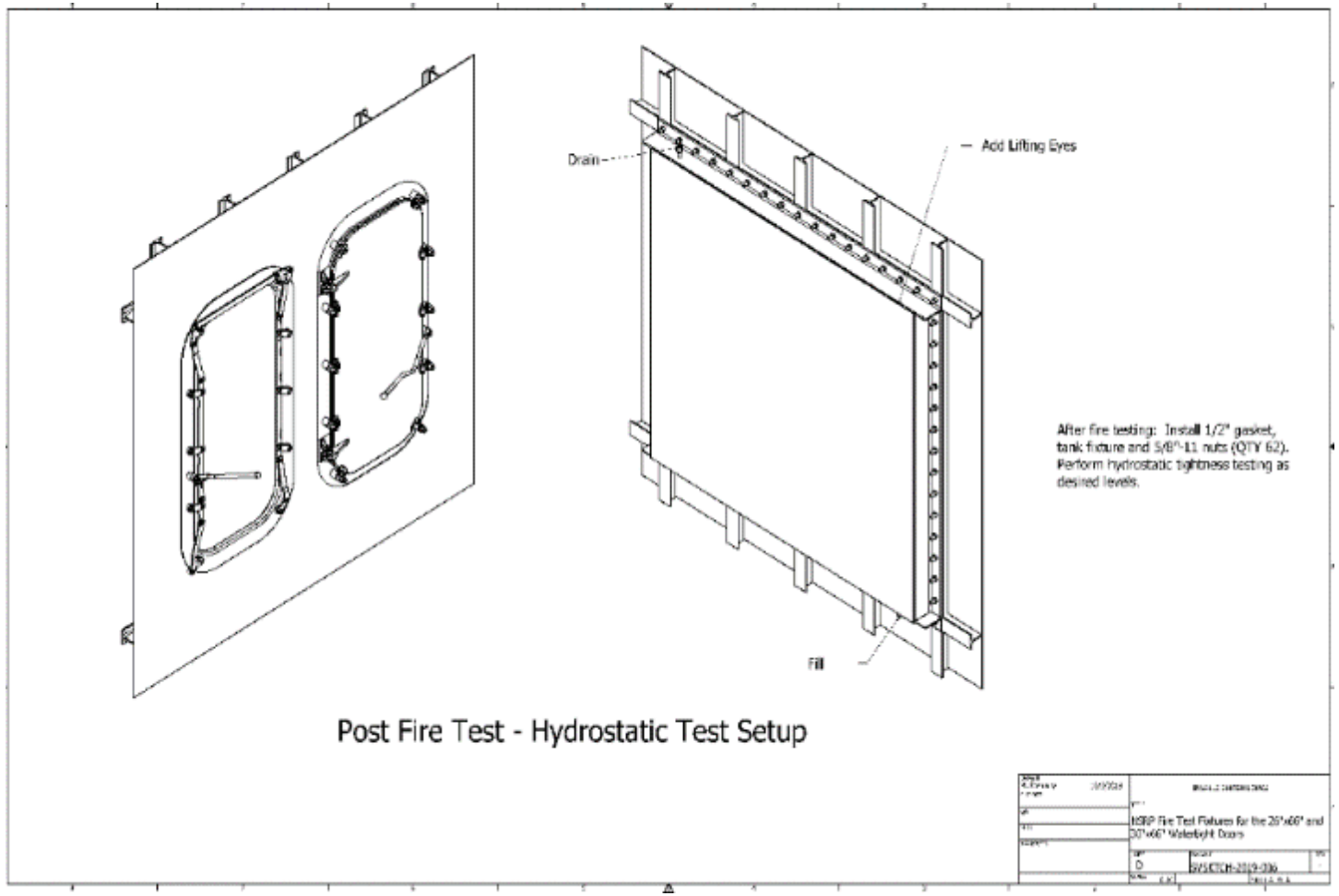
Test fixture design for 26”x66”QA and 30”x66”ID doors





Hydrostatic Test

Developing test fixture design for hydrostatic test chamber



Technology Transition

Test Reports

Final Project Workshop Materials

NAVSEA drawings

Re-issue existing drawings
Instruction for insulating the doors

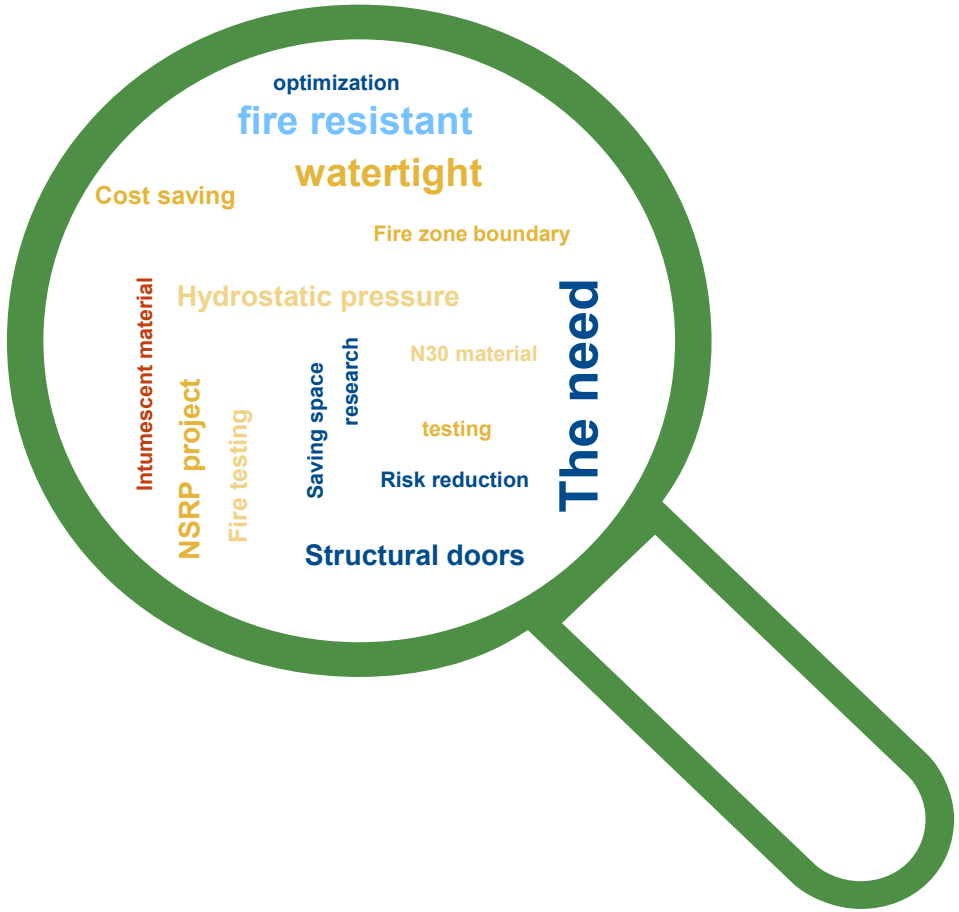
PMS cards

Update existing PMS card
Add inspection and maintenance instruction
of intumescent material

Industry discussions

Summary

The need	The plan	Implementation
Doors	**Research**	**Results**
Structural doors aren't fire resistant, and fire resistant doors aren't structural (i.e., watertight)	-Begin with new family of Navy watertight doors from prior NSRP project -Testing of various configurations of STI Marine Firestop materials	Compile test results and pursue NAVSEA approvals
We need a door that is both fire resistant AND watertight	Qualification testing for fire in Phase II	Final product in revised drawings



A more elegant and cost-effective solution