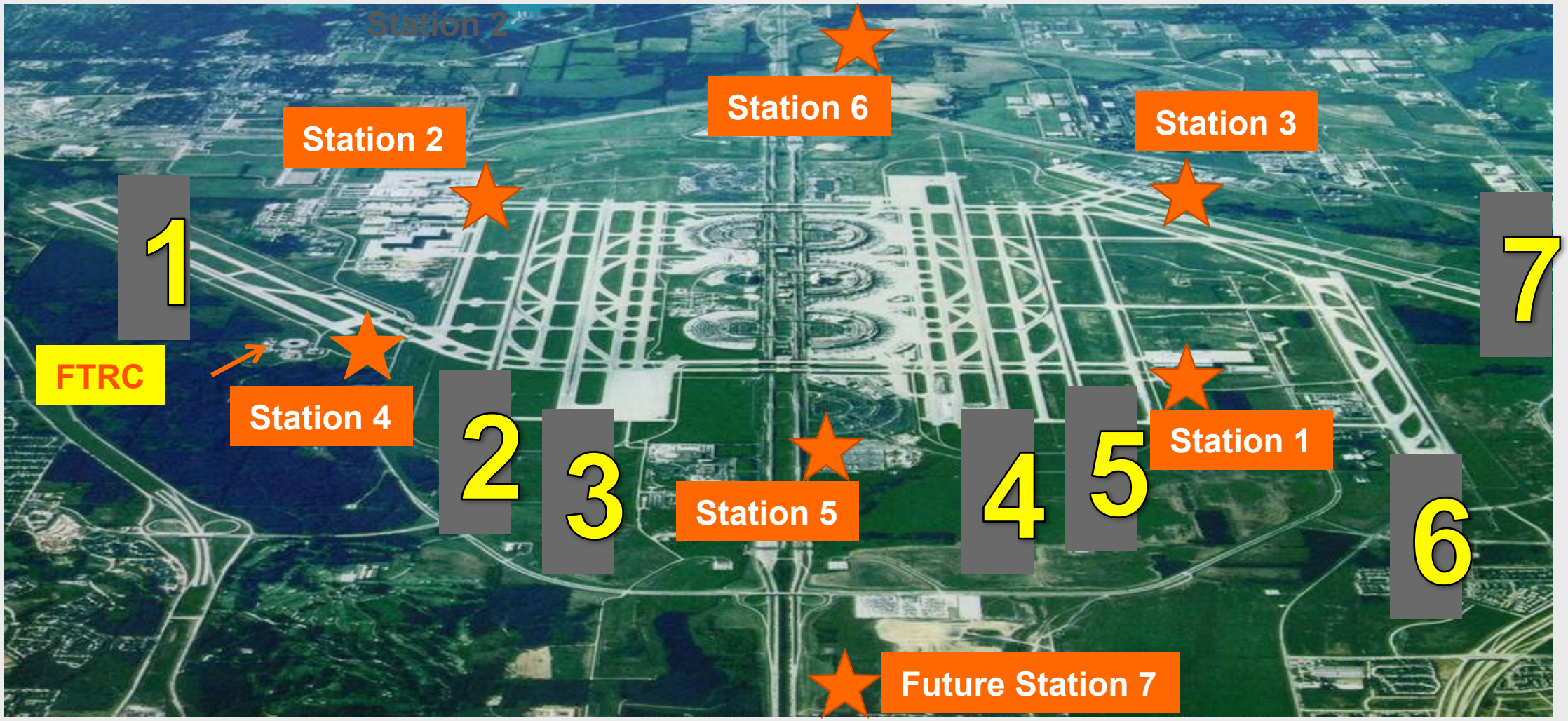
DFW Fire Training Research Center
PFC Fluoropolymer-Free Foam Concentrate
Research Results

DFW International Airport



DFW International Airport

DFW covers more than 26.9 square miles
Real property consists of 17,207 acres

Year Opened:
1974

World Rankings:
4th in terms of operations
11th in terms of passengers

DFW Airport Board Employees:
Approximately 1,900

On-Airport Employees:
Approximately 60,000

Fire Training Research Center - Mission

Since 1994, over 35,000 students have trained with FTRC from **44 US States** & **46 Countries**

Multi-lingual training curriculum (English, Spanish, Portuguese and Chinese)

Fire Training Research Center – Relationships/Partnerships

- International
  - International Civil Aviation Organization
  - World Health Organization
  - International Aviation Fire Protection Association

- Federal
  - National Fire Protection Association
  - Federal Aviation Administration
  - Center for Disease Control
  - Federal Emergency Management Association

Fire Training Research Center – Relationships/Partnerships

- State
  - Texas Governor's Division of Emergency Management

- Local
  - Public Health (Counties)
  - Emergency Management (Cities & Counties)
  - Hospitals
  - Universities
    - Oklahoma State University
    - University of Texas at Arlington
    - Embry-Riddle Aeronautical University

Fire Training Research Center

Fire Training Research Center

Research Collaborative Efforts

Past Projects

University of Texas at Arlington – Fiber Reinforced Polymer (FRP)
FAA Tech Center – High Reach Extendable Turret (HRET)
FAA Tech Center – Thermal Imaging Cameras (TIC)
Globe Manufacturing – Protective Clothing Testing
Lion Apparel – Extreme Heat Glove Test
Akron Brass Nozzle – High Pressure Flow Test
Cargo Fires on Aircraft – Pyrolance Extinguishing Technologies
Foam Research and Testing – field testing completed February /2017

Current Projects

FAA / Public Safety – UAS Drone use for Emergency Response / Management – April 2017
FAA Airspace Drone Detection Systems – April 2017

Future Efforts

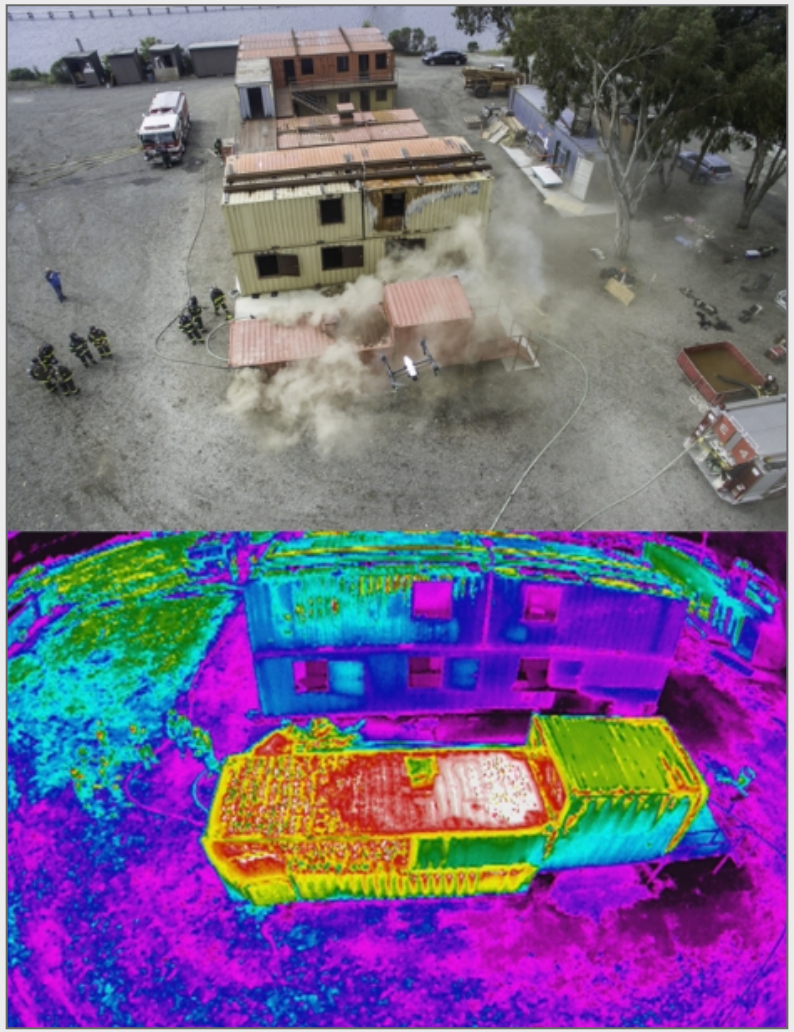
FAA Tech Center – Passenger Aircraft Interior Firefighting (Thermal Balance)
EF Johnson Technologies – Extreme Heat Radio Test

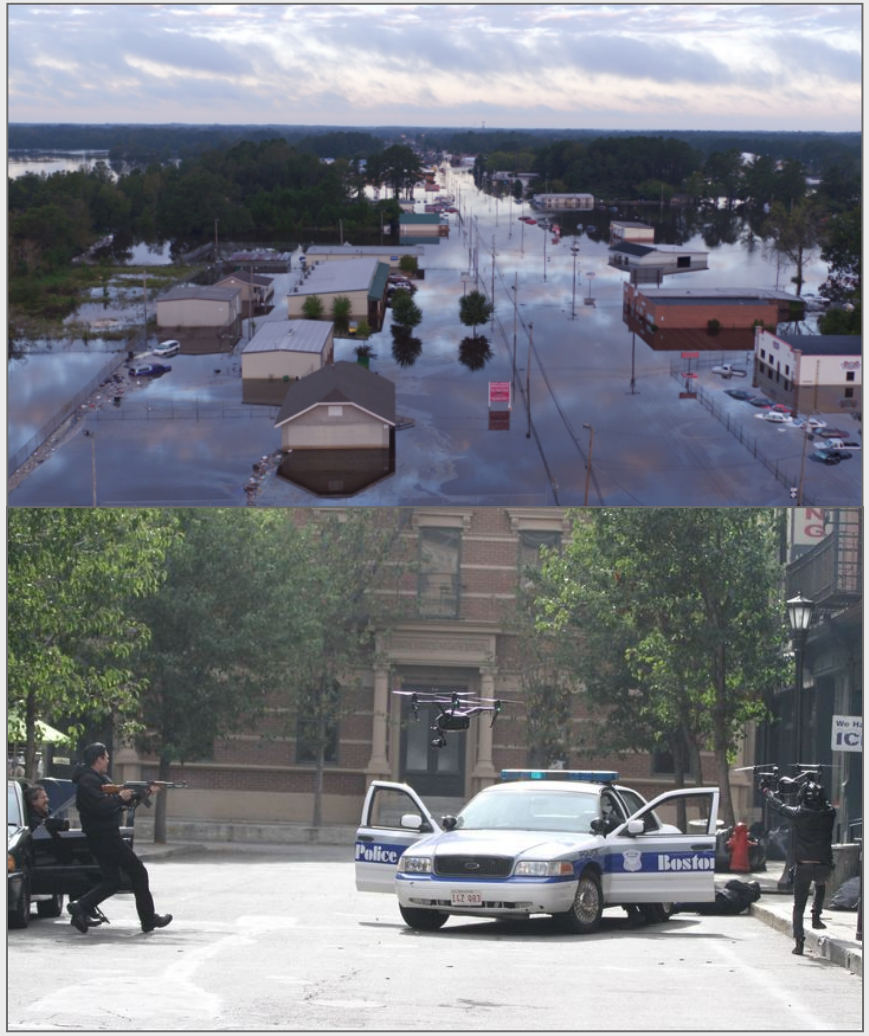
Fire Training Research Center

Research Collaborative Efforts

Fire Training Research Center

- Future Drone Public Safety Applications / Airport Detection Systems





Fire Training Research Center – Past

Research Collaborative Efforts

FAA Tech Center – Thermal Imaging Cameras

- Purpose of this research is to understand the capabilities of thermal cameras for ARFF operations by conducting both actual aircraft and simulated aircraft tests, and to identify the limitation of this technology for use during ARFF first response.
- Information gathered was used to draft an FAA Technical Report detailing the performance of thermal cameras and how they are used.

Fire Training Research Center – Past

Research Collaborative Efforts

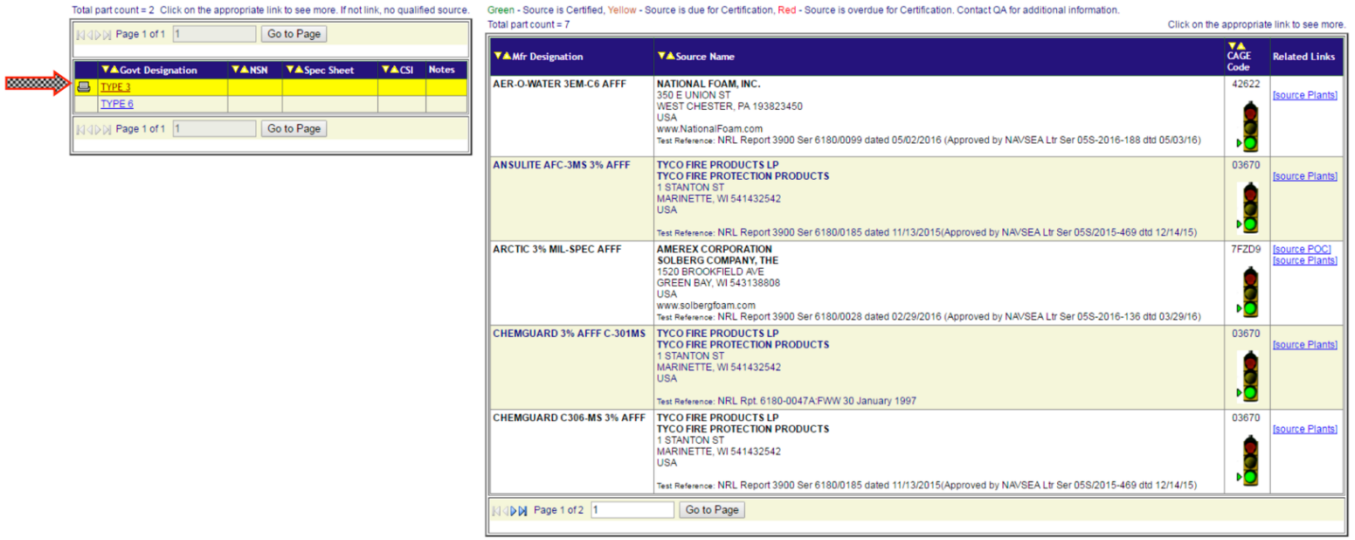
Akron Brass Nozzle

- Field testing of new high pressure nozzle designs

PFC Fluoropolymer-Free Foam & AFFF

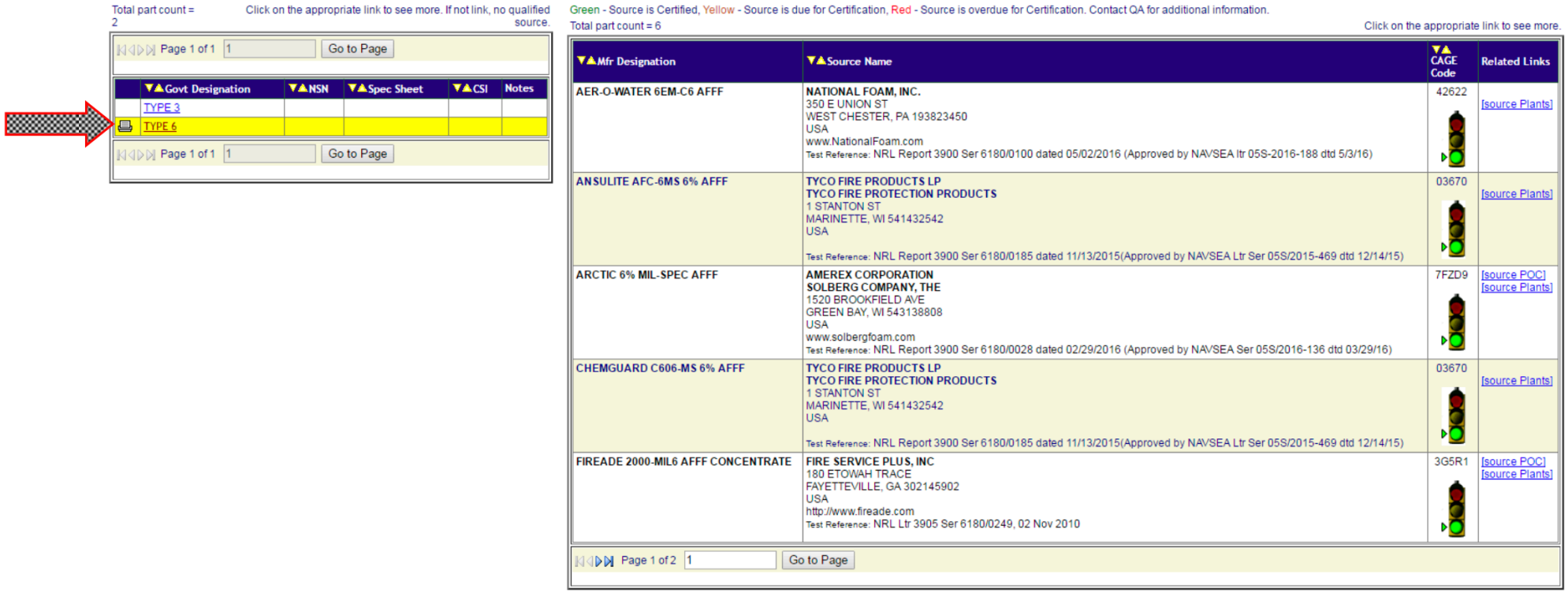
Figure 1. Screenshot of QPD Main Page

Figure 2. Screenshot of Click Type 3 Selection for List of Manufacturers (example)That Results When Type 3 Is Selected (Example)



https://www.faa.gov/airports/airport_safety/certalerts/media/part-139-cert-alert-16-05-Mil-Spec-AFFF-website-update.pdf

Figure 3. Screenshot of Type 6 That Results When Type 3 Is Selected (Example)



Total part count = 2

Click on the appropriate link to see more. If not link, no qualified source.

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	Govt Designation	NSN	Spec Sheet	CSI	Notes
	TYPE 3				
	TYPE 6				

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Green - Source is Certified, Yellow - Source is due for Certification, Red - Source is overdue for Certification. Contact QA for additional information.

Total part count = 6

Click on the appropriate link to see more.

Mfr Designation	Source Name	CAGE Code	Related Links
AER-O-WATER 6EM-C6 AFFF	**NATIONAL FOAM, INC.** 350 E UNION ST WEST CHESTER, PA 193823450 USA www.NationalFoam.com Test Reference: NRL Report 3900 Ser 6180/0100 dated 05/02/2016 (Approved by NAVSEA ltr 05S-2016-188 dtd 5/3/16)	42622	[source Plants]
ANSULITE AFC-6MS 6% AFFF	**TYCO FIRE PRODUCTS LP** **TYCO FIRE PROTECTION PRODUCTS** 1 STANTON ST MARINETTE, WI 541432542 USA Test Reference: NRL Report 3900 Ser 6180/0185 dated 11/13/2015(Approved by NAVSEA Ltr Ser 05S/2015-469 dtd 12/14/15)	03670	[source Plants]
ARCTIC 6% MIL-SPEC AFFF	**AMEREX CORPORATION** **SOLBERG COMPANY, THE** 1520 BROOKFIELD AVE GREEN BAY, WI 543138808 USA www.solbergfoam.com Test Reference: NRL Report 3900 Ser 6180/0028 dated 02/29/2016 (Approved by NAVSEA Ser 05S/2016-136 dtd 03/29/16)	7FZD9	[source POC] [source Plants]
CHEMGUARD C606-MS 6% AFFF	**TYCO FIRE PRODUCTS LP** **TYCO FIRE PROTECTION PRODUCTS** 1 STANTON ST MARINETTE, WI 541432542 USA Test Reference: NRL Report 3900 Ser 6180/0185 dated 11/13/2015(Approved by NAVSEA Ltr Ser 05S/2015-469 dtd 12/14/15)	03670	[source Plants]
FIREADE 2000-MIL6 AFFF CONCENTRATE	**FIRE SERVICE PLUS, INC** 180 ETOWAH TRACE FAYETTEVILLE, GA 302145902 USA http://www.fireade.com Test Reference: NRL Ltr 3905 Ser 6180/0249, 02 Nov 2010	3G5R1	[source POC] [source Plants]

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Fire Training Research Center

Revised ICAO Test Protocol

Fire test method objective:

To evaluate the ability of a foam concentrate to:

a) extinguish a fire of: 2.8 m2
- Performance Level A 4.5 m2
- Performance Level B 7.32 m2
- Performance Level C as appropriate

b) resist burn back due to exposure to fuel and heat.

Equipment:

a) A circular fire steel tray of: 2.8 m2
- Performance Level A 4.5 m2
- Performance Level B 7.32m2
- Performance Level C

Fire Training Research Center

Equipment – cont'd

b) The vertical wall shall be 200 mm;
c) Equipment or access to facilities to enable accurate recordings of:
- fuel
- air temperature
- water temperature
- wind velocity

d) 60 L of Avtur (Jet A) for performance level A tests
- 100 L of Avtur (Jet A) for performance level B tests
- 157 L of Avtur (Jet A) for performance level C tests

e) Branch pipe, straight stream, air aspirating nozzle
f) Suitable stop watch
g) Circular, burn back pot, measuring 300 mm (internal diameter), 200 mm high
h) 2 L of gasoline or kerosene.
i) Protective screen between tray and equipment, for protection against radiant heat, is acceptable. Testing conditions

a) Air temperature (EC) ≥ 15oC
b) Foam solution temperature (EC) ≥ 15oC
c) Wind velocity (m/s) ≤ 3
d) The test shall not be carried out in conditions of precipitation, if outdoors.

Fire Training Research Center

Testing conditions

- Air temperature (EC) ≥ 15degrees C
- Foam solution temperature (EC) ≥ 15degrees C
- Wind velocity (m/s) ≤ 3
- The test shall not be carried out in conditions of precipitation, if outdoors.

Fire Training Research Center

Fire Tests Performance

- Performance Level A / Level B / Level C Nozzle (Air Aspirated)
- Branch pipe
- Nozzle pressure
- Application rate
- Nozzle Discharge rate
- Fire size
- Fuel (on water substrate)
- Preburn time

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- Fire performance
  - extinguishing time
  - total application time
  - 25% re-ignition time
  - “Uni 86” Foam nozzle (See Appendix 3)
    - 700 kPa 4.1 l/min/m2 11.4 l/min
    - ≈ 2.8 m2 (circular) Kerosene 60 s ≤ 60 s 120 s ≥ 5 min
  - Uni 86” Foam nozzle (See Appendix 3)
    - 700 kPa 2.5 l/min/m2 11.4 l/min
    - ≈ 4.5 m2 (circular) Kerosene 60 s ≤ 60 s 120 s ≥ 5 min
  - “Uni 86” Foam nozzle (See Appendix 3)
    - 700 kPa 1.56 l/min/m2
    - 11.4 l/min ≈ 7.32 m2 (circular) Kerosene 60 s ≤ 60 s 120 s ≥ 5 min

- Test procedure
  - Position the chamber holding the premix foam upwind of the fire with the nozzle horizontal at a height of 1 m above the upper edge of the tray and at a distance that will ensure that the foam will fall into the centre of the tray.
  - Test the foam apparatus to ensure:
    - nozzle pressure
    - discharge rate.

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Test Procedure – cont'd

- When testing performance level A foam, place 60 L of water and 60 L of fuel into a 2.8 m2 tray.
- When testing performance level B foam, place 100 L of water and 100 L of fuel into a 4.5 m2 tray.
- When testing performance level C foam, place 157 L of water and 157 L of fuel into a 7.32 m2 tray.
- Position the protective screen, if required
- Test the foam apparatus to ensure a nozzle pressure of approximately 7 bar and a discharge rate of 11.4 l/min
- Record the air, kerosene, water and foam premix temperature and check it is in the correct range
- Record the wind velocity and check it is in the correct range
- Ignite fuel and allow 60 seconds preburn from full involvement.

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Test Procedure – cont'd

*Note 1: full involvement shall be obtained in less than 30 seconds after the beginning of ignition
*Note 2: ignition method shall forbid putting solid or liquid substance into the kerosene, for example ignition with a gas burner is acceptable.

- Apply foam continuously while maintaining the nozzle pressure and an application rate of 11.4 l/min for 120 seconds.
- Record extinction time.
  - Place burn back pot in centre of fire tray.
  - Ignite burn back pot 120 seconds after end of application of foam
  - Record when 25 per cent of the fuel area is re-involved with fire.
  - Fire fighting performance requirements
  - For each performance level, a foam concentrate is acceptable:
    - If the time to extinguish the fire from the overall surface of the tray is equal or less than 60 seconds and;
  - The re-ignition of 25% of the tray surface is equal or longer than 5 minutes
- *Note for testing authorities: At the 60 seconds time, minute flames (flickers) visible between the foam blanket and the inner edge of the tray are acceptable:
  - If they don't spread in a cumulative length exceeding 25% of the circumference of the inner edge of the tray and:
  - They are totally extinguished during the second minute of foam application.

July 2013 Version 2


40,000 gal underground water storage
3D Liquid Hydrocarbon Fuel Spill Trainer
Water Treatment Facility
A380 Prop
2-20,000 gal Propane tanks
Narrow-Body Prop
Student Center

3D Liquid Hydrocarbon Fuel Pit

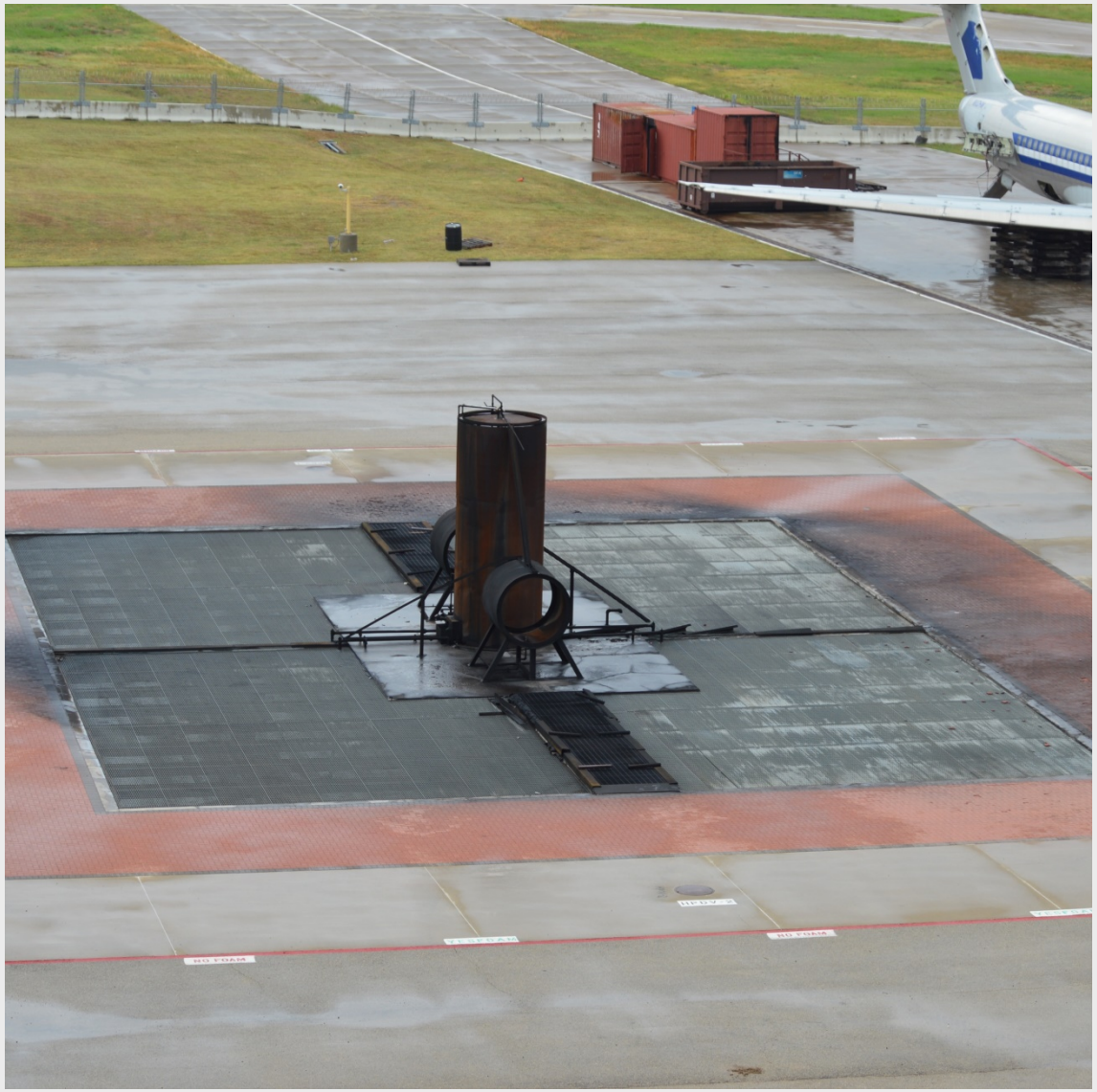
Testing was conducted using the 3D Liquid Hydrocarbon Fuel Pit at the DFW Fire Training Research Center

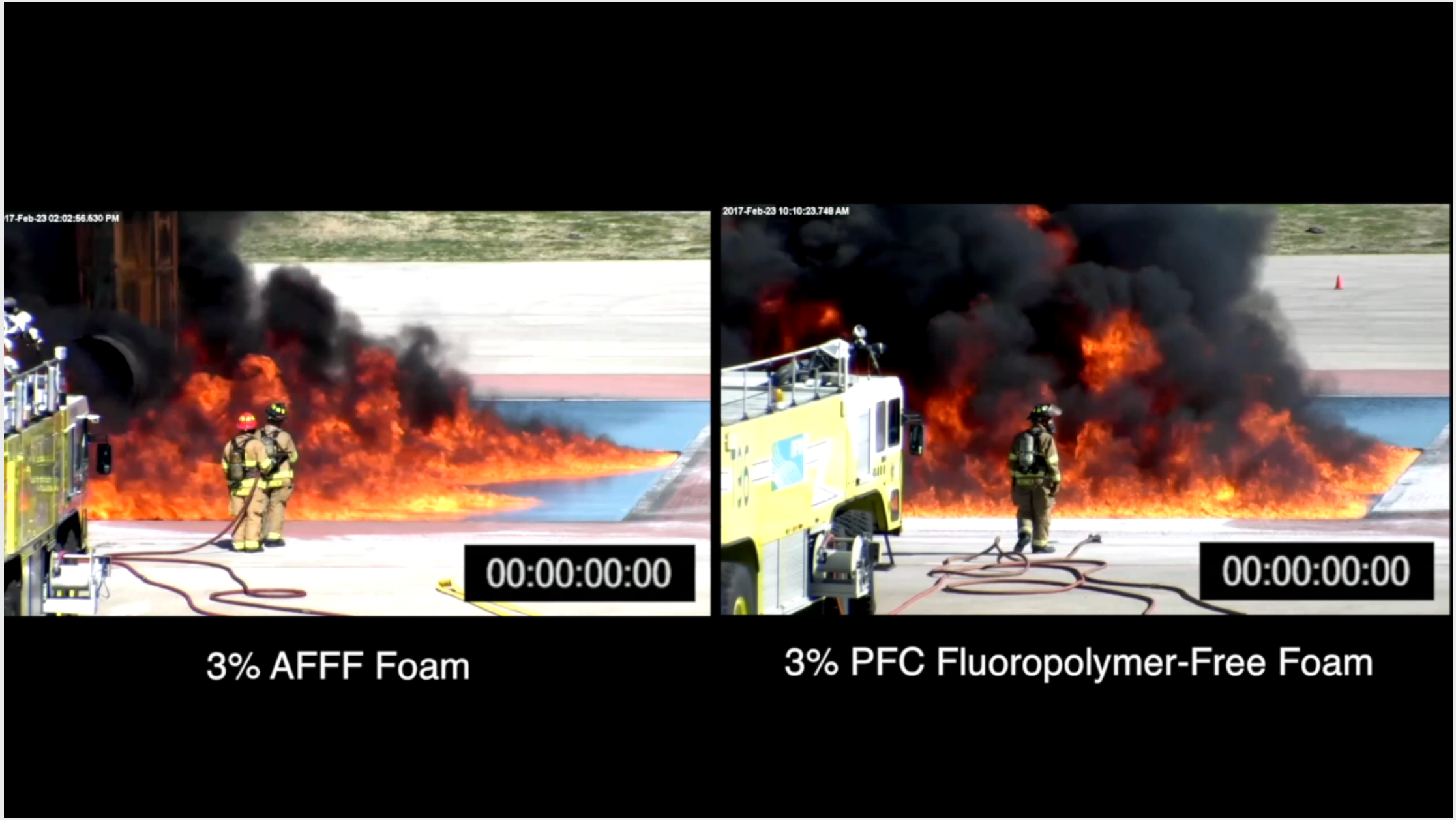
Four Independent Sections:

- 30 FT x 40 FT
- 9.144 M x 12.192 M

Testing Variables:

- Temperature above 59F or 15C




17-Feb-23 02:02:56.530 PM
00:00:00:00
3% AFFF Foam
2017-Feb-23 10:10:23.748 AM
00:00:00:00
3% PFC Fluoropolymer-Free Foam

3% PFC Fluoropolymer-Free Foam Concentrate

6% PFC Fluoropolymer-Free Foam Concentrate

6% PFC Fluoropolymer-Free Foam Concentrate

A-380 Large
Fuel Surface Burn Area

Testing was conducted using the A-380 Large Fuel Surface Burn Area at the DFW Fire Training Research Center

Diameter
- 152 Feet OR
- 46.329 Meters

Testing Variables:
- Temperature above 59F or 15C

6% PFC Fluoropolymer-Free Foam Concentrate

A-380 Pit Liquid Hydrocarbon

Fire Training Research Center

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