Aircraft Rescue Fire Fighting

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ICAO – ARFF objective

The principal objective of a ARFF Service is to save lives in the event of an aircraft accident or incident occurring at or in the immediate vicinity of an aerodrome.

The ARFF Service is provided to create and maintain survivable conditions, to provide egress routes for occupants and to initiate the rescue of those occupants unable to make their escape without direct aid.
ICAO – ARFF Response time

The operational objective of the ARFF Service should be to **achieve response time not exceeding 3 minutes** to any other part of the movement area in optimum visibility and surface conditions.

Response time is to be considered to be the time between the initial call to the ARFF Service, and the time when the first responding vehicle(s) are in position to apply foam at a rate of at least 50% of the discharge rate specified for the category of airport.

Any other vehicles required to deliver the amounts of extinguishing agents should arrive no more than 1 minute after the first responding vehicle(s) so as to provide continuous agent application.
### Table 9-2. Minimum usable amounts of extinguishing agents

<table>
<thead>
<tr>
<th>Aerodrome category</th>
<th>Foam meeting performance level A</th>
<th>Foam meeting performance level B</th>
<th>Complementary agents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water(^1) Discharge rate foam solution/minute</td>
<td>Water(^1) Discharge rate foam solution/minute</td>
<td>Dry(^2) chemical powders (kg)</td>
</tr>
<tr>
<td></td>
<td>(L) (L/minute)</td>
<td>(L) (L/minute)</td>
<td></td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>1</td>
<td>350</td>
<td>350</td>
<td>230</td>
</tr>
<tr>
<td>2</td>
<td>1000</td>
<td>800</td>
<td>670</td>
</tr>
<tr>
<td>3</td>
<td>1800</td>
<td>1300</td>
<td>1200</td>
</tr>
<tr>
<td>4</td>
<td>3600</td>
<td>2600</td>
<td>2400</td>
</tr>
<tr>
<td>5</td>
<td>8100</td>
<td>4500</td>
<td>5400</td>
</tr>
<tr>
<td>6</td>
<td>11800</td>
<td>6000</td>
<td>7900</td>
</tr>
<tr>
<td>7</td>
<td>18200</td>
<td>7900</td>
<td>12100</td>
</tr>
<tr>
<td>8</td>
<td>27300</td>
<td>10800</td>
<td>18200</td>
</tr>
<tr>
<td>9</td>
<td>36400</td>
<td>13500</td>
<td>24300</td>
</tr>
<tr>
<td>10</td>
<td>48200</td>
<td>16600</td>
<td>32300</td>
</tr>
</tbody>
</table>

**Note 1.** The quantities of water shown in columns 2 and 4 are based on the average overall length of aeroplanes in a given category. Where operations of an aeroplane larger than the average size are expected, the quantities of water would need to be recalculated. See the Airport Services Manual, Part 1 for additional guidance.

**Note 2.** Any other complementary agent having equivalent fire fighting capability may be used.
Fatal Accidents and Onboard Fatalities by Phase of Flight
Worldwide Commercial Jet Fleet | 2004 through 2013

Percentage of fatal accidents and onboard fatalities

<table>
<thead>
<tr>
<th>Phase of Flight</th>
<th>Fatal accidents</th>
<th>Onboard fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxi, load/unload, parked, tow</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>Takeoff</td>
<td>8%</td>
<td>7%</td>
</tr>
<tr>
<td>Initial climb</td>
<td>6%</td>
<td>3%</td>
</tr>
<tr>
<td>Climb (flaps up)</td>
<td>8%</td>
<td>12%</td>
</tr>
<tr>
<td>Cruise</td>
<td>10%</td>
<td>20%</td>
</tr>
<tr>
<td>Descent</td>
<td>3%</td>
<td>22%</td>
</tr>
<tr>
<td>Initial approach</td>
<td>8%</td>
<td>22%</td>
</tr>
<tr>
<td>Final approach</td>
<td>47%</td>
<td>18%</td>
</tr>
</tbody>
</table>

Exposure
(Percentage of flight time estimated for a 1.5 hour flight)

<table>
<thead>
<tr>
<th>Phase of Flight</th>
<th>Fatal accidents</th>
<th>Onboard fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxi, load/unload, parked, tow</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Takeoff</td>
<td>1%</td>
<td>10%</td>
</tr>
<tr>
<td>Initial climb</td>
<td>1%</td>
<td>14%</td>
</tr>
<tr>
<td>Climb (flaps up)</td>
<td>14%</td>
<td>57%</td>
</tr>
<tr>
<td>Cruise</td>
<td>57%</td>
<td>3%</td>
</tr>
<tr>
<td>Descent</td>
<td>11%</td>
<td>15%</td>
</tr>
<tr>
<td>Initial approach</td>
<td>12%</td>
<td>11%</td>
</tr>
<tr>
<td>Final approach</td>
<td>40%</td>
<td>4%</td>
</tr>
</tbody>
</table>

Note: Percentages may not sum precisely due to numerical rounding.
Phase of Flight

As mentioned earlier, the CICTT Phases of Flight are used for ICAO/IATA harmonized safety analysis. When evaluating the 103 accidents in 2013 by phase of flight, the following distribution is obtained:

- Approach: 18%
- Landing: 43%
- En route: 10%
- Standing: 9%
- Take-off: 12%
- Taxi: 8%

Take off incident
Kalitta crash 25.05.2008
Mid-air collision
Landing incident
Construction

• **Sports- & business aircrafts** (general aviation aircraft)
  - Light construction
  - Special attention to certain businessjets

• **Passengers aircrafts and freighters**
  - Strong construction
Construction parts

- fuselage = different parts:
  - Cockpit
  - Cabine
  - Luggage/cargo
  - Tail
Materials

- Construction materials
  - Aluminium/magnesium alloys

- New:
  - Lithium alloy
  - Composite materials vb.
    - Glare
      - GLass REinforced aluminum
  - Thermoplasts

- Isolation materials
  - More protection against ‘burn-through’
Important installations

• Escape / Entry
• Fuel system
• Hydrolic systems
• Electrical systems
• Oxygen systems
Escape / Entry systems
Tools....
Fuel systems

- Fuel kerosine:
  - Vb. AVRO RJ: 11,700l
  - Vb. B737: 21,000l
  - Vb. A320: 23,000l – 29,000l
  - Vb. A330-200: 139,000l
  - Vb. B747: 200,000l

- Gasoline ⇒ light aircrafts
Hydraulic systems

- Systems:
  - Steering
  - Landing gear
  - Brakes
- Redundant systems
- Pressure: 200 à 300 bar
- Fire risk oils!
Electrical systems

- Generators
  - Engine generators
  - APU
  - Emergency generator

- Batteries

- External power
Oxygen systems

- Generators
- Bottles
Target groups crash charts

2 different audiences?

General Fire Services
  > More accidents smaller aircrafts
  > General information?

Airport ARFF Services
  > Specific information
  > More detailed information

Don’t confuse with Recovery Manuals
<table>
<thead>
<tr>
<th>Constructor:</th>
<th>Client:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Recognition: type/fuel</td>
<td></td>
</tr>
<tr>
<td>2. Structure/overview important vehicle parts/ access to them</td>
<td></td>
</tr>
<tr>
<td>3. Disable direct hazards: safety regulations/ PPE</td>
<td></td>
</tr>
<tr>
<td>4. Access to the occupants</td>
<td></td>
</tr>
<tr>
<td>5. Dangers of gases, liquids, solid substance: safety regulations/PPE</td>
<td></td>
</tr>
<tr>
<td>6. Dangers in case of fire: safety regulations/PPE</td>
<td></td>
</tr>
<tr>
<td>7. Dangers in case of water submersion: safety regulations/PPE</td>
<td></td>
</tr>
<tr>
<td>8. Vehicle immobilization, lifting and stabilization</td>
<td></td>
</tr>
<tr>
<td>9. Information for towing</td>
<td></td>
</tr>
</tbody>
</table>
The A320 is a subsonic, medium range, civil transport aircraft.

The aircraft has 2 high bypass turbofan engines, mounted under the wings.

The cockpit is arranged for a 2 member crew. It also has place for 2 observers.

The passenger seating layout may be varied to suit operating requirements. The certificated maximum is 180 seats.

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Range
6,350 with Standlents in r with standlents
Typical seating: 1 x 150 (2-class)
Max payload: 10.6 tonnes
Wing span: 34.10 m
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Operator
Immatriculation

Engine #1
Standlents

Figure 1

Figure 2