

Flame Extinguishment Experiment-2 JAXA (FLEX-2J)/GCE-US



Glenn Research Center



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Objective:

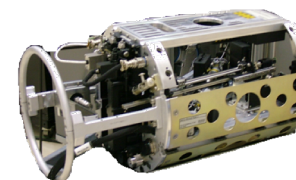
- ◆ Determine the influence of a flame spreading along a linear array of droplets on the flame spread rate and droplet motion.
 - Using the Multi-user Droplet Combustion Apparatus (MDCA) FLEX-2 hardware to dispense droplets along a thin SiC fiber at a discrete, controlled spacing and size, ignite one end of the array and allow the flame to spread and interact with the droplet array.
 - Measure burning rate, burning time, flame spread and droplet motion as a function of inter-droplet spacing, ambient pressure and gas composition.

Relevance/Impact:

- ◆ Liquid fuels are the overwhelming energy source in the transportation sector.
 - Design future combustors to minimize carbon footprint (maximize fuel efficiency) and minimize pollutant emissions.
 - Extend single droplet results to consider droplet-droplet interactions that are present in all practical combustors.
 - Prior droplet combustion results helped validate jet engine models by engine manufacturers.
- ◆ Fundamental information on the mechanisms of flame spread in a fuel spray.

Development Approach:

- ◆ Utilize FLEX-2 hardware and diagnostics already on-orbit in CIR and add specific FLEX-2J components.
 - Flight hardware specific to FLEX-2J:
 - CIR manifold bottles (3)
 - Fuel Reservoir (1)
 - Needle Kit (1 Kit with 3 needle pairs)
 - Fiber Kit (1 Kit with 6 fibers)
 - Adsorber Cartridge (1)
 - Igniters (3 MDCA Igniter pairs)



(Left) FLEX Chamber Insert Assembly Apparatus. (Right) Mike Fincke operating the CIR.

ISS Resource Requirements

Accommodation (carrier)	CIR
Upmass (kg) (w/o packing factor)	28 kg
Volume (m³) (w/o packing factor)	0.035
Power (kw) (peak)	1.0 kW
Crew Time (hrs) - Initial configuration of CIR Rack - Change-outs during experiment	25.5
Autonomous Ops (hrs)	210
Data Points	26

GCE-US is NASA's contribution to JAXA's Group Combustion Experiment in the Kibo module exploring flame spread combustion on a two-dimensional silicon carbide lattice.

Project Life Cycle Schedule

Milestones	Reqmts Due	SCR	RDR/PDR	CDR	VRR	Safety	PSR	Ship	Launch	Ops	Ops End	Final Report
Actual/ Baseline	Mar 2011	—	May 2012	Nov 2012	—	Dec 2012	May 2013	May 2013	Aug 2013	Oct 2014	Oct 2015	Oct 2016