Specifying Foam Systems
Three Simple Steps for Success

1. Identify and size hazards
2. Size and select the proportioning system
3. Design the apparatus

Note: If doing a retrofit – obviously the vehicle already exists. You still need to complete steps 1 and 2. At that point you may find it makes more sense to install the system on a different vehicle than you originally planned.
Identify and Size Hazards
Identify And Size Hazards

• What is your fire protection responsibility?
  – Residential
  – Wildland
  – Industrial
  – Marine
  – A Combination
Identify And Size Hazards

• What are the applications?
  – Class A, B, C or D?
  – Bomb suppression
  – Chemical or biological decontamination
Identify And Size Hazards

• Determine critical application rates and duration:
  – 15, 125 or 25,000 GPM?
  – Minutes or hours?
  – Guidelines available – NFPA

• Plan to succeed!
• Understanding critical application rate

The flow rate (water or solution) on a fire at which the fire does not grow:
- Exceed the critical application rate and the fire is extinguished
- Flow less than the critical application rate and the fire burns unchecked

Goal: How much water to treat
Identify And Size Hazards

- Determining critical application rate

Class A applications – Structures

IOWA Formula: Cubic feet / 100 = GPM

Example: 50’ x 40’ x 16’ Structure

32,000 Cubic feet / 100 = 320 GPM
• Determining critical application rate

Class B applications – Liquid fuels
NFPA 11
Identify And Size The Hazards

- NFPA 11 recommends minimum application rates
  - Flow
  - Duration
## Spill Fires – Non Diked Areas

<table>
<thead>
<tr>
<th>Minimum Application Rates</th>
<th>GPM per SQ./FT.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrocarbons:</td>
<td></td>
</tr>
<tr>
<td>AFFF/FFFP</td>
<td>0.10</td>
</tr>
<tr>
<td>Protein / Fluoroprotein</td>
<td>0.16</td>
</tr>
<tr>
<td>Alcohol / Polar Solvents:</td>
<td></td>
</tr>
<tr>
<td>AR Concentrate (Typical)</td>
<td>0.2</td>
</tr>
<tr>
<td>Min Discharge Time</td>
<td>15 Min</td>
</tr>
</tbody>
</table>

- AFFF 2500 Sq/Ft X .10 = 250 GPM
- AR-AFFF 2500 Sq/Ft X .20 = 500 GPM
**Identify And Size Hazards**

- **Tank fires – Full surface (Type III)**

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<td>0.16</td>
</tr>
<tr>
<td>Alcohol / Polar Solvents</td>
<td>Refer To Listings (0.3)</td>
</tr>
</tbody>
</table>

**Min Discharge Time**

| Flash Point Above 100 F           | 50 Min          |
| Flash Point Below 100 F           | 65 Min          |
| Crude Petroleum                   | 65 Min          |

\[
\text{AFFF} \ 2500 \ \text{Sq/Ft} \times \ 0.16 = 400 \ \text{GPM}
\]
Size & Select System
Size And Select System

• What water additives?
  – One or several?
  – System compatibility?
• What are proportioning rates?
  – Class A: 0.1% to 1.0%
  – Class B: 1%, 3% or 6%
  – Gels: See manufacturer’s recommendations
Size And Select System

- Determine minimum and maximum flow rates:
  - How many discharges are required?
  - What are the Min/Max flow rates of each discharge?
  - How many in service at any given time? Min/Max?
Size And Select System

- Systems available span a wide range of:
  - Performance
  - Features
  - Cost (Both initial install and ongoing operational)

- Thoroughly Investigate:
  - Understand the capabilities and limitations of each system
  - No one system does it all
  - Realistically define your needs based on the hazards
Size And Select System

• How accurate?
  – NFPA (minimum standard) or something tighter?
  – Know the accuracy of the system(s) you are considering and calculate the wasted foam:
    • Cost
    • Tank size
    • Logistics
Size And Select System

• Concentrate viscosity?
  – System capability?
    • How does system manufacturer rate the system?
  – Foam concentrate?
    • How does the concentrate manufacturer measure viscosity?
• What are operating pressures?
  – Intake and discharge: Min/Max?
  – Will you be using both normal and high pressure discharges?
Size And Select System

• Operating conditions:
  – How long are hose lays?
  – What is nozzle elevation?
    • High rise or aerial operations?
• Will these or other conditions affect your system’s operation?
Size And Select System

• Duration of the attack?
  – How much foam will you require?
  – Where will your foam supply come from?
    • On-board tank
    • Off-board pickup
    • Both
    • Refill system

• Will the system(s) you are considering be capable of handling these sources?
Size And Select System

• Do you require the ability to calibrate the system to the viscosity of the concentrate(s) you will be using?
  – Can the system be calibrated to the viscosity of the concentrate without consuming foam?
  – Can you flow foam where you operate to calibrate the system?
Size And Select System

• Require the ability to periodically test the system for readiness?
  – Concentrate flow required for testing?
  – Allowed to flow foam for testing?
Size And Select System

• A word of advice...

Keep It SIMPLE!
Size And Select System

- Selecting The System
- Numerous technologies available
  - Eductors
  - Balanced Pressure
  - Direct Injection
- Several sources of power
  - Water
  - DC
  - Hydraulic
Size And Select System

- In most cases, there are several manufacturers offering systems in each category
  - Within a category – not all are the same across competitors
  - Carefully check out performance, features, capabilities, limitations and reliability
    - Research the specs
    - Talk to current or previous users
• Eductors
  – Nozzle, In-line and By-pass
• General Characteristics:
  – Narrowest performance range
  – Lowest system and installation cost
  – Accuracy varies
  – Operating cost varies
  – Single point injection
  – Inlet pressures (typically 200psi)
  – Hose lay length
  – Nozzle & elevation
  – On-board / Off-board foam pickup capabilities can vary
• Around-The-Pump
  – Same General Characteristics as Inline and By-Pass Eductor Systems
• **Balanced Pressure**
  - Pump based (DC/Hydraulic/PTO), water powered, bladder tank

• **General Characteristics:**
  - Medium performance range
  - Higher system and installation cost
  - Accuracy varies
  - Operating cost varies
  - Some have pressure loss
  - Single or multiple injection point
  - On-board / Off-board foam pickup capability varies
Size And Select System

- **Direct Injection**
  - Pump based (DC/Hydraulic)

- **General Characteristics:**
  - Widest performance range
  - Higher system and installation cost
  - Highest accuracy
  - Minimal pressure loss
  - Single or multiple injection point - varies
  - On-board / Off-board foam pickup capability varies
## Size And Select System

<table>
<thead>
<tr>
<th>Disch</th>
<th>Size</th>
<th>Min Flow</th>
<th>Max Flow</th>
<th>Min %</th>
<th>Max %</th>
<th>Min Conc</th>
<th>Max Conc</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Rear</td>
<td>3”</td>
<td>80</td>
<td>500</td>
<td>0.3%</td>
<td>1%</td>
<td>.24</td>
<td>5</td>
</tr>
<tr>
<td>2) PreCon</td>
<td>1-1/2”</td>
<td>30</td>
<td>200</td>
<td>0.3%</td>
<td>1%</td>
<td>.09</td>
<td>2</td>
</tr>
<tr>
<td>3) Op Panel</td>
<td>2-1/2</td>
<td>40</td>
<td>300</td>
<td>0.3%</td>
<td>1%</td>
<td>.12</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total:** 10
Designing the Apparatus
Designing

- Key points to discuss with installer
  - Power requirements for your system
    - Electric
    - Load requirements
    - Load balancing
    - Hydraulic
      - PTO availability
      - HP requirements
      - Cooling – Oil to Air or Oil to Water?
  - Water
    - Pressure / flow loss
    - Filtration
Designing

• System Footprint?
  – Accessibility requirements
    • Service
    • Calibration
    • Maintenance
    • Repair
  – Any location limitations
    • Temperature
    • Physical damage due to
      – Road dirt
      – UV
      – Temperature
    • EMI /RFI interference
Designing

• Plumbing requirements?
  – Accessibility requirements
    • Service / Calibration / Maintenance / Repair
  – Common fitting approaches
    • Threaded / Flanged / Grooved Victaulic
  – System Requirements
    • Flow meters – straight pipe
    • Foam concentrate injection point(s)
  – Provide drains for cleaning / cold weather
Designing

• Concentrate source?
  – On-board (single or multiple tanks) / off-board / both
  – Does the system require flooded suction or is it capable of drafting
  – Be sure to provide for:
    • Tank shutoffs
    • Foam strainers
    • Tank level and low-tank sensors
    • Foam selector valving
    • Foam tank profile
• **Flushing**
  – How?
  – Flush water pressure?
  – If gel, what will you be flushing the system with?
    • Does that require a separate reservoir to hold the flushing agent?
Questions?
Thank You & Stay Safe!

David Durstine
ddurstine@akronbrass.com

Michael Dupay
mdupay@fireresearch.com