An Advanced Automated Microscope

Innovative Microscopy Research: Quantity Above Space

Innovation and integration are all that are required to use the Light Microscopy Module (LMM) as a laboratory microscope to perform research aboard the International Space Station (ISS). The LMM is remotely controllable, automated microscope that gives scientists the ability to study—and in real-time—the effects of the space environment on physics and biology. Specimens can be studied without the need to return the samples to Earth.

Microscope Modified for Space Research

The LMM built and fabricated commercial Leica RA Microscope configurations to operate in an automated mode with interaction from the ground support staff. Its core capabilities include a level of containment, while light imaging (visible), fluorescence, contrast microscopy are available in 2016 or 2017, and in imaging capability from a 0.9-magnification 1080 camera.

LMM Supported in the Fluids Integrated Rack

The LMM operates in the Fluids Integrated Rack (FIR), which is located in the U.S. Destiny laboratory of the ISS. The FIR provides the LMM with the necessary infrastructure to conduct research, including gas supply, launch, temperature, control power, illumination, and image capture, data processing and other resources. The FIR also provides isolation from vibrations on the station to allow for a more stable environment to obtain high-resolution images. The LMM, in conjunction with the FIR, will help improve the value of the basic science in space, which is ideal for low-cost robotic development.

Critical Research Enabled by LMM

This new capability is significant for the international community. Understanding these processes will help scientists and engineers build more efficient machines and consumer products both on Earth and in space applications. A team of experiments is planned for the LMM to allow for a detailed characterization of fluids, solids, two-phase flow, and biological samples. In the future, the LMM could be used to assist in manipulation of selected solid materials to advance knowledge of the effects of space on biology and to contribute to long-term mission space exploration.

Modified Microscope

Engineers at NASA Glenn Research Center modified a Leica RA Laboratory-grade microscope by adding 22 monitors to permit remote control, by stabilizing on the ground to level the demands of space and to reduce operations. As such, it contains all of the necessary optical components for use as a fully functional microscope. The microscope can house many different corporate corresponding to magnifications of 2.5×, 4×, 10×, 20×, 40×, 60×, 100×, and 100×-oil coupled objectives. Present capabilities include metallographic, microscopic, contrast microscopy, condensers, and objectives, and possibly laser beams.

LMM Control Block (LCB)

The electrical design of the LMM was part of the electronics of the Leica microscope and supports direct internal and external electronics that support a variety of imaging and breathing capabilities. Makers and basic operations have been added to control the basic functions of the Leica microscope. The LCB provides 16-axis of control for stepper motors and 4-axis of control for various motor rods.

Characteristics and Features

Modular Microscope

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