MODULAR RADIOLOGICAL CONTAINMENT SYSTEM
FOR THE NAVAL NUCLEAR LABORATORY

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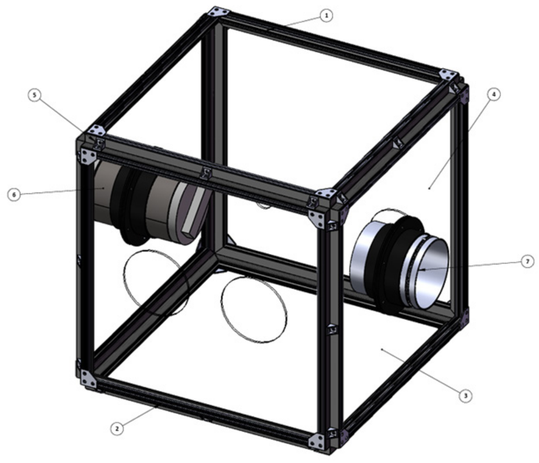
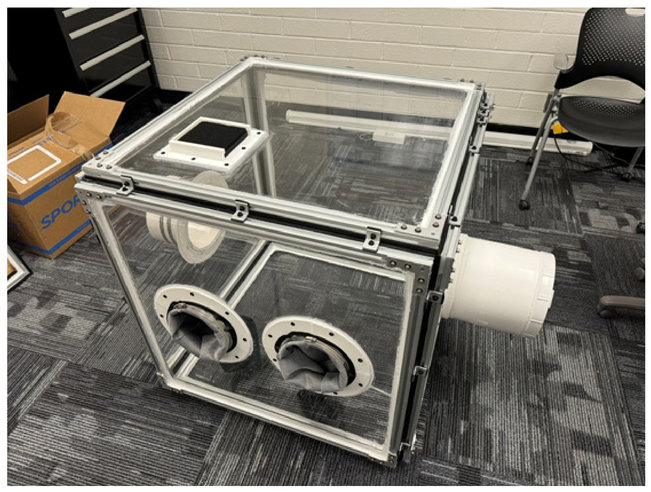
PROJECT DESCRIPTION

The Naval Nuclear Laboratory (NNL) has a number of processes that require contaminants to be sealed within radiological containments. Accidents or one-off processes often require custom containments which are costly and take time to design and build. To solve the problem of handling unique, one-off containment processes, NNL wants a modular radiological containment system that can be easily assembled and used for individual scenarios.

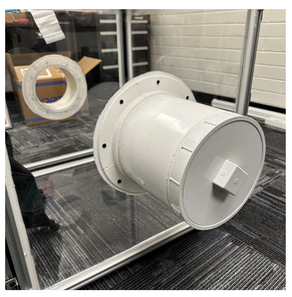
DESIGN



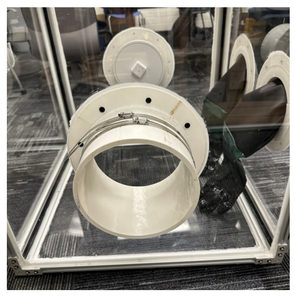
Complete containment design in CAD



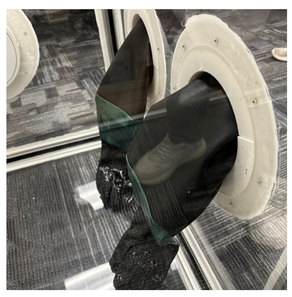
Complete and assembled containment box



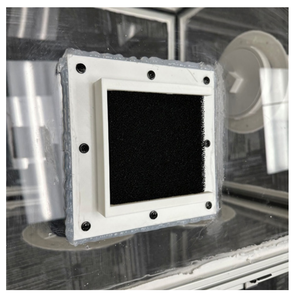
Transfer Sleeve



Swipe Port



Glove Port



HEPA Filter

REQUIREMENTS

REQUIREMENTS	TARGET	THRESHOLD	ACTUAL
Air and Watertight	N/A	No smoke enters while under vacuum	Zero leaks
Set-up Time	1 Hour	3 Hours	1 Hour
Panel Weight	20 lbs	50 lbs	14.6 lbs
Cost	N/A	$5,000	$4,757.04
Volume	N/A	15.625 ft3	15.625 ft3
Glove Ports	N/A	2	2
Swipe Port	N/A	1	1
Transfer Sleeve	N/A	1	1
Vacuum Port	N/A	1	1
HEPA Filter	N/A	1	1

The modular radiological containment is an acrylic T-slot based design. This design uses square sheets of acrylic housed in T-slot frames to provide modularity. The design uses different panels for individual subsystems including glove ports, transfer sleeves, HEPA filter, and swipe ports.

The requirement of airtightness was satisfied by a smoke test of the sealed edges while under vacuum. The test passed when no smoke entered the containment.

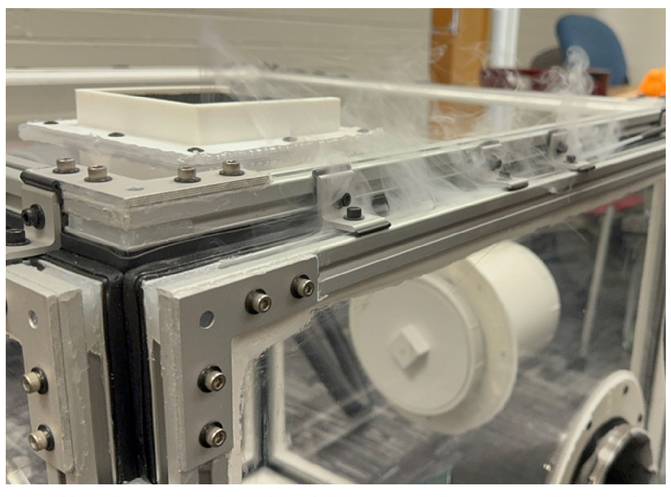
The watertightness requirement was satisfied by pouring water on the sealed edges as well as the subsystem seals. The seals passed when water did not leak for 5 minutes.

The set-up time was tested by assembling a 1x1x1 panel box with 3 operators. The time to assemble was 1 hour.

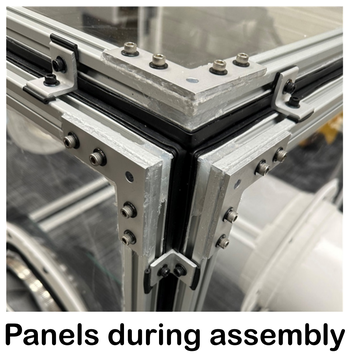
The panels each weigh 14.6 lbs.

The containment was assembled and proved to be self-supporting.

TESTING



Seals passing test by keeping smoke out



Panels during assembly

Seals passing water testing

CONCLUSION

The final containment box build passed all the tests performed to meet the given requirements. However, many lessons were learned along the way. Our team avoided misaligned expectations by sending meeting agendas before meetings, and summarized discussion notes. Another lesson learned included testing and prototyping early on in the design process.

In the future, our team recommends using different gaskets that are softer and thicker to maintain a more consistent seal. Another improvement would be installing a lighter swipe port subsystem to reduce the containment's weight.

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