

BSE Space Processing Hardware

Over the past 25 years, ITA (BSE's sister company) has developed a set of highly specialized automated miniature laboratories, mini-labs, for the purpose of conducting multi-purpose experiments in the microgravity environment of space or variable-g parabolic aircraft flight. Mini-lab hardware is based on sliding block technology where two or three fluid samples are brought into contact and "mixed" in a laminar or turbulent manner as required by experiment protocols. The hardware has the capability to conduct simple liquid mixing "diffusion" experiments to very sophisticated cell research and biomedical protein crystal growth experiments.

ITA's space processing hardware has utilized customer/user inputs/requirements to develop six (6) protein crystal growth techniques developed since the early 1980's: liquid-to-liquid diffusion, osmotic dewatering (similar to vapor diffusion), magnetic mixing, step gradient and reverse step gradient diffusion, and combinations of the above. All of these techniques have been tested in space and have provided excellent results.

HARDWARE	SIZE ANALOG	WEIGHT	DATA POINTS
 LMA Flown on the Shuttle	Cigarette Pack	~ 6 Oz	16
 MDA Flown on the Shuttle and Sounding Rockets	Brick	~ 4 Lbs	~100
 Single DMDA Flown on the Shuttle	Book	~ 8 Lbs	~300
 DMDA & DMDA-O Flown on the Shuttle And Mir	Breadbox	~ 16 Lbs	~400 with 9 Optical Wells



Astronaut Ron Parise operating MDA aboard STS-67



Astronaut Story Musgrave operating DMDA aboard STS-80



Astronaut Bill Gregory activating LMAs in space



Pre Activate Position Microgravity Position

Multi-purpose 4th Gen FMA Demonstration & Training Unit

Ground Control / Low-g Aircraft Fluid Mixing Apparatus

The ITA Fluid Mixing Apparatus (FMA) is a multi-purpose "see through" demonstration and training unit that is ideal for demonstrating liquid mixing in an aircraft, laboratory or classroom environment. The FMA can also operate as a "ground control" unit for experiments flown in space in a standard ITA Materials Dispersion Apparatus (MDA). Easy to load and operate, the FMA effectively demonstrates the sliding block technology of the MDA and clearly shows the liquid-liquid mixing (diffusion) process that takes place within an actual MDA. Made from clear Lexan, this very light weight and well sealed handheld unit is ideal for observing the diffusion process during variable-g aircraft training sessions or in ground-based instructional settings.

Instrument Versatility

ITA hardware is optimized for use in on-orbit platforms, in suborbital flight or in low-g aircraft environments. ITA hardware has been used by a broad range of researchers from professional researchers through elementary school students.

Flight-Proven Multi-purpose Space Processing Hardware

ITA's flight qualified hardware can perform numerous types of experiments in space: fluid diffusion/fluid mixing, cell biology, protein crystal growth for biomedical applications, inorganic crystal growth including zeolite crystals, thin film membrane casting, seed germination, and virtually any experiment that can be initiated by bringing together two or three experiment samples of fluids, and/or fluid and solid samples.

- The Materials Dispersion Apparatus (MDA)
 - ~100 data point/experiment well capability (~125 microliters/well)
- A Single Dual Materials Dispersion Apparatus (DMDA)
 - ~300 data point/experiment well capability
- The Dual Materials Dispersion Apparatus-Optical (DMDA-O)
 - Features a 150X video microscopic camera for select data wells
 - ~100 data point/experiment well capability
- The Liquid Mixing Apparatus (LMA)
 - 4 LMA Vials/experiments per tray (2 - 3 milliliters per vial)
 - Up to 16 data point/experiments per tray with capillaries

Space Processing Hardware Flight History

- 11 Space Shuttle Mid-Deck Locker missions
- 8 Sounding Rocket flights
- 1 Orbital Reentry Vehicle
- 2 International Space Station mission
- 1 Mir Space Station mission
- 4 Low-g aircraft flights

• 24 Space Missions
• 15 Space Shuttle Flights

What BSE Provides its Customers

ITA offers a turnkey service of commercial access to space. Services include the lease of flight qualified microgravity hardware for researchers desiring to conduct experiments in the microgravity environment of space, all associated flight documentation, and payload integration services required to fly an experiment on the chosen launch vehicle.

- Commercial Access to Space
- Space Processing Hardware to Perform Microgravity Experiments
- Low-Cost Leasing
- Comprehensive Engineering and Scientific Consultation Services
- Turnkey Operation

ITA's experience and know-how have permitted its customers to perform microgravity experiments at low-cost on an array of space vehicles including the U.S. Space Shuttle, the International Space Station, the Russian Mir Space Station, orbital re-entry vehicles, sounding rockets and low-gravity aircraft.



1st Gen MDA on Low-g aircraft development flight



3rd Gen MDA flown on Shuttle



2nd Gen Single DMDA flown on Shuttle



2nd Gen DMDA & DMDA-O flown on Shuttle & Mir



LMA flown on Shuttle