

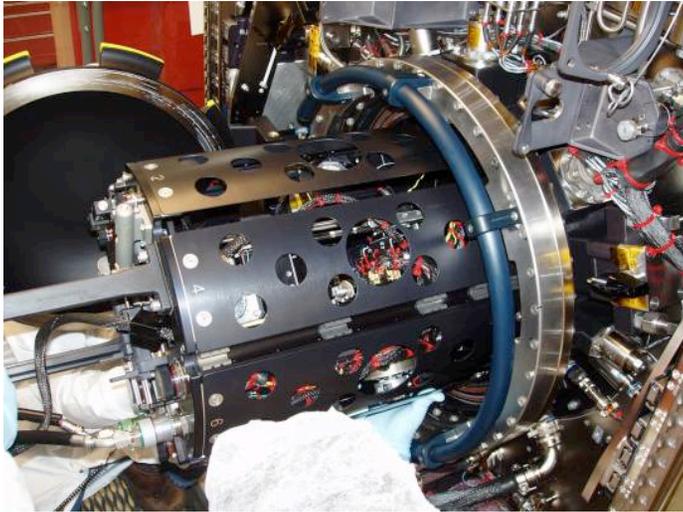


# Chamber Insert Assembly and Avionics Package

## MDCA

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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.



# Capabilities

## MDCA

- **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 provide 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.*

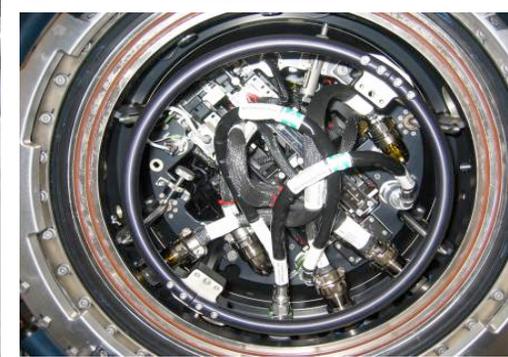
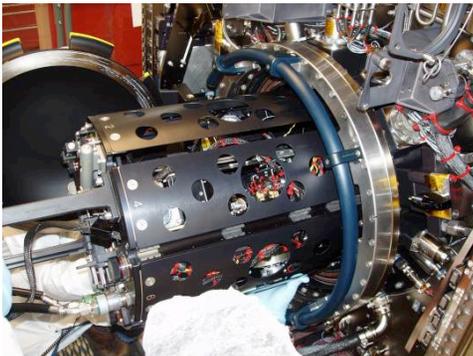


# Hardware Status

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



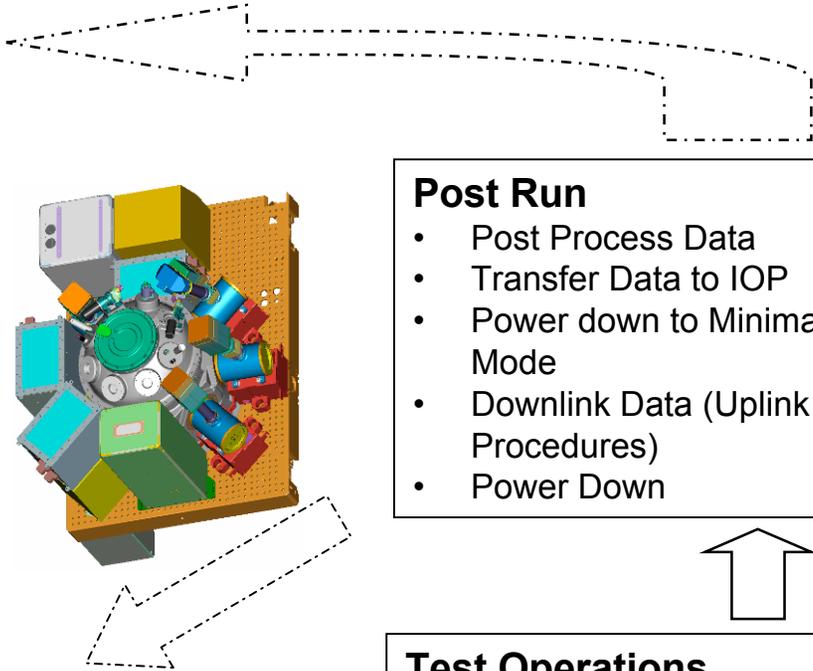


# Experiment Operational Flow

## CIR/ MDCA

**Configuration**

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



**Post Run**

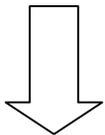
- Post Process Data
- Transfer Data to IOP
- Power down to Minimal Power Mode
- Downlink Data (Uplink Procedures)
- Power Down

**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





# Resource Requirements

## MDCA

- **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% O<sub>2</sub> – 60% CO<sub>2</sub>
  - 5 - 2.25 liter FOMA bottles filled to 40% O<sub>2</sub> - 20% CO<sub>2</sub> – 40% N<sub>2</sub>
  - 2 - 2.25 liter FOMA bottles filled to 40% O<sub>2</sub> - 60% N<sub>2</sub>
  - 6 - 3.8 liter FOMA bottles filled to 100% CO<sub>2</sub>
  - 1062.2 liters **(1.2 Kg)** of ISS N<sub>2</sub>
  - 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



# Resource Estimates

## MDCA

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- 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.

	Ascent Mass (kg)	Ascent Volume (m <sup>3</sup> )	Descent Mass (kg)	Descent Volume (m <sup>3</sup> )	On Orbit Stowage (m <sup>3</sup> )	Total Crew Time (hrs)	Average Power (kW)	Total Energy for Experiment (kW-hrs)	Total Data for Experiment (GB)
<b>MDCA</b>	54.098	0.147	54.098	0.147	0.003	NA	NA	NA	NA
<b>FLEX</b>	200.35	0.335	200.35	0.335	0.322	16.27	0.453	146.97	340



# 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**