

Presented as poster or presentation: Presentation

Division: Space Biosciences Division

Association: NASA Ames Research Center

Title: A state-of-the-art instrumentation package to support model organism research in space

**Abstract:**

Hardware was developed for the Ames student Fruit-Fly Experiment (AFEx) to support fly growth and analysis during spaceflight. The hardware consists of a 1.5U vented aluminum box that houses an acrylic habitat, video camera, LED lighting, and environmental sensors. Power is provided via two USB connectors, one of which also supports data downlink. While the hardware was designed for use with fruit flies, it will house plants on an upcoming mission and could be adapted for use with other systems.

# State-of-the-art instrumentation package to support model organism research in space

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Readiness level:  
 TRL 1-3: Concept  
 TRL 4-6: Prototype  
 TRL 7-9: Demonstrated

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Technology / Application

**Application:** This hardware has a generic bus design, and can be used to conduct space-flight biosciences experiments on board the International Space Station (ISS) with minimal modifications. Sample model organisms may include but are not limited to fruit-flies, plants/seeds, other insects, small vertebrate models etc.

**Customer:** Space Bioscience Division model organism research groups, external science investigators and students

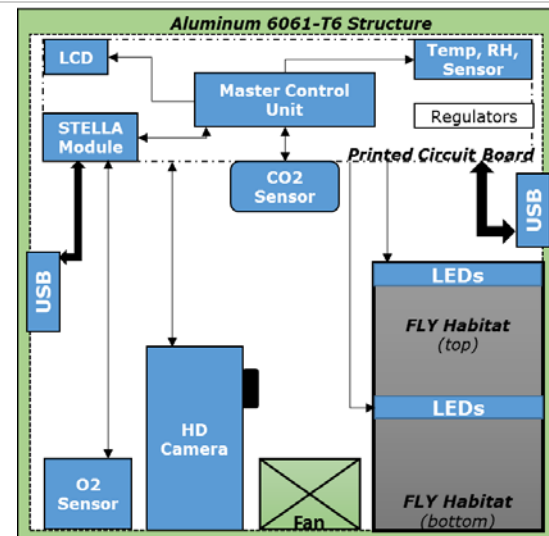
**Technology:** 1.5 U (100 x 100 x 150 mm) and 1.4 Kg unit with following characteristics,

- **Camera:** Modified off-the-shelf high definition camera (1080p @ 60fps)
- **Active Sensors** (during experiments): Temperature, Relative Humidity, CO2 and O2
- **Passive Sensors** (during experiment and launch, landing, stowage, return): Temperature and Relative humidity
- **Data Storage:** 128 GB removable micro-SD card
- **Variable Circadian Cycle:** With integrated white and infrared (IR) LEDs
- **Communication:** Configured for automatic operation with ISS-STELLA communication system additional near-real time data download mode
- **Habitat:** 40 x 40 x 95 mm organism habitat with variable vents and mesh
- **Venting/ Cooling/ Air circulation:** Suitable environment maintenance and air circulation using variable speed fan unit controlled by Master Control Unit (MCU)
- **LCD:** Built-in liquid crystal display for in-video display of environment monitoring parameters (temperature, relative humidity, CO2-ppm, O2-%)

**ARC Role:** Complete payload development, first and second space-flight demonstration and science missions with fruit-flies as model organism. This payload was first developed and flown as a student effort and training opportunity

**Technical Challenges:** Mass and dimensional constraints, compact integrated electrical and electronics design, biocompatibility, precision machining, clean build process (volatile glue)

**Level of Success:** Highly successful, demonstrated space-flight mission (AFEx-1)



Timeline

- **April 2011**, Concept proposed Fruit Fly research group
- **September 2012**, Preliminary Design Review by students in Code SC
- **July 2013**, Critical Design Review, students in Code SC
- **November 2013**, Safety review and flight clearance with SpaceX CRS-4
- **September 2014**, First flight mission (Ames Fruitfly Experiment - 1) on SpX-4
- **November 2015** (scheduled), Second flight mission (Ames Fruitfly Experiment-2)

POC

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