National Aeronautics and Space Administration

NASA

TECHNOLOGY SOLUTION

Robotics, Automation and Control

Compact Science Experiment Module

A compact modular enclosure for performing science experiments in space and on the ground

Crew time on the International Space Station (ISS) is extremely limited for any operations on science payloads. Autonomous science experiments in small self-contained cubical payloads are highly desirable because these payloads take up minimal space and spaceflight resources. The Compact Science Experiment Module (CSEM) was originally designed as a plug-and-play science experiment to study the activity of fruit flies in microgravity. It is comprised of a compact modular enclosure with a transparent habitat, camera with mirror to monitor two dimensions simultaneously, microcontroller for controlling the experiment, LED lighting for creating circadian effects, and various sensors to monitor that the environment stays healthy for the organism under study. The CSEM can be modified to study other organisms such as plants and small scale non-life science experiments. Powered through the USB cable, the CSEM can also connect to ISS telemetry for data transmission to the ground. The astronaut can simply plug in the USB cable to start the experiment.

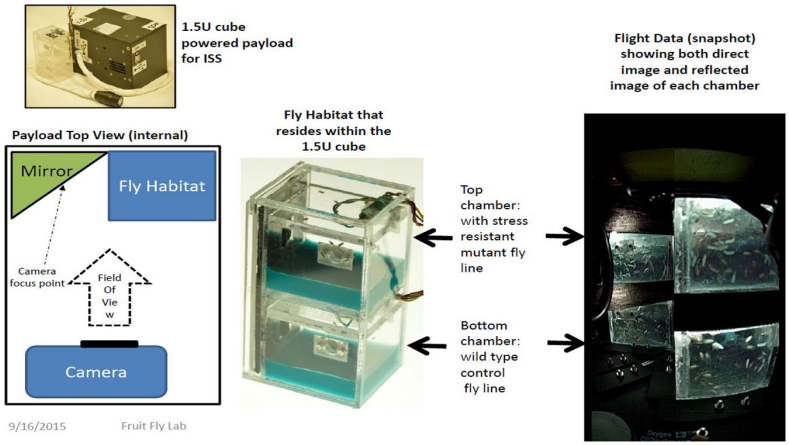
BENEFITS

- Autonomous (plug and play) requires little crew time
- Rugged and modular fits in standard rack on the ISS
- Small and lightweight
- Powered by the USB cable
- Customizable for each science experiment
- Science data can be stored and transmitted from ISS racks

THE TECHNOLOGY

The Compact Science Experiment Module (CSEM) provides a suitable experiment platform consisting of an enclosure that contains all the required components to perform science experiments that can house either living biological samples or other samples on both the ground and on the International Space Station (ISS). The invention provides required instrumentation for video capture and data storage, environmental monitoring, inclusive of sensing temperature in degree Celsius, relative humidity as a percentage, carbon dioxide in parts per million and oxygen in percentage format. Data can be stored within the module and retrieved after the experiment or can be transmitted to the ground as for example from the ISS, by connecting to the ISS telemetry system.

The Compact Life Science Experiment Module has been fully developed at NASA Ames Research Center and tested on the ISS. In general, fruit fly studies can provide information about the effects of spaceflight at the biochemical, cellular and organismal levels. Using fruit fly spaceflight hardware, researchers are able to investigate the role of spaceflight on development, growth, reproduction, aging, neurobehavioral responses, immunity, heart function, etc. The fruit fly genome matches the human disease genome by almost 77%, and flies have, therefore, been a useful tool for scientists to understand the genetics, and molecular biology of more complex biological systems like humans. The Compact Science Experiment Module is extremely adaptable to other model specimens and samples as well, and has also flown plant experiments on the ISS. The software can be tailored to accommodate different experiment scenarios by adjusting video imaging times, LED light cycles, data storage and telemetry etc.



The CSEM hardware

APPLICATIONS

The technology has several potential applications:

- Space applications on the ISS:

  Small scale science experiments in:
  Biology
  Plant growth
  Drug efficacy
  Environmental gas sensing/contaminants
  Physics
  Materials science

- Ground applications:

  Ground-based experiment controls for the above applications
  Remote experiments through wireless transmission

PUBLICATIONS

Patent No: 9,998,639

technology.nasa.gov

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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More Information

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Agency Licensing Concierge

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