

Title: Water Mist Systems For US Navy Ships

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For the past five years the US Navy has been conducting an aggressive research program to evaluate Halon alternatives for possible use on U S Navy ships. Research has focused on both chemical gaseous alternatives as well as water mist. Ultimately the best candidates that evolved from the program were HFC-227ea and high pressure water mist. The Navy made a public committment that the next new ship design (LPD-17) would be Halon free, and accordingly an analysis was done to determine ship impact (cost, space, weight) of the competing technologies. As a result, water mist was selected as the fire suppression system of choice to protect the propulsion machinery spaces on the LPD-I7. A surrogate water mist system identical to the design envisioned for LPD-17 was installed in the US Navy fire research vessel, the ex-Shadwell in Mobile,Alabama, and subjected to large scale fire tests in November 1996.

The system selected for LPD-17 delivers potable water at an application rate of .003 GPM per Ft³ from pumping stations consisting of a potable water tank and an eletric motor driven positive displacement piston pump rated 225 GPM at 1000 PSI (two pumping stations per ship to protect all five machinery spaces). Water is delivered to a bi-level nozzle grid in each space through stainless steel piping. Flow rate of each water mist nozzle is either 3.5 or 1.5 GPM depending on nozzle location (at nominal nozzle pressure of 1000 PSI). Nozzle grid is uniformly spaced per level with staggered spacing top to bottom (mid level of spaces uses grated walkways). Ninety per cent of the water volume is contained in droplets smaller than 275 microns.

Fire tests involving flammable liquid pool and spray fires ranging from .5 to 5 MW were conducted against both shielded and unshielded fire locations. Botom line results: for unobstructed fires of any size, extinguishment time was less than 1 minute. For obstructed fires (where “umbrella” shielding between fire and mist nozzle was approximately 10 square feet) extinguishing time was dependent on fire size. For 5 MW fires, extinguishing time was less than 1 minute. For 3 MW time was 1.5 minutes and for 1 MW time was about 2 minutes.

U.S. NAVY PRIMARY HALON 1301 APPLICATIONS

- **Commissioned Ships With Halon**

228 Ships

2,218 Systems

1,430,745 Pounds

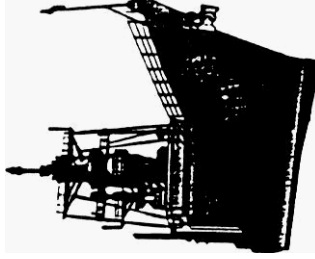


- **Military Sealift Command Ships With Halon**

46 Ships

331 Systems

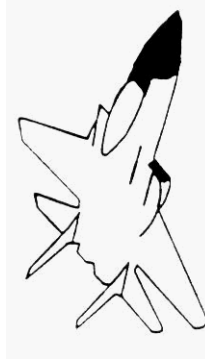
509,326 Pounds



- **Aircraft With Halon**

3,663 Aircraft

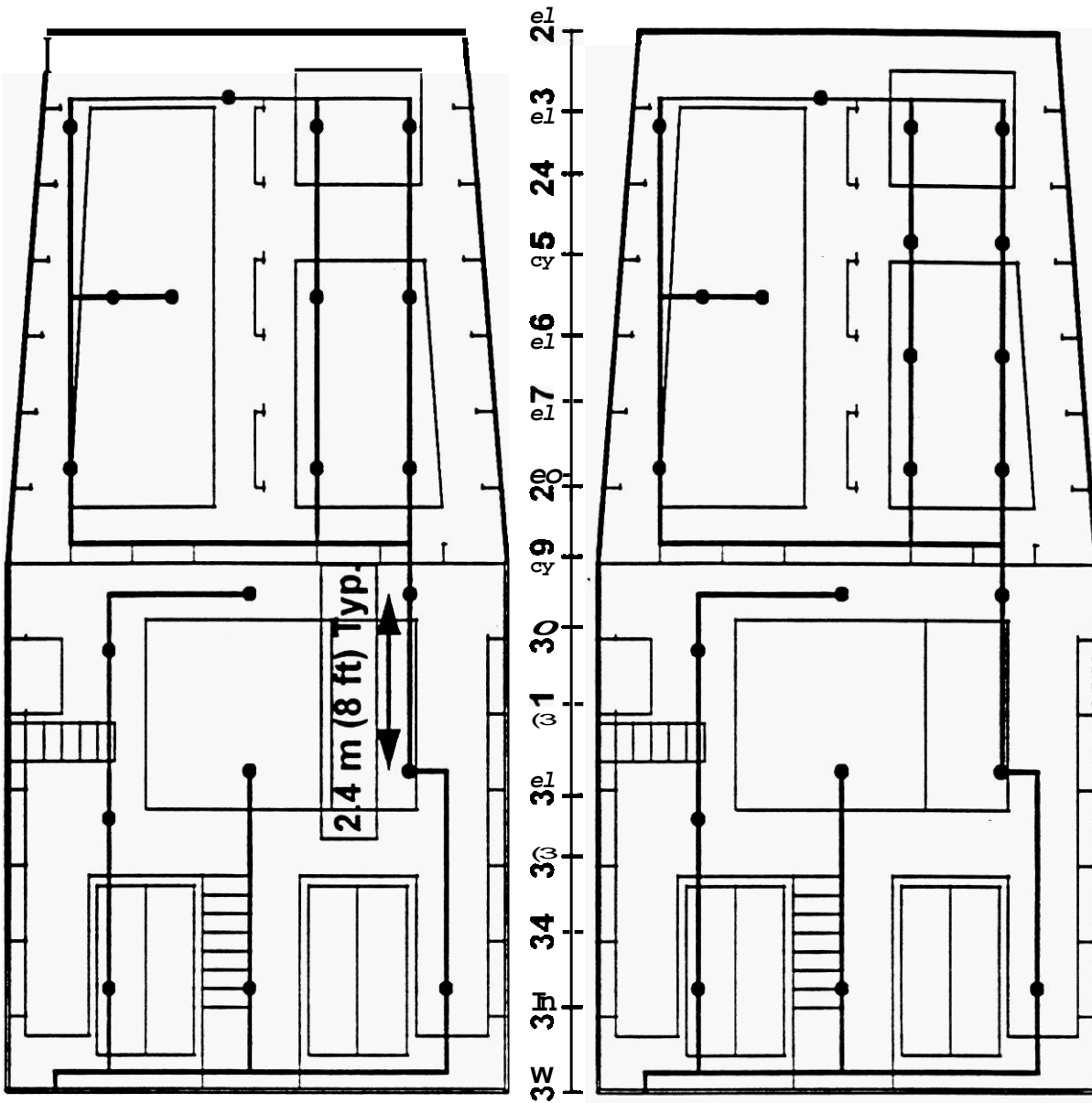
69,216 Pounds



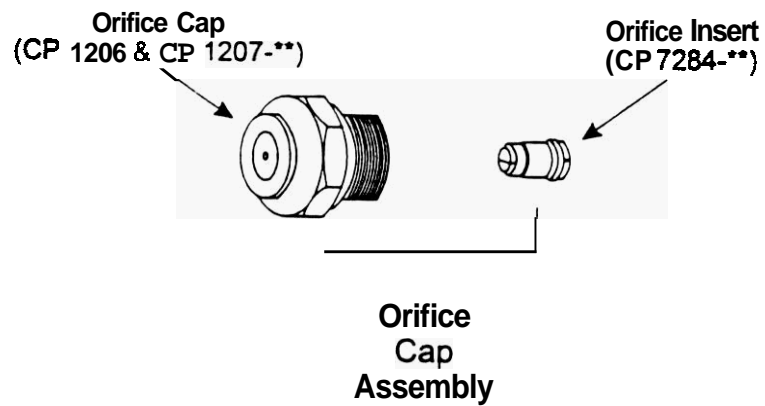
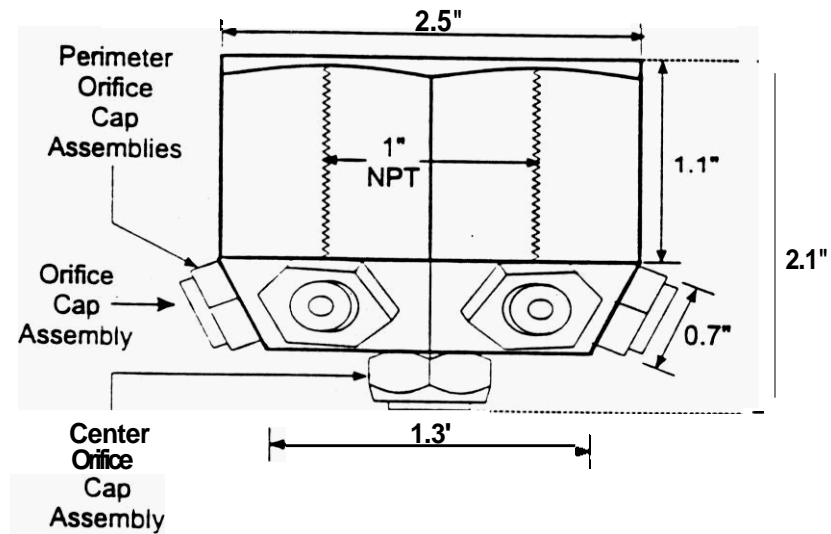
Water Mist Fire Extinguishing System Advantages

- Zero Ozone Depletion Potential
- Zero Global Warming Potential
- Non-Toxic
- Non-Corrosive (if Made from Potable Water)
- Tremendous Cooling Capacity

Overhead Pipe Networks



Spraying Systems Model 7N Nozzle Body (1-7N)



Note: ** are size designations

Fig. 5 - Water mist nozzle

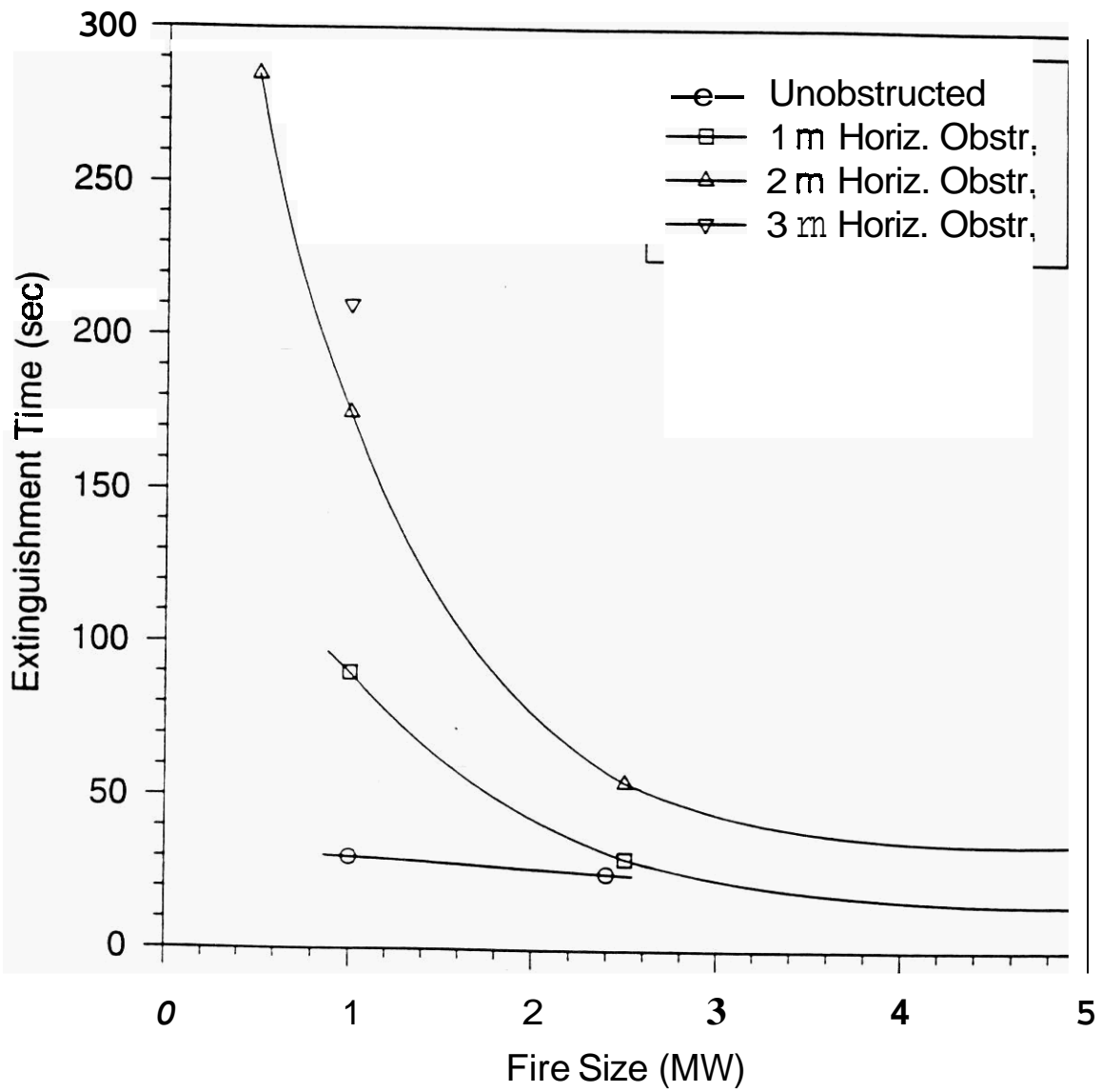


Fig. 11 - Mist system capabilities

Fuel Comparison (F76 vs. Heptane)

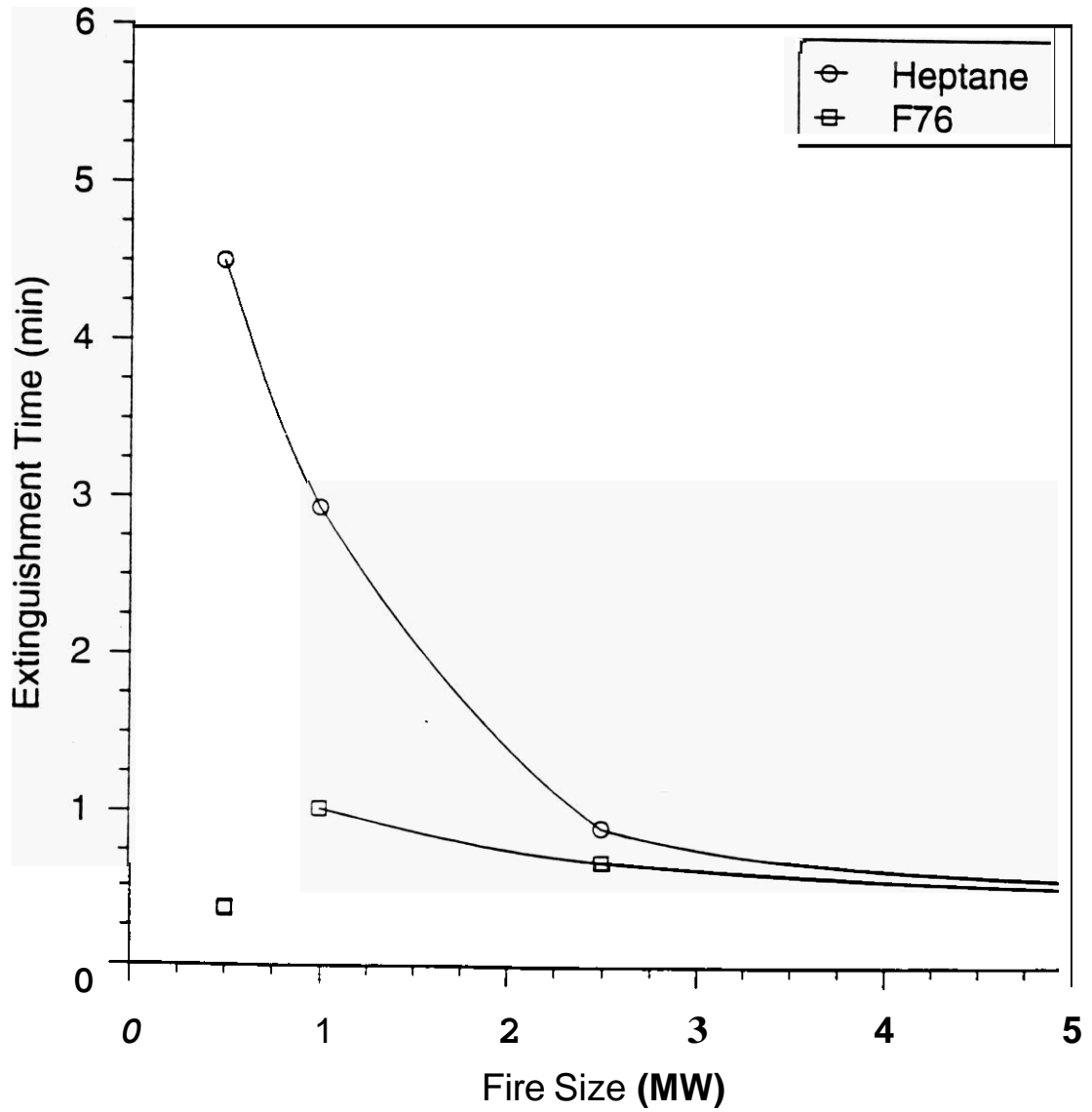
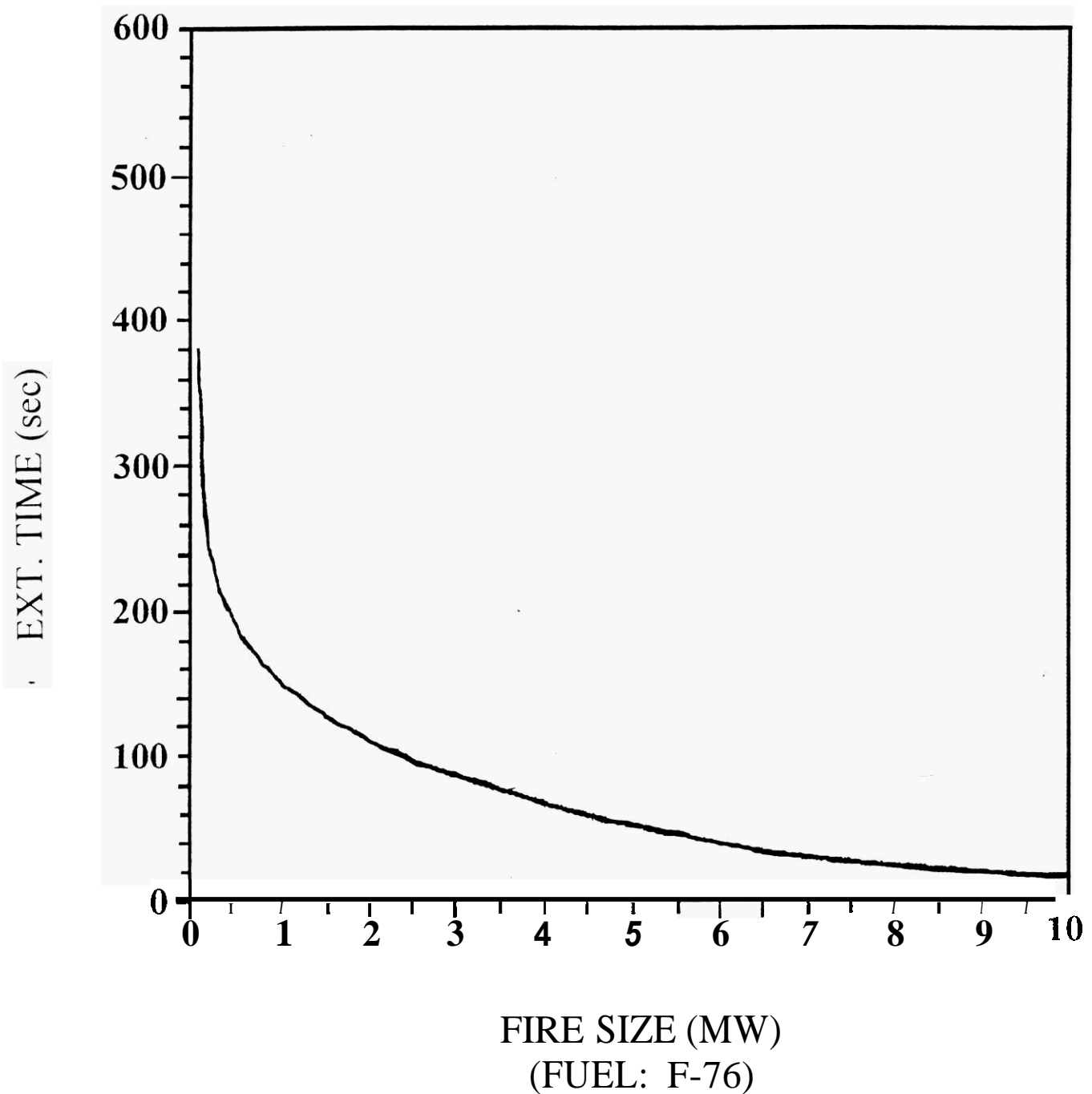


Fig. 12 - Fuel type comparison

PREDICTED EXTINGUISHMENT TIMES FOR THE LPD-I7
MAIN MACHINERY ROOMS
(OBSTRUCTED FIRES)



INSTALLATION CRITERIA

LPD-17

0 APPLICATION RATE = .003 GPM/FT³ BASED ON GROSS VOLUME

MMR#1 = 75,000FT³

FLOW = 225 GPM

0 NOZZLE GRID AT EACH LEVEL

0 2 3 OF FLOW AT UPPER LEVEL

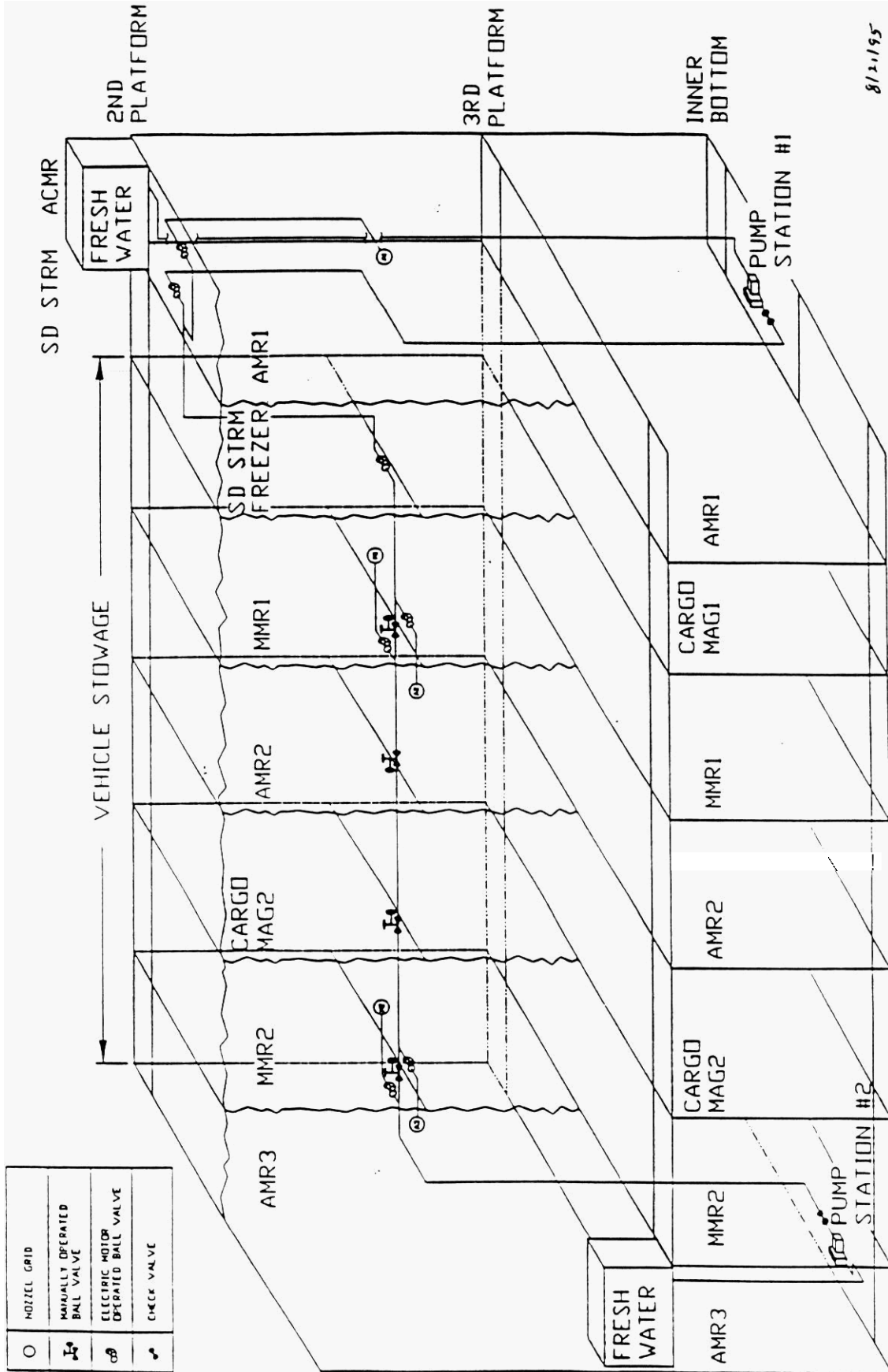
0 1/3 OF FLOW AT LOWER LEVEL

0 UNIFORM SPACING GRID (EXCEPT WHERE OBSTRUCTIONS)

0 NOMINAL NOZZLE SPACING 4-10.

0 PLACE NOZZLE UNDER ANY "UMBRELLA" SHIELD GREATER THAN 10 FT²

0 AFFF BRIN LING IN PILING



8/2/95

○	NOZZEL GRID
⊠	MANUALLY OPERATED BALL VALVE
⊙	ELECTRIC MOTOR OPERATED BALL VALVE
●	CHECK VALVE

**SHIP IMPACT
ALTERNATIVE FIRE EXTINGUISHING SYSTEMS
MACHINERY SPACES LPD-17**

	<u>HALON 1301</u>	<u>FM-200</u>	<u>WATER MIST</u>
WEIGHT	46,500 lbs	91,600 lbs	3,400 lbs
FOOTPRINT	480 sq ft	1500 sq ft	450 sq ft
COST OF COMPONENTS	\$ 220 K	\$ 540 K	\$ 330 K
RELATIVE INSTALLED COST	1.0	3.0	1.5

WATER MIST

◊ ELECTRICAL EQUIPMENT EXPOSURE TESTS

- ◊ EFFECT OF MIST ON ENERGIZED ELECTRICAL EQUIPMENT
EQUIPMENT DAMAGE
PERSONNEL SHOCK HAZARD
- ◊ EQUIPMENT (3 PHASE, 450 VAC) TO BE ENGULFED IN MIST
(.005 GPM/FT)
SWITCHBOARD
ELECTRIC MOTOR
MOTOR CONTROLLER
- ◊ METAL PLATE (2' X 6') TO SIMULATE PERSON
- ◊ MEASURE SHORTING/LEAKAGE CURRENT
PHASE-TO-PHASE
PHASE-TO-CHASSIS
PHASE-TO-PERSON
- ◊ TEST SCHEDULED FOR SEP/OCT 1997
- ◊ JOHN HOPKINS UNIVERSITY APPLIED PHYSICS LAB