MDA HALON Replacement Efforts

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Outline

- Background
  - Dry Bays
  - Engine Bays
- Alternate Agent/Technology Penalties
- Corrosion Screening Test for Gas Generator Exhaust Products ("Dust")
- Planned CF3I Ground Testing
- Operating/Test Considerations
  - Impact of Leak Location on Fire Fuel History
  - Representative VS Simplified Operating Conditions
- Recommendations
All MDC Aircraft Types Require Fire Protection

DRY Bay Protection
Dry Bay Protection Concept

Dry Bay Issues

- Effect of Equivalent Angle of Attack?
- Time Delay to Discharge?
- Fire or Explosion Protection?
Engine Bay Protection

( APU, AMAD, Gearbox, Etc. are Usually Included)

Engine Bay Installation
Alternate Agent/Technology Penalties

(Engine Bay Application)

Weight / Volume Multipliers

"Agent" Wt.

Density, Press & Fill Ratio

Realize for Mission

Fuel

Converged Solution (TOGW): New Designs

Engine

Airframe (Struct, Brackets, Wing, Etc.)

Cavity Volume

Equip Weight: Retrofit

Bottle Weight & Volume

HOTWC.96 459
Representative F/A Engine Bays Protection Penalties

Estimate Based on 1994 Data

Corrosion Screening Tests

(Trace "Dust" From Solid Propellant Gas Generators)
Solid Propellant Gas Generators

"Dust" Samples

* Interior "Dust" Collected from inside Canister

** Expelled "Dust" Collected by Sweeping or Water Flush & Filtration
**Corrosion Screening Test**
(Per ASTM F1110-90)

**Al Coupon**
AlClad + Alodine or Anodize

**"Dust"**
(Dry or "Pasta")

**Al Coupon**
AlClad + Alodine or Anodize

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**Corrosion Test Results**

<table>
<thead>
<tr>
<th>Source of &quot;Dust&quot;</th>
<th>Preparation</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior of Gas Generator</td>
<td>Dry Paste</td>
<td>0</td>
</tr>
<tr>
<td>Expelled &amp; Collected By Water</td>
<td>Dry Paste (Dust + H20)</td>
<td>0</td>
</tr>
<tr>
<td>Rinse &amp; Filtration</td>
<td></td>
<td>0 &amp; 1</td>
</tr>
<tr>
<td>Expelled &amp; Collected By Dry</td>
<td>Dry Paste (Dust + H20)</td>
<td>0</td>
</tr>
<tr>
<td>&quot;Sweeping&quot;</td>
<td></td>
<td>0 &amp; 1</td>
</tr>
</tbody>
</table>

**NOTES**
0 = No Corrosion
1 = Mild Corrosion (Alodine and/or Anodize Penetrated but Base Metal Unaffected)
4 = Severe Corrosion (Base Metal Attacked)
* = Test per ASTM F1110-90
Planned CF3I Ground Testing

(Potential Toxic Impact on Maintenance Crew)

CF3I Concentration Test
Homogeneous 0.4% CF3I “Cloud”

- 30 Deg. Exhaust
- 36 Ft.
- ~ 8 Sec.

Ht. = 5 Ft.  
29 Ft. Dia.

~ 4 Sec.

Homogeneous 0.4% CF3I “Cloud”
"Cloud" Shape / Height?

Engine Bay Dispersion
( ~ 40 Cubic Ft.)
### Fuel Leak Location Impact

<table>
<thead>
<tr>
<th>Location of Leak</th>
<th>Norm Press</th>
<th>Decay Press</th>
<th>Decay Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>25 Psi</td>
<td>25-0 Psi</td>
<td>0-2 Sec</td>
</tr>
<tr>
<td>B</td>
<td>300 Psi</td>
<td>300-4 Psi</td>
<td>5-60 Sec</td>
</tr>
<tr>
<td>C</td>
<td>1500 Psi</td>
<td>1500-0 Psi</td>
<td>5-60 Sec</td>
</tr>
</tbody>
</table>

### Recommendations

- Understand the Fire Scenarios & Extinguishing Mechanisms
  - **Define** Various Fire Initiation / Development / Extinguishing / Re-ignition Scenarios
  - High Speed Instrumentation to Improve Understanding
    - Concentration, Pressure, Velocity ?
  - Theoretical Modeling to Mature the Science
  - Experiments to Determine / Verify the Mechanism of **Gas** Generator Extinguishing, Among Others
- Reduce **Weight/Volume** Penalties
  - Continue R&D on CF3I and **Gas** Generators, Others
  - DoD / **NIST** / ARPA Next-Generation Program
- **'NOFire'** Certification
  - Engine Bays / Dry Bays ?