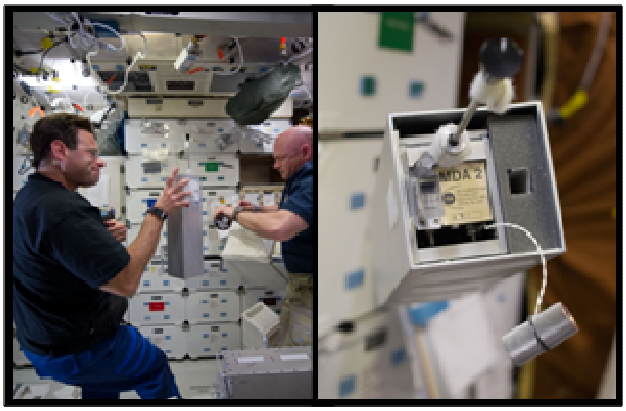
Materials Dispersion Apparatus (MDA)



BioSpace Experiments, Inc.™ (BSE) is offering a unique opportunity to fly microgravity experiments on the SpaceX Dragon spacecraft scheduled for launch the 3rd Qtr 2013. Aboard the Dragon will be BSE's flight-proven Materials Dispersion Apparatus (MDA) space processing hardware. Earth orbit offers a unique environment for investigating the physical effects of the absence of gravity on fluids, as well as the solidification and processing of organic and inorganic materials, among other applications. Although the fundamental effects of gravity are well known (bouyancy, sedimentation, convection, etc.), its impacts on materials and processes are subtle and intriguing. The promise of routine access to the microgravity space environment to produce unique experimental results and useful new materials aboard the NextGen launch suppliers can finally unlock the value of this unique experimentation and manufacturing environment.

The MDA hardware will be a part of BSE's commerical experiments package flown in association with NanoRacks, Inc. The mission will be the next of several that are planned to give routine access to the space environment for academic researchers, industry and the student STEM education space experiments community. The MDA is capable of simultaneously accommodating up to 90 separate investigations, enabling a wide variety of research applications. The mission will offer multiple slots on the mini-laboratory apparatus, enabling reduced cost to each participant. This means that scientists and engineers from academia, government and industry, as well as student investigators, can acquire access to space, in a proven laboratory environment, at a very accessible price. Opportunities are now available to participate on these early commercial resupply missions to the ISS for economical space experimentation and in-space manufacturing.

Research Areas Supported by the MDA

Experiment	Application
Protein Crystal Growth	Biomedical Research
Protein Diffusion	Biomedical Research
Collagen Polymerization	Biomedical Research
Fibrin Clot Formation	Biomedical Research
Microencapsulation of Drugs	Biomedical Research
Cell Biology	Biomedical Research
Electrokinetic Transport	Fluid Physics
Fluid Mixing	Fluid Physics
Immiscible Phases	Fluid Physics
Miscible-Immiscible Liquid Behavior Studies	Fluid Physics
Wetting Studies	Fluid Physics
Ceramic/Polymer Membrane Casting	Manufacturing Process Research
Electro Optic Polymer Crystallization	Manufacturing Process Research
Precipitation Morphology	Manufacturing Process Research
Zeolite Crystallization	Manufacturing Process Research

This is not an exhaustive list. Please contact BSE to discuss your specific research requirements.

108 Ashland Drive
Downingtown, PA 19335
www.biospaceexperiments.com
Tel: 610-280-0869
Cell: 484-431-5028

BioSpace Experiments, Inc.

BSE
Opening Low Earth Orbit to Easy and Affordable Commercial Access

MDA Capabilities

The MDA is a commercial microgravity space processing laboratory which is capable of mixing up to 90 separate samples of any two or three fluids or solids at precisely timed intervals. The standard MDA has been flight-qualified to two levels of containment and has flown on seven Shuttle and six sounding rocket flights.

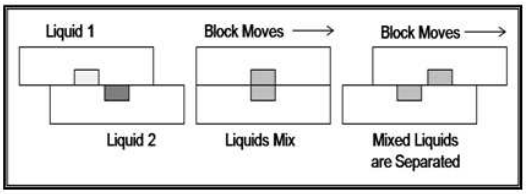
The apparatus operates by moving two blocks, which contain wells holding the various experimental substances, in relation to each other. The wells on the blocks are not contiguous at launch, to keep the experimental fluids separated until they are brought into contact or mixed in orbit. Shortly after achieving orbit, a crew member manually activates the MDA to move the blocks into alignment, allowing the fluids to come into contact or mix. The blocks are moved once again prior to reentry, to again misalign the wells and secure the materials.

Four mixing methods are available: liquid-to-liquid diffusion, osmotic dewatering (analogous to vapor diffusion), magnetic mixing, or step gradient mixing. The experimenter has the option to incorporate any one of these techniques, or a combination of them, within the limits of his or her science protocol and the MDA capabilities. At the present time we anticipate that there will be temperature control available during this SpaceX Dragon mission.

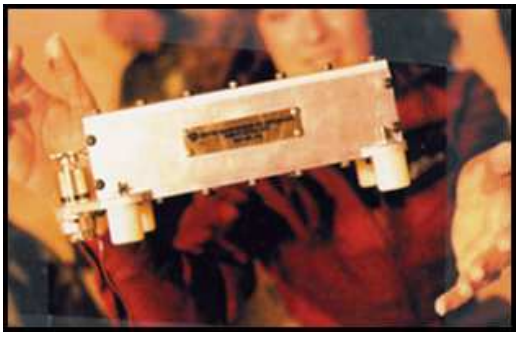
MDA Mission Specifications

- **Number of Data Samples Available**
  - 90 Experiment wells/data points
  - Each well can contain up to 125 microliters (µl) of fluid. The top block is fixed at 125 µl per well, and the bottom block can be varied from 25 to 125 µl in each well.
- **Temperature Control**
  - Dragon/ISS shirt sleeve environment: 18°-27°C (64° -81°F) (No temperature control)
  - 6º C and 20º C (with temperature control)
- **Mixing Methods**
  - Liquid-to-liquid diffusion
  - Osmotic dewatering (analogous to vapor diffusion)
  - Magnetic mixing
  - Step gradient
- **Fluid Levels of Containment**
  - Two or three, dependent upon experimental requirement to contain hazardous material
- **Power Requirements**
  - No power required in manual mode
  - 12 volt zinc-air activated batteries
  - 110 watts (with temperature control)
- **Flight History**
  - STS-37, STS-43, STS-52, STS-56, STS-67 STS-69, STS-134, STS-135

Principle of Block Operation for Mixing Fluids within the MDA



Early MDA During Low-g Aircraft Hardware Development Flight



3rd Generation MDA Flown on Space Shuttle

For more information and flight booking call Ron Jones at 703-447-1188 or email ron.jones310@gmail.com

Rev.120730

108 Ashland Drive
Downingtown, PA 19335
www.biospaceexperiments.com
Tel: 610-280-0869
Cell: 484-431-5028