MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Microgravity Sciences Onboard the International Space Station and Beyond (6)

Author: Dr. Andrés Mora Vargas
Central American Association for Aeronautics and Space (ACAE), United States, andres.mora@acae-ca.org

Ms. Jennifer Solis Ocampo
Central American Association for Aeronautics and Space (ACAE), Costa Rica,
jennifer.solisocampo@ucr.ac.cr
Ms. Mariela Rojas Quesada
Central American Association for Aeronautics and Space (ACAE), Costa Rica,
mariela.rojasquesada@ucr.ac.cr
Mr. Roberto José Aguilar Martínez
Central American Association for Aeronautics and Space (ACAE), Costa Rica,
roberto.aguilarmartinez@ucr.ac.cr
Dr. Marcela Hernández Jiménez
Universidad de Costa Rica, Costa Rica, marcela.hernandezjimenez@ucr.ac.cr
Mr. Mariano Jimenez Brenes
Central American Association for Aeronautics and Space (ACAE), Costa Rica, mjimenez@systronic.co.cr

DESIGN OF A NANOLAB TO MONITOR THE ELYTRA OF A CHRYSINA BEETLE AT THE INTERNATIONAL SPACE STATION

Abstract

This paper presents the development of an experiment that will monitor the effects of microgravity conditions on the elytra of a Costa Rican indigenous beetle at the International Space Station (ISS).

Some beetles of the genus Chrysina have elytra (the two wing cases of a beetle) with metallic appearance. This property, called structural color, has been investigated by the Materials Science and Engineering Investigation Center (CICIMA) of the University of Costa Rica (UCR) and could have applications in the space field as an external coating protecting the electronics of aircraft and satellites. The tests at the ISS will allow monitoring the material under conditions of microgravity and cosmic radiation.

In 2013, together with Aeronautics and Space Central American Association (ACAE), a sample of elytra from the species C. chrysargyrea was carried aboard a weather balloon to an altitude of approximately 40,000 meters above ground level (AGL). Results from this test showed no damage due to solar radiation. As a next step, ACAE seeks to provide the technical support needed to evaluate the sample of elytra under microgravity conditions.

The payload will be taken to the ISS using the service offered by the company Nanoracks which has restrictions on volume, mass, and power consumption. The system consists of a 1U cube or "nanolab" (10 cm side, 1kg) printed in PLA and monitoring electronic components that include sensors for measuring temperature, humidity, and degradation of elytra by capturing images.

We have developed two iterations of the nanolab where the latest iteration was completely functional for data collection and image capturing. We are currently developing the third iteration that includes microscopy imagery and increasing the complexity of the nanolab's mechanical and electrical components. To analyze the load stiffness and the vibration resistance of all the components, the third iteration of the nanolab will be tested by sending it up to 12,000 feet AGL as a payload inside a UCR student-build sounding rocket.

In this paper, we present the development of our Nanolab including the three iterations it has gone through. We have considered volume limitations, electrical variables, endurance and reliability of the system. Further, we have identified the parameters required to successfully monitor possible variations in the elytra through microscopy and digital photography when subjected to conditions of microgravity on the ISS.