

ESL-TR-91-302

AFFF/HALON DUAL NOZZLE TEST

JULY 1991

FINAL REPORT



**ENGINEERING & SERVICES LABORATORY
AIR FORCE ENGINEERING & SERVICES CENTER
TYNDALL AIR FORCE BASE, FLORIDA 32403**

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PREFACE

This report was prepared by the Engineering and Services Laboratory, Air Force Engineering and Services Center, Tyndall Air Force Base, Florida 32403.

Mr Hugh A. Pike, AFESC/RDCF, was the Project Officer. This report presents the results of the AFFF/Halon Dual Nozzle test conducted from 3 May 1991 to 5 June 1991 at Tyndall AFB, Florida.

This report has been reviewed and is approved.



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14. ABSTRACT The purpose of this test series was to evaluate and compare the fire suppression performance of a new dual agent nozzle from Regal Products, Inc. with the P-19 standard aqueous film forming foam (AFFF) and halon handline nozzles. A dual agent nozzle may have application in suppressing 3-D Class B fires where the fire suppression attributes of a gaseous agent will complement the fire suppression and securing performance of AFFF. This nozzle was provided by Regal Products, Inc. for evaluation at no cost to the government. Objectives for the test series were: - Measure and compare the maximum throw range and discharge patterns of the test nozzles with those of AF standard AFFF and halon nozzles. - Evaluate and compare the fire suppression performance capability of the test AFFF nozzle to the P-19 AFFF handline nozzle. - Evaluate the ergonomic properties of the test dual agent nozzle, to include ease of operation, back-pressure and comfort.					
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SECTION I

INTRODUCTION

A. BACKGROUND

The purpose of this test series was to evaluate and compare the fire suppression performance of a new dual agent nozzle from Regal Products, Inc. with the P-19 standard Aqueous Film Forming Foam (AFFF) and halon handline nozzles. A dual agent nozzle may have application in suppressing 3-D Class B fires where the fire suppression attributes of a gaseous agent will compliment the fire suppression and securing performance of AFFF. This nozzle, was provided by Regal Products, Inc. for evaluation at no cost to the government.

B. TEST OBJECTIVES

Test objectives for the test series were as follows:

1. Measure and compare the maximum throw range and discharge patterns of the test nozzles with those of Air Force standard AFFF and halon nozzles.
2. Evaluate and compare the fire suppression performance capability of the test AFFF nozzle to the P-19 AFFF handline nozzle.
3. Evaluate the ergonomic properties of the test dual agent nozzle, to include ease of operation, back-pressure, and comfort.

C. MEASURES OF MERIT

The measures of merit were the capability and ease of operation of the dual agent nozzle as subjectively evaluated by experienced firefighters. For the fire suppression tests, extinguishment time, quantity of agent used, throw range, and ease of operation were the parameters used in determining the success of the apparatus.

D. SCOPE

This project evaluated the operational performance of a dual AFFF and halon handline nozzle manufactured by Regal Products, Inc. of Shrewsbury, Massachusetts. The apparatus mounts an air-aspirating AFFF nozzle and a halon nozzle on the same control handle. The maximum agent throw ranges were measured and compared TO the standard P-19 firefighting vehicle handline nozzles. HCFC-142b, a non-toxic, non-ozone depleting chemical with physical properties similar to Halon 1211 was used to evaluate the throw range of the Regal and P-19 halon nozzles. No Halon 1211 was released during this test series. Foam physical properties were measured and compared for the standard P-19 and Regal AFFF nozzles. Fire suppression capabilities of the Regal AFFF nozzle were evaluated and compared to the standard P-19 AFFF handline nozzle. Extinguishing time and throw range were the governing test parameters for comparison. Ergonomic considerations such as, ease of operation, back-pressure, and comfort were also subjectively evaluated by experienced firefighters. A total of four 150 square-foot test fires were conducted. Each burned 50 gallons of JP-4.

E. TEST AUTHORITY

HQ USAF Program Management Directive (PMD) Number 63723F (2104), dated March 1985, provided the authority for this test. This test program was conducted in accordance with AFR 80-14.

F. TEST ITEM DESCRIPTION

The Regal dual agent nozzle tested is a prototype unit machined from aluminum. An air aspirating AFFF nozzle was mounted side-by-side with a halon nozzle on a single plate. A handle, fabricated from a folded aluminum plate was welded to the lower side of the nozzle mounting plate. Separate control valves were provided for each agent on the upper side of the assembly. Agents may be applied separately or simultaneously. Discharge patterns for both agents were non-variable straight stream. Designed discharge rates were 50 GPM at 100 PSI for the AFFF and 5 lbs/sec for the halon. Hose connections were 3/4 inch for the halon nozzle and 1 inch for the AFFF. The unit weighed 5 1/2 pounds.

SECTION II

TEST DESCRIPTION

A. INTRODUCTION

This test program was conducted to measure the maximum throw range of the dual agent nozzles and compare the results with those of the standard P-19 AFFF and halon handline nozzles. The standard P-19 AFFF handline nozzle is a non-aspirating unit manufactured by Elkhart Brass, part number 4000-13.1.00 (2CB714), rated for 60 GPM at 100 psi nozzle pressure. The standard P-19 halon nozzle used during this test was manufactured by Amerex Corporation, part number 5295. AFFF testing was conducted in accordance with NFPA Standard 412, Evaluating Foam Fire Fighting Equipment on Aircraft Rescue and Fire Fighting Vehicles. Although halon is not specifically addressed in NFPA 412, these test procedures were used as a guide, in conjunction with NFPA 12B, Halon 1211 Fire Extinguishing Systems, to evaluate the throw range of the halon nozzles. To evaluate the fire suppression performance of the AFFF nozzles, 150 square foot fires burning 50 gallons of JP-4 each were conducted for the series, two for each AFFF nozzle.

The AFESC 100-foot environmentally-safe fire test facility, located on Farmdale Road, Tyndall AFB, Florida was used for all fire tests. The facility was modified for this test series with a steel ring 14 feet in diameter to create a burn area of 150 ft².

Pretest briefings were conducted before each fire to evaluate weather conditions, discuss the results of the previous test, verify that all systems were functional, and plan the next fire test. Individual protective equipment was worn by all actively involved personnel.

B. THROW RANGE TESTS

This test evaluated the throw ranges of the AFFF and halon nozzles. The procedures outlined in NFPA 412 were used as a test guide. A bracket was fabricated to secure the handline nozzles to the tailgate of a pick-up truck. AFFF tests were conducted with the nozzle secured 41 inches above the ground at a 30° elevation angle, while halon nozzle tests were conducted with the nozzles at 0° elevation. AFFF was dispensed for a 30 second period. Premixed AFFF was supplied from a P-4 firefighting vehicle. The P-4 was used as its output can be controlled to regulate the nozzle pressure to 100 psi during discharge operations. Both the AFFF and the halon handlines were equipped with pressure gauges at the nozzle to permit nozzle pressure to be monitored during operation. Average flow rates were calculated by measuring the agent quantities used and dividing by the flow times. The maximum depth of the AFFF blanket in the center of the distribution pattern was measured and recorded. Foam quality was also subjectively evaluated by experienced firefighters. Maximum throw ranges for both the standard P-19 handline and Regal nozzles were measured and recorded. Halon nozzle maximum throw ranges were evaluated by discharging HCFC-142b, a non-toxic, non-ozone depleting chemical with physical properties similar to Halon 1211, through the halon nozzles and observing the throw range with an observer adjacent to the target area. Data were recorded on the Nozzle Distribution Pattern Test Data Sheet, provided in Annex 5 of the test plan.

C. AFFF FIRE TEST

A 150 ft² burn area was created by placing a 14 foot diameter, six-inch high ring in the 100-foot burn pit. Fifty gallons of JP-4 was floated on water in the ring and ignited. After a 30-second pre-burn period, the fire was attacked and extinguished using either the standard AFFF handline nozzle from the P-19 or the Regal AFFF nozzle. This fire test was completed twice with each AFFF nozzle (total of four fires). The extinguishing times and agent used were measured and compared. The agent used was calculated by multiplying the dispensing time with the previously measured flow rates from each nozzle. No fire extinguishing tests were conducted for the halon nozzles.

D. ERGONOMIC FACTORS EVALUATION

Throughout the tests described in the above paragraphs, the handline nozzles were operated and subjectively evaluated by experienced firefighters. The standards for comparison were the standard P-19 handline nozzles. To facilitate evaluating the maximum back pressure at the control handle, both nozzles were briefly operated simultaneously. At the conclusion of the test series, the firefighters were interviewed to ascertain the plus and minus operational factors of the dual agent test nozzle as compared to both P-19 nozzles individually.

E. INSTRUMENTATION AND DATA COLLECTION

The P-4 pump output pressure was adjusted prior to each test to maintain the desired nozzle pressure of 100 psi. The P-4 pump output pressure gauge was used to measure the pump pressure. A calibrated flow meter and stop watch were used to determine the average AFFF flow rates. HCFC-142b flow rates were calculated by weighing the container before and after each operation and dividing by the dispensing time. A pressure gauge was installed to measure the nozzle pressure during operation. All data were recorded on the data collection sheets provided in Annex 5 of the test plan. A video camera recorded all test activities.

SECTION III

TEST RESULTS

A. GENERAL

Nozzle tests were conducted on the Civil Engineering test runway adjacent to the fire test pit on Farmdale Road, Tyndall AFB, Florida. Fire tests were conducted in the AFESC 100-foot fire test facility. AFESC personnel recorded all test data on data forms provided in Annex 5 of the test plan.

B. THROW RANGE TESTS

1. AFFF Throw Range and Foam Quality Tests.

The nozzles, mounted on the back of a pick-up truck at a 30° elevation angle, were oriented to expel agent in a direction that placed the wind behind the nozzle. The P-4 supplied premixed 3% AFFF at the required pressure (100 psi nozzle pressure) through a 1 1/2 inch diameter, 200 foot long fire hose. A flow meter, calibrated in gallons per minute (GPM), was installed in the center of the 200-foot hose to measure agent quantities used. Both an Elkhart AFFF nozzle, as used on the Air Force Standard P-19 firefighting vehicle, and the AFFF side of the Regal Dual Nozzle Apparatus were operated from the truck-mounted test stand at 100 psi nozzle pressure. Ambient temperature was 78°F. Both the maximum throw range and the foam quality were essentially the same for the Elkhart and Regal nozzles. Table 1 contains specific results of these tests.

Table 1. AFFF Nozzle Throw Range and Agent Quality Test Results

DATE	TEST NO.	NOZZLE	FLOW RATE (gpm)	NOZZLE (PSI)	MAX THROW (ft)	WIND (mph)	FOAM DEPTH (in)	FOAM QUALITY
15 May	1	Elkhart	56	100	95	4	.37	Good
5 June	2	Regal	50	100	95	5	.50	Good

2. Halon Nozzle Throw Range Tests.

HCFC-142b was placed in a 150-pound flightline halon extinguisher and pressurized with nitrogen and an adjustable pressure regulator. Halon nozzles were mounted on the back of the pick-up truck mounting apparatus in a similar manner to the AFFF tests. The halon nozzle used for this comparison test was an Amerex nozzle that is used on the Air Force standard flightline halon extinguisher and the P-19 firefighting vehicle. Initial tests were attempted using a 30° nozzle elevation angle. However, the halon simulant, HCFC-142b, dispersed into the air immediately, reducing the throw range to near zero. The nozzle was reoriented to 0° elevation angle and the test

continued. Even with the nozzle adjusted to 0° no agent reached the ground in liquid form. The maximum throw range was measured by an observer located adjacent to the target area. Ambient temperature was 90°F. Test results are contained in Table 2.

Table 2. Halon Nozzle Throw Range Test Results

DATE	TEST NO.	NOZZLE	FLOW RATE lb/sec	NOZZLE (PSI)	MAX THROW (ft)	WIND (mph)
4 June	1	Amerex	N/A	100	21	3
4 June	2	Regal	2.8	100	28	5

C. AFFF FIRE TEST

Four 150 ft² fires burning 50 gallons of JP-4 each were conducted to compare the fire suppression performance of the AFFF half of the Regal dual nozzle to that of the standard P-19 AFFF handline nozzle. Premixed three percent AFFF, dispensed from a P-4 firefighting vehicle was used for all fire tests. Table 3 contains the results of these fire tests. As can be observed from the test data, fire suppression by the two nozzles is comparable.

Table 3. AFFF Fire Suppression Tests

DATE	TEST NO.	NOZZLE	FLOW RATE (gpm)	NOZZLE (PSI)	AGENT USED (gal)	EXT. TIME (sec)	TEMP deg F	WIND (mph)
5 June	1	Regal	50	100	13	15	86	5
5 June	2	Regal	50	100	14	17	90	5
5 June	3	Elkhart	56	100	17	18	90	5
5 June	4	Elkhart	56	100	12	13	91	5

D. ERGONOMIC FACTORS EVALUATION

In addition to operating the nozzles in a test stand to measure throw range, all nozzles were operated by experienced firefighters to evaluate the equipment/firefighter interface of the system. At the conclusion of the test series, both firefighters were interviewed and their comments recorded. Following is a consensus of these comments concerning the Regal Dual Agent Nozzle.

1. The handle is too short, uncomfortable, and difficult to handle. A larger, comfortably-fitting pistol grip handle would improve the system significantly.

2. While both the standard P-19 and Regal halon nozzles produce little back pressure to the operator, the standard halon nozzle, that lays in the operator's hand without a handle, is easier to handle and control than the Regal nozzle. Both operators preferred the standard halon nozzle.

3. The Regal AFFF nozzle presented the same awkwardness as the halon nozzle due to the uncomfortable handle and off-center position of the nozzle relative to the handle. The nozzle tends to rise more than the standard nozzle while dispensing agent. The apparatus did not feel as comfortable and balanced in the operator's hand as the standard AFFF nozzle.

4. Advancing and maneuvering the apparatus with both hoses attached was very difficult and awkward without a helper. Maintaining directional control of the nozzle while dispensing both agents simultaneously was achieved only with considerable difficulty by a single firefighter.

SECTION IV

CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The flow rates and throw distances of the AFFF and halon sections of the Regal Dual Agent Nozzle were essentially the same as the standard P-19 handline AFFF and halon nozzles. The fire suppression performance, as measured by the extinguishing times and agent quantities used, of the Regal AFFF section of the Regal nozzle was essentially the same as the standard P-19 Elkhart AFFF nozzle. The balance and comfort of the Regal nozzle was less than desirable, primarily due to the short non-form fitting handle and the off-center location of the nozzles relative to the handle.

B. RECOMMENDATIONS

An over and under arrangement of the nozzles should be investigated to improve nozzle balance and flow control for dual nozzle operations. A larger, form-fitting pistol grip handle should be fitted to provide a balanced, comfortable interface with the firefighter.

APPENDIX A

AFFF/HALON DUAL NOZZLE

TEST PLAN

AIR FORCE ENGINEERING AND SERVICES CENTER
Tyndall Air Force Base, Florida 32403

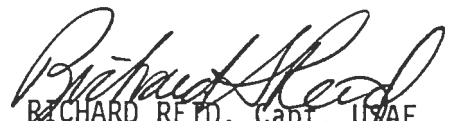
AFFF/HALON DUAL NOZZLE

9 APRIL 1991

TEST PLAN

This test plan has been reviewed and approved by:


HUGH A. PIKE
Test Director


RICHARD REID, Capt, USAF
AFESC/RDCS (SAFETY OFFICER)


RICHARD N. VICKERS
Chief, Air Base Fire Protection
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SECTION I

INTRODUCTION

A. SCOPE

This project will evaluate the operational performance of a dual Aqueous Film Forming Foam (AFFF) and Halon handline nozzle manufactured by Regal Products, Inc. of Shrewsbury, Massachusetts. The apparatus mounts an aspirating AFFF nozzle and a halon nozzle on the same control handle. The maximum agent throw range and distribution patterns will be measured and compared for the standard P-19 firefighting vehicle handlines and the dual nozzle being tested. HCFC-142b, a non-toxic, non-ozone depleting chemical with physical properties similar to Halon 1211 will be used to evaluate the throw range and distribution patterns of the test and P-19 Halon nozzles. No Halon 1211 will be released into the atmosphere during this test series. Foam physical properties will be measured and compared for the standard P-19 and test AFFF nozzles. Fire suppression capabilities of the test AFFF nozzle will be tested and compared to the standard P-19 AFFF handline nozzle. Extinguishing time and throw range will be the governing test parameters for comparison. Ergonomic considerations such as, ease of operation, back-pressure, and comfort will also be subjectively evaluated by experienced firefighters. A total of four fires of 150 square feet and burning 50 gallons of JP-4 each are planned for the test series.

B. BACKGROUND

A dual agent nozzle may have application in suppressing 3-D Class B fires where the fire suppression attributes of a gaseous agent will compliment the fire suppression and securing performance of AFFF in fuel fires. This nozzle, being offered for evaluation by Regal Products, Inc. at no cost to the government, may have application in this scenario.

C. AUTHORITY

HQ USAF Program Management Directive (PMD) Number 63723F (2104), dated March 1985, provides the authority for this test. This test program will be conducted as directed in the PMD and AFR 80-14.

D. PURPOSE

The purpose of this test series is to evaluate and compare the fire suppression performance of the P-19 standard AFFF and Halon handline nozzles with a new dual agent nozzle from Regal Products, Inc.

E. TEST ITEM DESCRIPTION

This dual agent nozzle is a prototype unit machined from aluminum. An air aspirating AFFF nozzle is mounted side-by-side with a Halon nozzle on a single plate. A handle, fabricated from an aluminum plate is welded to the lower side of the nozzle mounting plate. Separate agent control valves are provided for each agent on the upper side of the assembly. Agents may be applied separately or simultaneously. Discharge patterns for both agents are non-variable straight stream. Designed discharge rates are 50 GPM at 100 PSI for the AFFF and 5 lbs/sec for the Halon. Hose connections are 3/4 inch NPSH for Halon nozzle and 1 inch NPSH for the AFFF. The unit weighs 5 1/2 pounds.

SECTION II

TEST OBJECTIVES AND MEASURES OF MERIT

A. TEST OBJECTIVES

1. Measure and compare the maximum throw range and discharge patterns of the test nozzles with those of Air Force standard AFFF and Halon nozzles.

2. Evaluate and compare the fire suppression performance capability of the test AFFF nozzle to the P-19 AFFF handline nozzle.

3. Evaluate the ergonomic properties of the test dual agent nozzle, to include ease of operation, back-pressure, and comfort. This objective will be subjectively evaluated by at least two experienced firefighters. The standard for comparison will be the standard P-19 handlines.

B. MEASURES OF MERIT

The measures of merit are the capability and ease of operation of the dual agent nozzle as subjectively evaluated by two or more experienced firefighters. For the fire suppression tests, extinguishment time, quantity of agent used, throw range, and ease of operation are the parameters to be used in determining the success of the apparatus being tested.

SECTION III

MANAGEMENT AND ORGANIZATIONAL RESPONSIBILITIES

A. MANAGEMENT

Overall test responsibility rests with the AFESC/RDCF Test Director. The Test Director will delegate authority, as necessary. Specific responsibilities for safety, instrumentation, photography, and engineering support are listed in the following paragraphs.

B. ORGANIZATIONAL RESPONSIBILITIES

1. HQ AFESC - The Air Force Engineering and Services Center is responsible for overall test management.
2. AFESC/RDCF will:
 - a. Develop, coordinate, and publish a test plan.
 - b. Provide the Test Director and Range Safety Officer.
 - c. Provide the necessary fire test facilities, AFFF and simulated Halon agents (HCFC-142b), instrumentation and data collection systems.
 - d. Have overall test authority and be the final judge as to test protocol and relative merit of the test results.
 - e. Determine test protocols and outline test results.
 - f. Prepare a test report describing the method of test and test results.
3. Regal Products, Inc. will:
 - a. Provide the test dual agent nozzle at no cost to the government.

SECTION IV

TEST EXECUTION

A. GENERAL

This test program will be conducted by measuring the maximum throw range and distribution patterns of the dual agent nozzle and comparing the results with those of the standard P-19 AFFF handline. AFFF testing will be conducted in accordance with NFPA Standard 412, Evaluating Foam Fire Fighting Equipment on Aircraft Rescue and Fire Fighting Vehicles. Although Halon is not specifically addressed in NFPA 412, these test procedures will be used as a guide, in conjunction with NFPA 12B, Halon 1211 Fire Extinguishing Systems, to evaluate the distribution pattern of the halon nozzles. To evaluate the fire suppression performance of the AFFF nozzles, 150 square foot fires burning 50 gallons of JP-4 are planned for the test series. four fires are planned for the series, two for each AFFF nozzle.

The AFESC 100-foot environmentally-safe fire test facility, located on Farmdale Road, Tyndall AFB, Florida will be used for all fire tests. The facility will be modified for this test series with a steel ring 14 feet in diameter to create a burn area of 150 ft².

The Test Director will not permit anyone to approach the fire without his expressed consent. Pretest briefings will be conducted before each fire to evaluate weather conditions, discuss the results of the previous test, verify that all systems are functional, and plan the next fire test. Individual protective equipment will be worn by all actively involved personnel and will be tested and verified as fully operational before fuel is placed in the pit. At T-30 minutes (30 minutes before ignition time) the pretest checklist, included at the end of Annex 3, will be completed to ascertain the readiness of all functions. These functions will include, but are not limited to, safety, weather, test pit readiness, and data collection readiness. When all functions are ready, the fire will be ignited. The order to ignite the fuel will be given by the AFESC Test Director.

B. NOZZLE SPRAY DISTRIBUTION PATTERN TEST

The purpose of this test is to evaluate the throw range and distribution pattern of the AFFF and Halon nozzles. The procedures outlined in NFPA 412 will be used for this portion of the test. A bracket will be fabricated to secure the handline nozzles with a 30° elevation angle. AFFF will be dispensed for a 30 second period. Both the AFFF and the Halon handlines will be equipped with a pressure gauge at the nozzle so that nozzle pressure can be measured during operation. The depth of the AFFF blanket will be measured and plotted in the target area out to a depth of 1/2 inch. Distributions patterns for both the standard P-19 AFFF handline and the test AFFF nozzle will be plotted and compared. Halon nozzle distribution patterns will be evaluated by discharging HCFC-142b, a non-toxic, non-ozone depleting chemical with physical properties similar to Halon 1211, through the Halon nozzles and observing the throw range and distribution pattern with an observer adjacent to the target area. So as not to contribute to the ozone depletion problem, no Halon 1211 will be used during this test series. Data will be recorded on the Nozzle Distribution Pattern Test Data Sheet, provided in Annex 5.

C. AFFF FIRE TEST

A 150 ft² burn area will be created by placing a 14 foot diameter, six-inch high ring in in the 100-foot burn pit. Fifty gallons of JP-4 will be floated on water in the ring and ignited. After a 30-second pre-burn period the fire will be attacked and extinguished using either the P-19 AFFF handline and standard nozzle or the test AFFF nozzle. This fire test will be completed twice with each AFFF nozzle (total of four fires). The extinguishing times and agent used will be measured and compared. The agent used will be measured by recording the agent and water levels from the site glasses on the side of the P-19 before and after the tests. No fire extinguishing tests are planned using the Halon nozzles.

D. ERGONOMIC FACTORS EVALUATION

Throughout the tests described in the above paragraphs, the handline nozzles will be operated and subjectively evaluated by experienced firefighters. To facilitate measuring the maximum back pressure at the control handle, both nozzles will be briefly operated simultaneously. At the conclusion of the test series, these firefighters will be interviewed to ascertain the plus and minus operational factors of the dual agent test nozzle as compared to both P-19 nozzles.

E. INSTRUMENTATION AND DATA COLLECTION

The AFFF and water level site glasses on the P-19 will be used to determine the quantity of AFFF used. Both the AFFF and the Halon handlines will be equipped with a pressure gauge at the nozzle so that nozzle pressure can be measured during operation. All data will be recorded on the data collection sheet contained in Annex 4. One video camera will record all test activities. Still camera photographs will be taken of selected events. Test data results do not constitute approval or endorsement for use of the tested product by U.S. Armed Force units. No data will be distributed without direction from the U.S. Air Force Engineering and Services Laboratory.

SECTION V

SAFETY

A. GENERAL

Safety is an integral part of the test. The Test Director is responsible for accident prevention. Personnel and equipment safety will take precedence over test execution at all times. Special emphasis will be placed on providing thorough supervision and guidance throughout all test phases. Permission briefings will be conducted daily by the test director detailing the test procedures for the day and emphasizing safety in all test phases.

The AFESC Test Director is ultimately responsible for safety. The Safety Officer is responsible for range safety and the conduct of the fire test. However, the test may be suspended at any time by anyone if a safety hazard is observed. Identification of a potential safety hazard will result in test suspension until the hazard can be evaluated and corrected to the satisfaction of the Test Director and the Safety Officer.

B. IDENTIFIED HAZARD

A JP-4 open pit fire, by its very nature, is hazardous. The largest fire planned for this test series will be 14 feet in diameter and will burn up to 50 gallons of JP-4 for approximately three minutes. The approved test plan has been examined for safety distance from surrounding objects and is well within safe distance limits.

C. SAFETY REPORTING

Accidents, incidents, and serious hazards will be reported in accordance with AFR 127-4 through AFESC/SEG and HQ USAFADWC/SEG. The Safety Officer is responsible for accident/incident reporting.

The Test Director will ensure that all appropriate safety procedures are followed throughout all testing. Testing will be suspended if an event occurs contrary to this checklist. During the the actual fire testing, observers will be located a minimum of 300 feet from the edge of the fire pit.

Individual protective equipment will be worn the test facility operators during all fire tests. During the Halon dispersion test the observer will also wear Self-Contained Breathing Apparatus (SCBA).

Additional safety procedures are contained in Annex 3.

SECTION VI
ENVIRONMENTAL IMPACT

In accordance with AFR 19-2, Air Force Form 813 has been completed and approved. The determination has been made that this test series qualifies for a Categorical Exclusion 2y. As stated in the Form 813, it is anticipated that all evidence of visible smoke will be dispersed within one hour. Any major fuel spills or other unplanned event that may affect the environment will immediately be reported to the AFESC and Tyndall AFB environmental offices.

ANNEX 1
TEST SCHEDULE

TEST APPARATUS PREPARATION	2-12 APRIL 91
TEST SET-UP	8-12 APRIL 91
AGENT DISTRIBUTION PATTERN TESTS	17APRIL 91
FOAM PROPERTY TESTS	17 APRIL 91
FIRE TESTS	18-19 APRIL 91

NOTE: *Dates are tentative.*

ANNEX 2
LOGISTICS SUPPORT

A. FACILITY REQUIREMENTS

The test facility for this test is the 100 foot AFESC Fire Research Facility #1, located approximately 7 miles southeast of the main gate at Tyndall AFB, Florida. This test site will be used for all fires conducted in this series.

B. PERSONNEL REQUIREMENTS

Personnel to support this test will be provided by AFESC/RDCF.

<u>Agency/Organization</u>	<u>Personnel Required</u>
AFESC/RDCF	Test Director Safety Officer Fire Pit Operator (2 ea) Data collector (1 ea) Video Operator (1 ea)
USAF HOSPITAL - TYNDALL AFB	Emergency Medical Care

C. MATERIAL REQUIREMENTS

Material requirements are as follows:

ITEM	QUANTITY	SOURCE
JP-4	200 gal.	AFESC/RDCF
Video tape	6 cassettes	AFESC/RDCF
35 mm film	6 rolls	AFESC/RDCF
AFFF (type 3%)	10 gallons	AFESC/RDCF

D. EQUIPMENT REQUIREMENTS

ITEM	QUANTITY
P-19 Fire Fighting Vehicle	1
Portable Fire Extinguishers	4
Protective Clothing (sets)	3
SCBA units	2
First Aid Kit	1
Hand Held Radios	2
Electric Ignition System	1
35mm Still Frame Cameras	2
VHS 1/2" Video Cameras	2
Stopwatches	2
Tape measure	1
Wind Direction Instrument	1
Grid Stakes	24
Various Size Fire Hoses	
150 pound Flightline Extinguisher	1

ANNEX 3

SAFETY

A. PURPOSE

This Safety Plan establishes the safety areas for the medium scale fire testing of the Dual Nozzle Apparatus. Fire tests will be conducted at the AFESC Fire Research Facility #1 located on Farm Dale Road, Tyndall AFB, Florida. This plan identifies the agency responsible for the test area. This document contains detailed Safety Rules which govern the conduct of this test series. The Test Director or Safety Officer will insure adherence to all safety policies. Before conducting any live fire tests at the Fire Research Facility, the Base Fire Department Communications Center will be notified. The following documents are applicable to this test:

AFOSH 127-11 & 50, First Aid Kits
AFOSH 127-31, Personal Protective Clothing and Equipment
AFR 92-1, Paragraph 4-14, Safety Equipment for Fire Fighters
AFR 127-4, Accident Reporting

B. OVERALL SAFETY RESPONSIBILITY

HQ AFESC/RDCF, as Test Director, is responsible for enforcing the overall safety program for the test. The Test Director will maintain close coordination with the AFESC Safety Officer (AFESC/SE) and the Air Defense Weapons Center Ground Safety Officer (USAFADWC/SEG) on all safety matters.

C. GENERAL SAFETY

1. Safety Briefing. The Test Director will brief all test personnel on known safety hazards in associated with this test and test site. Supervisors will, in turn, brief their personnel on these hazards.

2. Visitors. Visitors will be permitted at the test site only with the approval of the Test Director. Visitors will be instructed on applicable safety regulations.

3. Individual Safety Responsibility. Careful attention to potential hazards associated with fire testing must be stressed at all levels of responsibility. The purpose of the safety rules outlined herein is to present the most important elements in experimenting with controlled fires. These rules do not cover all the possible hazards which may occur at the site. As new problems arise, new safety measures must be established. This Safety Plan must be strictly adhered to by all personnel. The procedures outlined in the plan shall be accepted as minimum safe conduct. Only the Test Director may authorize a deviation from this plan.

4. Vehicles. For vehicles other than fire-fighting vehicles conducting actual fire-fighting operations, speeds shall not exceed 20 mph when driving on unpaved roads. Seat belts will be used at all times while vehicles are in motion. When a vehicle is parked, the hand brake will be set and the transmission put in park or reverse. Unauthorized vehicles will not be parked in the vicinity of the fire pit during fire test operations.

5. First Aid. An adequate supply of first-aid items will be maintained at the site. These items will be properly stored and periodically inspected. All personnel will be briefed upon the locations of first aid kit/supplies. An appropriate vehicle will be designated and available to transport injured persons to the base medical center, if required.

6. Accident Reporting (Emergency).

a. Scope. The purpose of this procedure is to ensure expedient handling and care of personnel injured in an accident or disaster. All post-emergency reporting and investigation of an accident will be performed in accordance with applicable Air Force Regulations.

b. Responsibility. Each person involved in this program must be familiar with the emergency reporting procedures established by this plan and immediately implement these procedures in the event of an accident. The Test Director will insure that all personnel are familiar with this procedure.

c. Emergency Reporting Procedures. In the event of an accident at the test site, the following procedures will be followed:

(1) The Test Director will direct appropriate first aid. Caution will be exercised to prevent aggravation of an accident-related injury.

(2) Tyndall Air Force Base Hospital Ambulance Service will be notified by calling extension 911. The nature of the accident, including apparent condition of injured personnel and the location of the test site, will be reported to the medical personnel. The Test Director or the Safety Officer will decide whether to transfer the injured directly to a hospital or to request emergency ambulance support.

(3) The Test Director or the Safety Officer will determine the seriousness of the accident. If the accident is not serious enough to require emergency hospitalization or ambulance service, the injured person will be taken to a doctor or hospital by normal means of transportation.

(4) All accidents requiring emergency treatment or first aid must be reported to the AFESC Safety Officer (AFESC/SE).

D. FIRE PREVENTION, REPORTING, AND EMERGENCY PROCEDURES

This paragraph defines the responsibility for fire prevention and reporting procedures related to the test.

1. Responsibility. The Test Director will be responsible for the implementation of the procedures established by this plan. All on-site personnel must be completely familiar with these procedures to ensure proper response to an emergency.

2. Fire Prevention Procedures. The procedures listed below are to be followed in an effort to reduce chances of an uncontrolled fire. Three portable fire extinguishers will be at the test site, and all personnel

participating in the fire test will be briefed on the locations and proper use of the extinguishers.

E. TEST SITE LOCATIONS

All fire tests will be conducted at the 100 foot AFESC Fire Research Facility #1, located on Farm Dale Road. These tests be conducted in accordance with AFESC Office Instruction dated 7 April 1988, titled "Live Fire Demonstration/Tests."

F. NOTIFICATION

Before conducting a fire test, notify the Fire Department Communications Center at Extension 3-2884.

1. The Communications Center will be requested to notify the following:
 - a. Command Post - 3-2155
 - b. Air Traffic Control Tower - 3-4553
 - c. Base Hospital - 3-7514
 - d. Security Police - 3-2028
 - e. Division of Forestry - 3-2641
 - f. Base Weather - 3-2856
2. The Fire Department Communications Center will need an estimate of the duration of the live fire tests.

PRETEST CHECK LIST
TO BE USED BEFORE CONDUCTING FIRE TESTS AT
FIRE RESEARCH FACILITIES NO. 1

DATE: _____ TIME: _____

VERIFIED

PROCEDURES

- _____ Brief all personnel on proper safety procedures.
- _____ All personnel at the test site are required for the test or are an approved visitor?
- _____ Brief all personnel on accident and fire reporting procedures.
- _____ Radio or telephone communications available?
- _____ Post telephone numbers for the ambulance and fire department by the telephone or radio.
- _____ Ensure that adequate first aid kit is available.
- _____ Ensure that an emergency eye wash apparatus is available.
- _____ Ensure that all fuel valves are closed and that there are no fuel leaks prior to fuel ignition.
- _____ Ensure Individual Protective Equipment is fully charged and operational.
- _____ Secure area prior to igniting fire.

ANNEX 4

LARGE-SCALE FIRE TEST PIT OPERATIONAL PROCEDURES

The following are general procedures to be used during the operation of the 100 foot fire test pit during all fire tests.

1. Insure all agencies are notified of test events.
2. Conduct Safety Briefing.
3. Verify all data collection equipment in place and operational.
4. Insure downrange/fire pit area clear.
5. Verify amount of fuel to be used; flow fuel in test area.
6. Start data collection.
7. Ignite fire.
8. 30-second pre-burn.
9. Conduct fire event/test.
10. Secure fire burn area/downrange.
11. Check test results.
12. Conduct post-test and facility shutdown procedures.
13. Notify all agencies that test complete & facility secure.
14. Conduct critique.
15. Document test results.

ANNEX 5

DUAL AGENT NOZZLE TEST

NOZZLE DISTRIBUTION PATTERN TEST DATA SHEET

DATE: _____ TIME: _____ TEST CONDUCTORS: Dees / Lewis

NOZZLE: AFFF: _____ HALON: _____ P-19: _____ REGAL: _____ AFFF TYPE: _____

HCFC-142b QUANTITY: BEFORE: _____ AFTER: _____ QUANTITY USED: _____

WATER QUANTITY: BEFORE: _____ AFTER: _____ WATER USED: _____

AFFF QUANTITY: BEFORE: _____ AFTER: _____ AFFF USED: _____

NOZZLE PRESSURE: _____ psi FLOW RATE: _____ gpm

PLOT FOAM DEPTH: (STAKES ON 3 FOOT CENTERS)

RANGE					CENTERLINE			
_____	ft	*	_____	*	_____	*	_____	*
_____	ft	*	_____	*	_____	*	_____	*
_____	ft	*	_____	*	_____	*	_____	*
_____	ft	*	_____	*	_____	*	_____	*
_____	ft	*	_____	*	_____	*	_____	*
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_____	ft	*	_____	*	_____	*	_____	*
_____	ft	*	_____	*	_____	*	_____	*
_____	ft	*	_____	*	_____	*	_____	*
_____	ft	*	_____	*	_____	*	_____	*

↑
Nozzle position

COMMENTS:

DUAL AGENT NOZZLE TEST
FIRE TEST CONDUCT CHECKLIST AND DATA COLLECTION SHEET

TEST NO: _____ NOZZLE: P-19: _____ REGAL: _____ DATE: _____ TIME: _____

WATER QUANTITY: BEFORE: _____ AFTER: _____ WATER USED: _____

AFFF QUANTITY: BEFORE: _____ AFTER: _____ AFFF USED: _____

OPERATING PRESSURE: _____ psi TOTAL AGENT USED: _____

METEOROLOGICAL DATA:

TEMPERATURE: _____ WIND: _____

TEST READINESS:

_____ Weather within limits	_____ Communications check
_____ Fire vehicles ready	_____ Ignition system ready
_____ Video cameras ready	_____ Fuel in pit
_____ Emer. Medical notified	_____ Access gate secured

CLEARANCE FOR IGNITION:

_____ Safety Officer _____ Fire Department

IGNITION TIME: _____ AGENT APPLICATION: START: _____ END: _____

EXTINGUISH TIME: _____

MAXIMUM AGENT THROW RANGE: _____ WIND: DIR: _____ SPEED: _____ mph

GENERAL COMMENTS: .