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NAVAL AIR WARFARE CENTER

EFFECTS OF CANDIDATE FLUROCARBON HALON 1301 REPLACEMENT AGENTS ON METAL FIRES

System Requirements Department

David D. Thurston

Naval
Air Warfare Center, Lakehurst

4/26/95

Candidate Flurocarbon Replacements for 1301

Tri-Service Halon Replacement Program for Aviation

Down-Selected Agents

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Air Warfare Center, Lakehurst

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Aircraft Metal Fires

F/A-18A/B and C/D
Engine Casing

S-3B VIKING
Landing Gear

FIRE MECHANISMS

Fluorocarbon Effects on Metal Fires

EXPERIMENTAL FINDINGS

Exothermic Reaction Rates

Heat Release Rate

Combustion Zone

Spread Rate

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Metal Fire Test Program

EXPERIMENT SET UP

Test Apparatus

Test Conditions

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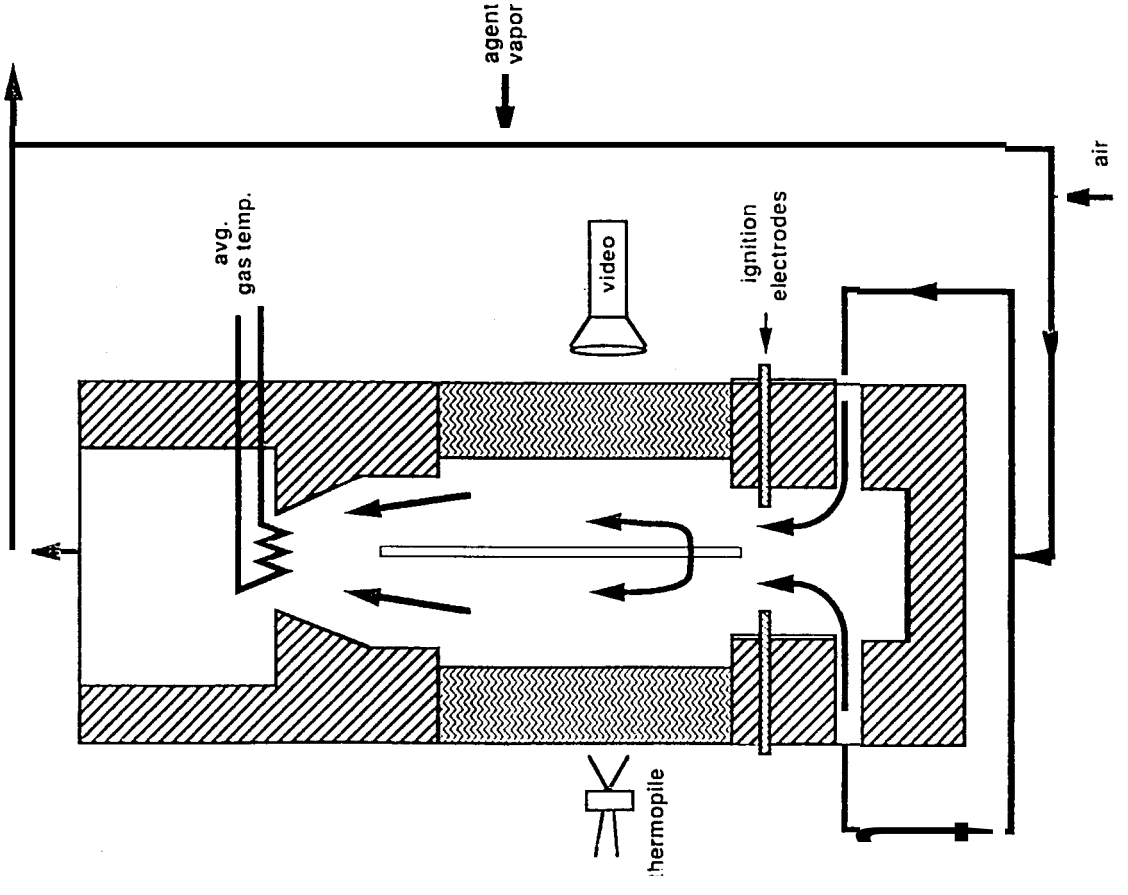
Apparatus Schematic



Metal Fire Test Program (Cont'd)

METAL SAMPLES

Titanium

Magnesium

TEST PROCEDURES

Data Collection

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Metal Fire Test Data

MAGNESIUM BURNING IN PRESSURIZED AIR WITH AGENT VAPOR

TEST I.D.	AGENT (ADD-ON, WGT%)	GAS FLOW VELOCITY (cm/s)	CHAMBER PRESSURE (Mpa/psig)	BURN RATE (MM/S)
Mg-11,12,13,14	HALON 1301 10%	13	0.79/100	EXTING.
Mg-25,26,27	-	37	0.27/25	EXTING.
Mg-47,48	HALON 1301 10%	13	0.79/100	EXTING.
Mg-39,40	-	37	0.27/25	EXTING.
Mg-41,42	HFC-125 (5%)	13	0.79/100	EXTING.
Mg-37,38	-	37	0.27/25	EXTING.
Mg-39,40	HFC-227 (5%)	37	0.27/25	EXTING.
Mg-30,31	FC-218 (10%)	37	0.27/25	EXTING.
Mg-43,44,45	FC-218 (5%)	14	0.72/90	EXTING.
Mg-32,33	-	37	0.27/25	EXTING.
Mg-34,35,36	CF_3I (5%)	37	0.27/25	EXTING.

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MAGNESIUM BURNING IN PRESSURIZED AIR

TEST I.D.	AMBIENT GAS	MASS FLOW RATE OF GAS (g/s)	GAS FLOW VELOCITY (cm/s)	CHAMBER PRESSURE (Mpa/psig)	BURN RATE (MM/S)
Mg-24	AIR	1.33	42	0.24/20	3.66
Mg-21	-	-	22	0.44/50	4.23
Mg-4	-	-	13	0.79/100	4.14
Mg-5	-	-	-	-	3.75
Mg-50	-	1.89	36	0.27/25	4.14
Mg-52	-	-	-	-	3.45
Mg-53	-	-	-	-	3.33
Mg-16	AIR + Nitrogen (10% ADD-ON)	1.46	13.9	0.79/100	3.75
Mg-19	-	-	-	-	3.53
Mg-20	-	-	-	-	3.57

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Metal Fire Test Data (Cont'd)

TITANIUM BURNING IN ELEVATED OXYGEN ATMOSPHERES

TEST I.D.	WEIGHT PERCENT OXYGEN	CHAMBER PRESSURE (Mpa/psig)	GAS FLOW VELOCITY (cm/s)	AGENT (ADD-ON, WGT%)	BURN RATE (MM/S)
Ti-14	40	0.79/100	13	NONE	1.85
Ti-15					1.94
Ti-20	"	"	14	NITROGEN	1.63
Ti-21				10%	1.67
Ti-16				HALON-1301	1.11
Ti-18	"	"	N	10%	EXTING.
Ti-19					EXTING.
Ti-22					1.57
Ti-23			12	HFC-125	EXTING.
Ti-24	"	"		10%	EXTING.
Ti-25					1.92
Ti-39	50	0.31/30	33	NONE	2.53
Ti-40					2.59
Ti-37	"	"	34	HALON-1301	1.07
Ti-38				15%	1.05
Ti-34	"	"	34	HFC-125	1.07
Ti-36				15%	0.96
Ti-32	"	"	34	HFC-227	1.88
Ti-33				15%	1.9
Ti-26	50	0.38/40	27	NONE	2.48
Ti-27					2.41
Ti-28	"	"	28	HALON-1301	1.24
Ti-29				15%	1.2

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Test Performance and Data Reduction

TEST RESULTS

Lower Exothermic Reactions

Extinguishing Action

CONCLUSIONS

Feasibility of Candidates