

Annual Conference on Fire Research  
Gaithersburg, MD, October 28-31, 1996

## Flammable Liquid Storeroom Halon Replacement Testing

Alexander Maranghides,<sup>a, b</sup> Ronald S. Sheinson,<sup>b</sup> Bruce H. Black<sup>a</sup>

NAVAL RESEARCH LABORATORY  
Navy Technology Center for Safety and Survivability  
Combustion Dynamics Section, Code 6185, Washington, DC 20375-5342, USA  
(1-202) 404-8101, Fax (1-202) 767-1716  
E-mail: maranghi@ccfsun.nrl.navy.mil; sheinson@ccfsun.nrl.navy.mil

The United States Navy is investigating fixed fire extinguishing systems for future use in shipboard Flammable Liquid Storerooms (FLSRs) where halon 1301 total flooding systems have been used. The test program aimed at determining the halon replacement agent of choice for shipboard FLSRs will be conducted at the Naval Research Laboratory's (NRL's) Chesapeake Bay Detachment (CBD) in two test compartments. Phase 1 tests will be conducted in a 28 m<sup>3</sup> (1,000 ft<sup>3</sup>) test compartment. This test bed will be applicable to many smaller shipboard compartments. Phase 2 tests will use a 280 m<sup>3</sup> (10,000 ft<sup>3</sup>) compartment, a representative size for large shipboard FLSRs.

The purpose of this paper presentation is to address the design of the Phase 1 test compartment. Phase 1 tests will serve as a learning process for designing and executing larger scale FLSR tests. The prime objectives of Phase 1 testing are:

- identify the halon replacement agent of choice and its optimum design concentration;
  - determine the optimum post fire suppression hold time (time prior to venting) and reentry time;
  - evaluate the option of using the Water Spray Cooling System (WSCS), an NRL innovation.
- The WSCS is designed to reduce compartment temperature and acid decomposition products as well as to enhance reignition protection and expedite compartment reclamation.

WSCS results from real scale halon replacement testing aboard the *ex*-USS SHADWELL demonstrated that the Water Spray Cooling System is a viable option for rapid reduction of compartment temperature and reduction of acids generated during suppression as well as subsequent acid removal.<sup>1</sup> In the 370 m<sup>3</sup> (13,000 ft<sup>3</sup>) test compartment, the low pressure WSCS tested provided very rapid compartment temperature reduction in 15 seconds with less than 20 gallons of water. The ability of the WSCS to run off the ship's firemain or from its own pressurized water tank make it a viable option for rapid post incident compartment reentry by the fire fighting party.

After intermediate and initial full scale testing, NRL proposed heptafluoropropane, HFP, (HFC-227ea, C<sub>3</sub>F<sub>7</sub>H, manufactured by Great Lakes Chemical Corporation as FM-200) as the

---

Supported by the U.S. Naval Sea Systems Command

a. GEO-CENTERS, Inc. Fort Washington, MD.

b. Authors to whom correspondence should be addressed.

clean agent of choice for U.S. Navy shipboard machinery spaces where the primary fire threat is pressurized flammable liquids.<sup>2</sup> FLSR Phase 1 testing will be performed primarily with HFP, with limited baseline comparison tests with Halon 1301. Other alternative and replacement technologies will also be evaluated.

This paper presentation will address the layout and instrumentation particulars of FLSR Phase 1 test compartment. Suppression agent discharge system and Water Spray Cooling System layout and instrumentation particulars will be addressed. This paper will also cover fuel selection and use, fire scenario particulars including compartment ventilation shutdown and preburn time selection, test running procedures, and the test matrix for Phase 1.

#### References:

1. A. Maranghides, R. S. Sheinson, B. H. Black, M. Peatross, and W.D. Smith, "The Effects of a Water Spray Cooling System (WSCS) on Real Scale Halon 1301 Replacement Testing and Post Fire Compartment Reclamation," Proceedings of the Halon Options Technical Working Conference, May 7-9, 1996, Albuquerque, NM, pp. 435-446.
2. Sheinson, R. S., Maranghides, A., Friderichs, T., Black, B. H., Smith, W., and Peatross, M., "Recommendations for the LPD-17 Main and Auxiliary Machinery Rooms Total Flooding Fire Suppression Systems," NRL Letter Report 6180/0193.1, 24 July 1995.