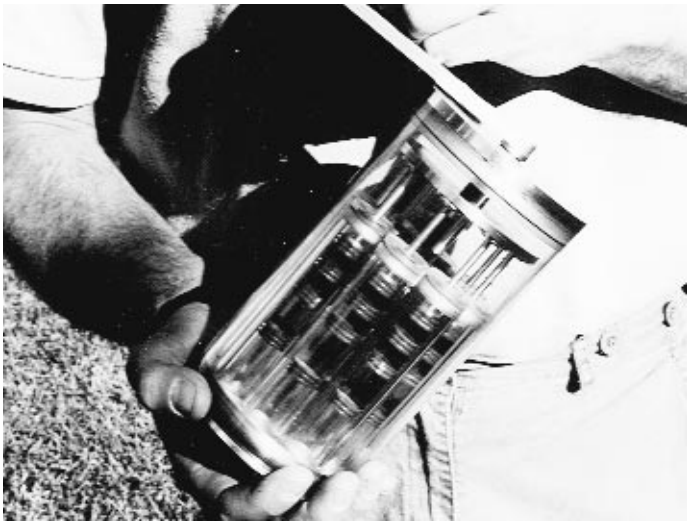
Commercial Generic Bioprocessing Apparatus



This Group Activation Pack holds several eight-chambered Fluid Processing Apparati, allowing many experiments to take place simultaneously.

Biotechnology — the application of engineering and technological principles to the life sciences — is a major component of NASA's microgravity science research. One of the instruments available to biotechnology researchers aboard the Space Shuttle is the Commercial Generic Bioprocessing Apparatus.

This research tool allows a variety of sophisticated bioprocessing experiments to be performed in one apparatus. Many of the experiments have applications that could improve life on Earth while providing solutions to issues associated with extended stays in space. Major areas of investigation include biomedical testing and drug development, ecological systems development, and biomaterial products and processes. The facility can start bioprocessing reactions by mixing or heating a sample and can also initiate multiple-step, sequential reactions — a technique called *phased processing.*

On the First United States Microgravity Laboratory, biomedical experiments included investigations into how the human body fights disease, how infectious organisms like bacteria can be controlled, and how cells and molecules develop and grow in reduced gravity. Other experiments focused on seed germination and the effects of microgravity on plant and animal development. Ecological test system experiments studied how to efficiently use bacteria to treat waste and recover water, processes needed for long-term spaceflight. Biomaterial experiments included new methods for producing protein crystals and industrial crystallizers, and the growth of biomolecular gels of *bacteriorhodopsin*, a protein that — because of its ability to harvest light energy — has vast potential for electronic memory storage.

The Commercial Generic Bioprocessing Apparatus uses an eight-chambered Fluid Processing Apparatus (FPA), several of which are organized into Group Activation Packs (GAP). The ability to conduct multiple experiments simultaneously gives versatility and flexibility to this unique facility. Each chamber of a Fluid Processing Apparatus can hold an experiment up to several milliliters in volume. A large quantity (432) is available in each Group Activation Pack, with 2 to 24 apparati available for each experiment. The experiments can be activated simultaneously by turning a crank on the activation pack.

Each experiment in a Fluid Processing Apparatus consists of a glass tube that contains a neutral storage medium and the sample, an experiment activator that initiates bioprocessing, and a termination fluid that fixes the experiment for postmission analysis. The fluids are separated by rubber stoppers. Once on orbit, a crewmember mixes the samples and places them in an incubator for a preprogrammed period. Processing is terminated automatically, and the samples are removed, prepared for landing, and stored. Some experiments will be kept in the Spacelab module at ambient temperature, and others will be stored in middeck lockers. Some experiments, such as the protein crystal growth experiments, will be placed in a commercial refrigerator incubator module set to a specific temperature such as 37 °C or 22 °C. Samples can be monitored throughout the mission.

Commercial Generic Bioprocessing Apparatus Experiment

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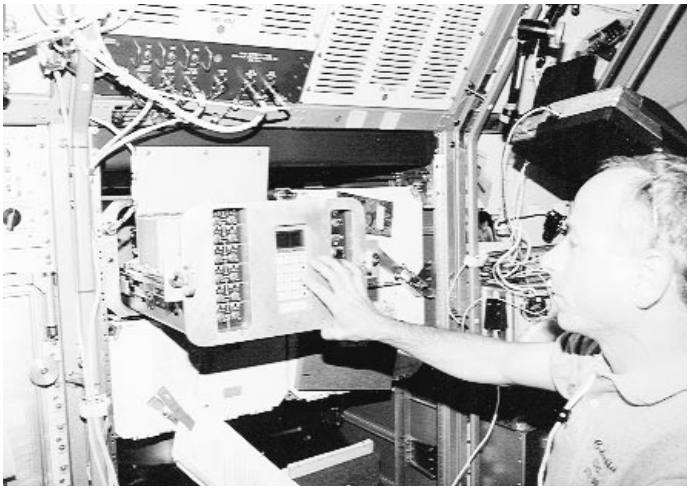


Mission Specialist Carl Meade Activating the Generic Bioprocessing Apparatus on USML-1

Biomedical Testing and Drug Development

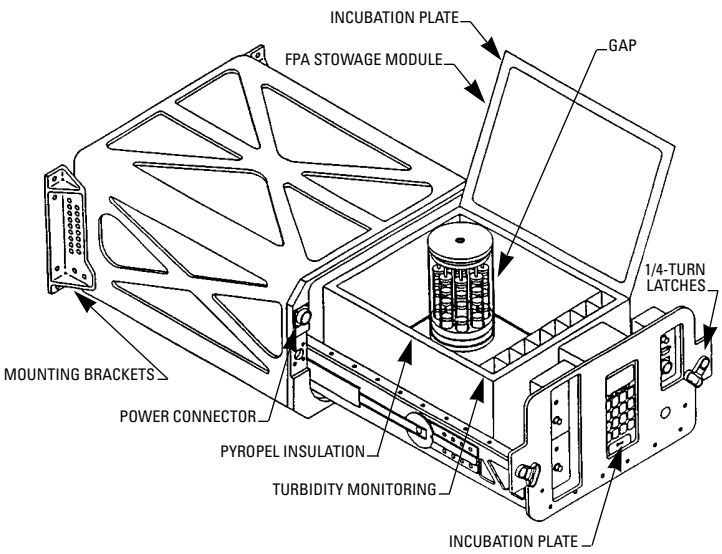
Purpose: To provide information to develop a better understanding of how microgravity affects bone metabolism, the immune system, and the neuromuscular system
Significance: Information from these experiments may help scientists understand the changes caused by exposure to microgravity, allowing them to develop and test new drugs and treatments for diseases and disorders that affect human health, including cancer, osteoporosis, and Acquired Immune Deficiency Syndrome (AIDS).

Ecological Test Systems

Purpose: To investigate controlled agricultural applications, waste management processes, and methods of controlling microbes
Significance: These experiments will evaluate the effects of microgravity on seeding, seed germination, plant development, and bacterial products and processes. An understanding of the development of plants and the relationships between bacteria and plants will be crucial to extended stays in space where plants will be used as both a food source and a means of purifying air.

Biomaterials Products and Processes

Purpose: To investigate the effects of microgravity on the growth of bacteria, to investigate new pharmaceutical products and delivery systems, and to study materials that could be used as replacements for skin, tendons, blood vessels, and corneas
Significance: These investigations will provide important information on how bacteria grow in the absence of gravity-driven fluid flows, on the ability to grow structures that can deliver drugs directly to cells, and on models for potential implants, such as synthetic skin for burn victims.



Commercial Generic Bioprocessing Apparatus Hardware