

## Enabling Micro-Gravity Research: Upgraded Legacy Hardware to Support Basic Research on Low-g Aircraft, Suborbital and Orbital Platforms

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### Abstract

The post-Shuttle generation of launch vehicle providers will offer new flight opportunities to the micro-gravity ( $\mu$ -g) research community. Traditionally plagued by high costs and a lack of launch opportunities, today's  $\mu$ -g community stands at the threshold of resurgence when the new higher launch rate commercial vehicles begin routine operations. As a new generation of space researchers considers how tourism-focused suborbital and orbital missions can be used for commercial and university research and education, they should consider how the rich legacy of  $\mu$ -g hardware developed during the shuttle era can meet their emerging  $\mu$ -g needs.

The private sector has developed flight proven hardware, performed a myriad of experiments and conducted a wealth of meaningful scientific, commercial, and student experiments on aircraft, sounding rockets, suborbital and orbital platforms. This paper presents an overview of the flight hardware development experience, capabilities and  $\mu$ -g resources available from one American Commercial Space company founded in the mid-1980's, Instrumentation Technology Associates (ITA). It describes an impressive array of low-cost experiment/space processing flight hardware available for lease to researchers applicable for use on aircraft, sounding rocket, next-gen suborbital and/or orbital platforms.

This paper will also describe the latest generation of demonstration and training/ground control hardware (see photo) suitable for use on low-g aircraft that can be used as a tool to visually demonstrate fluid sample mixing both on the ground (e.g., a lab or classroom

environment) and in parabolic flight that essentially mimics the flight proven hardware available for use on various commercial space missions including foreign carriers and the International Space Station. The wide variety of research areas supported by these mature 2<sup>nd</sup> and 3<sup>rd</sup> generation "mini-labs" including the new 4<sup>th</sup> generation fluid diffusion demonstration and training/ground control hardware will be discussed. The paper will also provide an update on an upcoming 2011 orbital mission where leased ITA hardware will be flying a bevy of experiments from research organizations and academic institutions including 16 winning student experiments, the result of a nationwide STEM education competition involving over 20,000 students, 14 states, and 447 submitted research proposals for an opportunity to fly as part of the new Student Space Experiment Program (SSEP).



**The ITA Materials Dispersion Apparatus (MDA) Demonstration and Training Unit (shown being loaded) is applicable for use on Low-g aircraft or in classrooms or labs as a ground control unit supporting on-orbit experiments.**