Compressed Air Foam System
for future ARFF
ARFFWG annual conference 2012

Kim T. Olsen
Asst. Fire Chief
Copenhagen Airport
Introduction to CAFS
Compressed Air Foam System
Crash Rescue Equipment & Bob Releay
Rosenbauer
Leonding, Austria 2007
Rosenbauer Panther CA5
CAFS testing
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CAFS testing
Wurfweitenversuche
FLASH CAFS
Rosenbauer Leonding
13.06.2006
Rosenbauer CAFS testing
Copenhagen Airports new Rosenbauer Panther CA5 CAFS on the main turret
August 2007
FLASH CAFS – construction of admixing chamber

- Inlet
- Admixing chamber
- Pressure regulating valve
- Expansion ratio-controller
- Pressure translator
- Outlet
- Differential pressure gauge
8 x 50 litter, 300 bar air bottles
Mixing chamber
Testing in Copenhagen
CAFS and new foam – Solberg ReHealing Foam
Testing in Copenhagen
CAFS and new foam – ReHealing Foam
Testing in Copenhagen
CAFS and new foam – ReHealing Foam
Testing in Copenhagen
CAFS and new foam – ReHealing Foam
CAFS testing with Rosenbauer
Testing with Rosenbauer with out the CAFS engaged
Testing with Rosenbauer with out the CAFS engaged
Testing with Rosenbauer with out the CAFS engaged
Testing with Rosenbauer with out the CAFS engaged
Testing with Rosenbauer with CAFS engaged
Testing with Rosenbauer with CAFS engaged
"Compressed Air Foam Systems—Experience in Aviation Fire and Rescue, Urban, and Rural Environments"

Foam Concentrate and the Environment

CAFS for ARFF

Kim Olsen has over 34 years experience in aviation safety and security. He has worked his way through the ranks of Copenhagen Airport and currently serving as the Assistant Fire Chief. He has held executive positions in both the International Aviation Fire Protection Association (IAFPA) and the Aircraft Rescue & Fire Fighting Working Group (ARFWWG). He is the Chief Instructor at the Copenhagen Airport ARFF School and provides instruction in ARFF on all Danish Incident Command courses at the Danish Emergency Services College in Tingskov. Kim is actively involved in a number of projects that are leading change and innovation in ARFF and will share his experience in dealing with the environmental issues surrounding the use of foam concentrates and detail the tactical use of CAFS in aircraft firefighting and rescue.

QFRS—CAFS in the Urban Environment

2 Medium Scania Pumper were fitted with CAFS in 2009. These appliances are specifically designed to deal with the challenges of the urban environment. QFRS presenters will provide information on the process from delivery to implementation and give some examples of incident that have proven the value of CAFS.

ACT Fire Service—CAFS in the iZone and Rural Environment

After the disastrous bush fire of 2003, the ACT FS invested in 4 Off Road CAFS vehicles. These have been in successful operation since 2005 and the ACT FS is now the most experienced user in the iZone environment in Australia. Their most experienced instructor will detail the implementation process and report on their operational experiences with CAFS.

This one day seminar will provide a rare opportunity to learn about the values of CAFS from leaders in their fields. Any organisation that is considering investing in CAFS technology will have access to essential information on all issues associated implementation. Don’t miss this opportunity to learn about a technology that can greatly increase the effectiveness of fire suppression and protection in almost every context.
CAFS Road Show Sydney
CAFS Road Show Sydney
CAFS Road Show Sydney
CAFS Road Show Sydney
CAFS Road Show Sydney

Why Consider CAF?

- Water conservation.
- Improved knockdown speed and reduced water run off.
- Reduced chances of re-ignition due to deeper penetration of water into the fuel mass.
CAFS Road Show Perth
CAFS Road Show Brisbane
Shan Raffel
CAFS Road Show Brisbane
CAFS Road Show Wellington NZ
Why bother?
Why aren’t more people using CAFS?

Does it work? It’s to good to be true!

- Aspirated foam works why change?
- CAFS is often misunderstood. It’s not only for structural and class A fires.
- Change is hard: Aspirated and non aspirated foam is in ARFF fire-fighters’ DNA
- The Environmental issues!
Mix ratio: 0.3%
Approx. expansion: 8:1
Solution pressure: 130 psi
Air pressure: 130 psi
Solution flow: 90 gpm
Air flow: 90 cfm
Compressed Air Foam Systems (CAFS) Testing
CNPP, Vernon France
May 21-25 2012
Compressed Air Foam Systems (CAFS) Testing Information

- **Aim**
  - The aim of the testing is to evaluate the use of CAFS on an aviation fire to influence future rules (ICAO and EASA).

- **Objectives**
  - To measure the fire fighting performance of an AFFF in an 80m$^2$ fire test;
  - To measure the fire fighting performance of CAFS in a number of 80m$^2$ fire tests;

- **Method**
  - 5 tests will be carried out on an 80m$^2$ fire containing a replica fuselage using CAFS
  - The test programme, systems for testing and foam concentrates will be finalised on the Monday.
UK CAA works with leading operators to carry out Compressed Air Foam System fire tests.

The UK Civil Aviation Authority, along with specialist safety experts and a number of airport operators have taken part in tests to determine the effectiveness of Compressed Air Foam Systems (CAFS) on aviation fires. The trials, carried out at the test facility of the risk-control company, CNPP, in Vernon, France in May 2012, will feed into the current ICAO and EASA work on CAFS.

The tests were based on an 80m² fire tray with a replica fuselage in the middle of a pool of 1,500 liters of fuel. The results of the tests were captured by CNPP research staff and once collated will be made available to the wider industry.

Simon Webb who is leading the project for the CAA, said: “This testing was an excellent example of the regulator, operators and manufacturers working together for the common aim of improving safety in aviation. The results of this research have delivered a key objective of the CAA Safety Plan to encourage the use of new technology in fire fighting and will direct us on the way forward with the CAFS technology.”

The tests also found that the new generation fire fighting foams, which do not contain fluorinated products associated with the problem of environmental persistence, performed as well as the currently used film-forming foams. Thus the results identify those types of products and systems which satisfy both fire-fighting and environmental objectives.

Industry partners in the tests included the UK Airport Operators Association, Copenhagen airport and Changi Airport Group, Singapore.
Firemen attack location for test 1 to 4

Tank

Anemometer and Ambient temperature

Intermediate

Heat Fluxmeter

Burnback pot

Firemen attack location for test 5

Initial

Intermediate

Diam 1.50m

25.00m

86 m² tests configuration
<table>
<thead>
<tr>
<th>TEST</th>
<th>TYPE</th>
<th>FLOW</th>
<th>SYSTEM</th>
<th>FOAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AFFF</td>
<td>200</td>
<td>ASPIRATED</td>
<td>BRANCH</td>
</tr>
<tr>
<td>2</td>
<td>AFFF</td>
<td>200</td>
<td>750</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>AFFF</td>
<td>1400</td>
<td>CAPS</td>
<td>A SO</td>
</tr>
<tr>
<td>4</td>
<td>FF</td>
<td>2000</td>
<td>AVANCED</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>FF</td>
<td>2000</td>
<td>2000</td>
<td>200</td>
</tr>
</tbody>
</table>
## Tests Schedule

<table>
<thead>
<tr>
<th>Test Ref. and Type</th>
<th>Date</th>
<th>Type</th>
<th>Flow</th>
<th>System</th>
<th>Foam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibration tests without fire</td>
<td>21&lt;sup&gt;th&lt;/sup&gt; May PM, 22&lt;sup&gt;nd&lt;/sup&gt; May AM</td>
<td>For each combination listed below</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire test n°1</td>
<td>22&lt;sup&gt;nd&lt;/sup&gt; May PM</td>
<td>AFFF Level B</td>
<td>200</td>
<td>Aspirated System A</td>
<td>Foam X</td>
</tr>
<tr>
<td>Calibration and protocol</td>
<td>22&lt;sup&gt;nd&lt;/sup&gt; May PM</td>
<td>AFFF Level B</td>
<td>200</td>
<td>Aspirated System A</td>
<td>Foam X</td>
</tr>
<tr>
<td>Fire test n°2</td>
<td>23&lt;sup&gt;rd&lt;/sup&gt; May AM</td>
<td>AFFF Level B</td>
<td>200</td>
<td>CAFS System A</td>
<td>Foam X</td>
</tr>
<tr>
<td>AFFF</td>
<td>23&lt;sup&gt;rd&lt;/sup&gt; May AM</td>
<td>AFFF Level B</td>
<td>200</td>
<td>Aspirated System A</td>
<td>Foam X</td>
</tr>
<tr>
<td>Fire test n°3</td>
<td>23&lt;sup&gt;rd&lt;/sup&gt; May PM</td>
<td>AFFF Level B</td>
<td>200</td>
<td>Aspirated System A</td>
<td>Foam X</td>
</tr>
<tr>
<td>Benchmark AFFF</td>
<td>23&lt;sup&gt;rd&lt;/sup&gt; May PM</td>
<td>AFFF Level B</td>
<td>200</td>
<td>Aspirated System A</td>
<td>Foam X</td>
</tr>
<tr>
<td>Fire test n°4</td>
<td>24&lt;sup&gt;th&lt;/sup&gt; May AM</td>
<td>AFFF Level C</td>
<td>140</td>
<td>CAFS System B</td>
<td>Foam Y</td>
</tr>
<tr>
<td>AFFF</td>
<td>24&lt;sup&gt;th&lt;/sup&gt; May AM</td>
<td>AFFF Level B</td>
<td>200</td>
<td>CAFS System C</td>
<td>Foam Z</td>
</tr>
<tr>
<td>Fire test n°5</td>
<td>24&lt;sup&gt;th&lt;/sup&gt; May PM</td>
<td>FF Level B</td>
<td>200</td>
<td>CAFS System C</td>
<td>Foam Z</td>
</tr>
</tbody>
</table>
Calibrating and adjusting systems
Test nr. 1
AFFF – 200 l/m - aspirated
Test nr. 1
AFFF – 200 l/m - aspireret
Test nr. 1
AFFF – 200 l/m - aspirated
Test nr. 1

AFFF – 200 l/m - aspirated
Test nr. 1
AFFF – 200 l/m – aspirated
pre-burn 60 sec.
Test nr. 1

AFFF – 200 l/m - aspirated
Test nr. 1
AFFF – 200 l/m - aspirated
Test nr. 1
AFFF – 200 l/m - aspirated
Test nr. 1
AFFF – 200 l/m - aspirated
Test nr. 1

AFFF – 200 l/m - aspirated
Test nr. 1
AFFF – 200 l/m – aspirated – burn back test
Test nr. 1
AFFF – 200 l/m – aspirated – burn back test
Test nr. 2

AFFF – 200 l/m – CAFS
Test nr. 2
AFFF – 200 l/m – CAFS
Test nr. 2
AFFF – 200 l/m – CAFS
pre-burn
Test nr. 2

AFFF – 200 l/m – CAFS
Test nr. 2

AFFF – 200 l/m – CAFS
Test nr. 2

AFFF – 200 l/m – CAFS
Test nr. 2
AFFF – 200 l/m – CAFS
Test nr. 2
AFFF – 200 l/m – CAFS – burn back test
Test nr. 2
AFFF – 200 l/m – CAFS – burn back
Test nr. 3
AFFF – 200 l/m – aspirated – benchmark test
Test nr. 3
AFFF – 200 l/m – aspirated – benchmark test
Test nr. 3
AFFF – 200 l/m – aspirated – benchmark test
Test nr. 3

AFFF – 200 l/m – aspirated – benchmark test
Test nr. 3
AFFF – 200 l/m – aspireret – benchmark test
Test nr. 4
AFFF level C – 140 l/m – CAFS
Test nr. 4

AFFF level C – 140 l/m – CAFS
Test nr. 5
FFF (Fluor Free Foam) – 200 l/m – CAFS
Test nr. 5
FFF (Fluor Free Foam) – 200 l/m – CAFS
Test nr. 5
FFF (Fluor Free Foam) – 200 l/m – CAFS
Test nr. 5
FFF (Fluor Free Foam) – 200 l/m – CAFS
Test nr. 5
FFF (Fluor Free Foam) – 200 l/m – CAFS
Test nr. 5
FFF (Fluor Free Foam) – 200 l/m – CAFS
Test nr. 5
FFF (Fluor Free Foam) – 200 l/m – CAFS
AFFF aspireret test

Heat Flux at 25 meter

- t0 = Foam application
- t1 = Fire is controlled
- t2 = Loss of control
- t3 = Fire is extinguished

Heat Flux (kW/m²)

Time (min)
Fluorine Free Foam CAFS test

- $t_0 =$ Foam application
- $t_1 =$ Fire is controlled
- $t_2 =$ Fire is extinguished
- $t_3 =$ Burnback pot ignition
- $t_4 =$ Foam application; End of test