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Flammable Liquid Storeroom Halon 1301 Replacement Testing - Phase 1: Preliminary Results

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COMBUSTION DYNAMICS SECTION

Flammable Liquid Storerooms (FLSRs)

- The United States Navy is investigating fixed fire extinguishing systems for future use in Flammable Liquid Storerooms (FLSRs) where Halon 1301 total flooding systems have been used. The two phase program is conducted at NRL's Chesapeake Bay Detachment (CBD).

FLSR 1 and FLSR 2

- Phase 1 tests are conducted in a 28 m^3 (1,000 ft^3) test compartment. This test bed will be applicable to many smaller shipboard compartments.

- Phase 2 tests will be conducted in a 280 m^3 (10,000 ft^3) compartment which is a representative size for large shipboard FLSRs.

Primary Objectives of the FLSR 1 Program

- Quantify Heptafluoropropane (HFC-227ea, HFP) performance in terms of required agent concentrations, fire suppression, reignition performance, and quantities of agent decomposition products.
- Investigate the performance of the Water Spray Cooling System (WSCS) for various initiation times, flow rates, application durations, and number and locations of WSCS nozzles.
- Compare test results of HFP to test results of Halon 1301

FLSR 1 Test Matrix

Series	Agent	Fires	WSCS	Variables
1	None	Yes	No	Background fires
2	HFP	No	No	Cold Discharges
3	None	Yes	No	Background fires
4	HFP	No	No	Cold Discharges
5	HFP/ 1301	Yes	No	Agent conc.
6	HFP	Yes	Yes	WSCS
7	HFP	Yes	Yes	WSCS
8	HFP	Yes	Yes	WSCS
9	HFP/ 1301	Yes	Yes	Varyin agent
10	HFP	Yes	Yes	Fire si
11	HFP	Yes	Yes	Fuel
12	HFP	Yes	Yes	Hold Times
13	HFP	Yes	Yes	Door Open

Sequence of Events

- Open dampers and initiate fan motors
- Fuel leak initiation
- Fuel ignition (prolonged ignition will yield a larger fire, initially)
- "Detection" can be determined using detectors or thermocouple simulation
- Time delay (associated with shipboard alarm response time)
- Secure fan motors ~ 5 seconds
- Close dampers ~ 20 seconds
- Discharge agent (activate CO_2)
- "Hold Time"
- Venting initiation

Fires

- Fire 1 is a 3-D Class B (methanol (80%) n-heptane (20%)) cascading fire located in the forward port corner of the compartment within the shelving.
- Fire 2 is a Class A (solid fuel (cardboard)) fire contained in a 2 ft x 2 ft pan located in the forward starboard corner of the compartment.
- Fire 3 is located in the center of the compartment and is also a Class A fire contained in a 2 ft x 2 ft pan.

Tests Series 1

Fire #	Flow Rate (gpm)	Fuel Flow (min:sec)	Ignition (min:sec)	Preburn Duration (min:sec)	Shelving
1	0.4	3:10	Immediate	3:10	Perforated
1	0.4	2:10	Immediate	2:10	Perforated
1	0.4	2:10	00:27 delay	1:43	Perforated
1	0.4	2:10	Immediate	2:10	Solid
1	0.4	2:10	No Ignition	0:00	Solid
1	0.4	1:10	Immediate	1:10	Perforated
1	0.3	3:10	Immediate	3:10	Perforated
1	0.3	2:10	Immediate	2:10	Perforated
1	0.3	1:10	Immediate	1:10	Perforated
2	N/A	N/A	3:00	5:25	Both
2	N/A	N/A	3:30	1:30	Both
3	N/A	N/A	2:57	4:49	Both
3	N/A	N/A	3:19	6:32	Both
1	N/A	N/A	3:09	5:34	Both
1	0.4	2:10	Immediate	2:10	Perforated
2	0.4	2:10	00:29 delay	1:41	Perforated
2	0.4	2:10	Immediate	2:10	Perforated
2	0.4	2:10	Immediate	2:10	Perforated

Current/ Future Work

FLSR 1 and 2

- Complete FLSR 1 tests
- Finalize FLSR 2 design
- Construct FLSR 2
- Investigate alternative technologies (funding permitting)

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