Chamber Insert Assembly and Avionics Package

MDCA

Chamber Insert Assembly (CIA)

Avionics Package

MDCA Core Capabilities

• MDCA provides the core capabilities of the Flame Extinguishment investigations:
  – Droplet Dispensing
  – Droplet Deployment
  – Droplet Ignition

• Providing these common capabilities on one platform allows many PIs to use MDCA for their own, independent investigations.
• **MDCA Droplet Dispensing**
  – There are two independent fuel dispensers on the MDCA Chamber Insert Assembly (CIA).
  – Fuel reservoirs are replaceable on each of the dual dispensers.
  – Each dispenser feeds independent dispensing needle.
  – This modularity allows for use of different fuels or switching from one reservoir to the other without crew intervention.

• **MDCA Droplet Deployment**
  – System allows for motionless, free deployment (untethered) of droplets to promote spherical symmetry of gas and liquid phases.
  – Opposed dispensing needles synchronously retract to leave droplet freely floating in full view of diagnostics.

• **MDCA Droplet Ignition**
  – Ignition system provides symmetric, non-intrusive ignition of the droplet fuel vapor.
  – Hot wire igniters are activated using optimized parameters for each specific test to minimize momentum imparted to the droplet (igniter distance from droplet, igniter power and on-time).

• **Additional MDCA, PI-Specific Capabilities**
  – PIs can choose to build on these core capabilities to make their experiments unique, and perform additional science as required.
  – *Enhancement for FLEX is the Retractable Indexing Fiber Support (RIF) to tether droplet.*
Hardware Status

**MDCA**

- MDCA Assembly Status
  - All first flight packages are fully assembled
  - Open work summary
    - Apply Labels to Fuel Reservoirs
    - Assemble ORU Kits
Experiment Operational Flow

**CIR/ MDCA**

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**Configuration**
- Install Experiment Avionics Package
- Install Experiment Diagnostics
- Configure/Install CIA
- Install Gas Bottles

**Pre-Test Operations**
- Apply Power
- Perform CIR self-test
- Experiment check-out

**Test Operations**
- Fill Chamber
- Power on Diagnostics
- Review Health and Status
- Start Test Run – Perform Real-Time Test Procedures
- Downlink Real-Time Data
- Shut-down Diagnostics

**Post Run**
- Post Process Data
- Transfer Data to IOP
- Power down to Minimal Power Mode
- Downlink Data (Uplink Procedures)
- Power Down

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• MDCA will run 196 total test points for FLEX.
• The number of test points was determined by the PI Investigations, repeating half the points for confidence of success.
• FLEX requires the following items based on 196 test points: (FOMA Bottles in standard liters)
  – 8 - 2.25 liter FOMA bottles filled to 40% O2 – 60% CO2
  – 5 - 2.25 liter FOMA bottles filled to 40% O2 - 20% CO2 – 40% N2
  – 2 - 2.25 liter FOMA bottles filled to 40% O2 - 60% N2
  – 6 - 3.8 liter FOMA bottles filled to 100% CO2
  – 1062.2 liters (1.2 Kg) of ISS N2
  – 12 Fuel Reservoirs
    • 6 Methanol filled to 1.35 ml
    • 6 Heptane filled to 0.73 ml
  – 2 large adsorber cartridge
    • 1 filled with Silica Gel
    • 1 filled with Molecular Sieve
  – 6 Beaded Fiber Arm Assemblies
The following table shows the estimated mass, volume, crew time, power and data information. These numbers are based on our estimates to achieve complete science.

<table>
<thead>
<tr>
<th></th>
<th>Ascent Mass (kg)</th>
<th>Ascent Volume (m$^3$)</th>
<th>Descent Mass (kg)</th>
<th>Descent Volume (m$^3$)</th>
<th>On Orbit Stowage (m$^3$)</th>
<th>Total Crew Time (hrs)</th>
<th>Average Power (kW)</th>
<th>Total Energy for Experiment (kW-hrs)</th>
<th>Total Data for Experiment (GB)</th>
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</thead>
<tbody>
<tr>
<td><strong>MDCA</strong></td>
<td>54.098</td>
<td>0.147</td>
<td>54.098</td>
<td>0.147</td>
<td>0.003</td>
<td>NA</td>
<td>NA</td>
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<td><strong>FLEX</strong></td>
<td>200.35</td>
<td>0.335</td>
<td>200.35</td>
<td>0.335</td>
<td>0.322</td>
<td>16.27</td>
<td>0.453</td>
<td>146.97</td>
<td>340</td>
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</table>
Launch and On-Orbit Configuration

**MDCA**

- All MDCA hardware will be launched in stowage in the MPLM
  - MDCA CIA and Avionics Package will be bagged and soft stowed
  - MDCA ORU kits consisting of consumables and replacement hardware will be bagged and soft stowed.

- **MDCA On-Orbit configuration consists of integration with CIR. CIA installed within the CIR chamber and Avionics Package located at the PIL on the back of the Optics Bench**