NASAfacts

PharmaSat Nanosatellite

NASA's PharmaSat nanosatellite is about the size of a loaf of bread and weighs approximately 10 pounds. It contains a controlled environment micro-laboratory packed with sensors and optical systems that can detect the growth, density and health of yeast cells and transmit that data to scientists for analysis on Earth. PharmaSat is a secondary payload on an U.S. Air Force four-stage Minotaur 1 rocket to deliver the U.S. Air Force's TacSat 3 satellite to orbit. This nanosatellite platform opens numerous secondary payload opportunities to conduct research in space at lower cost and with greater frequency than previously possible.

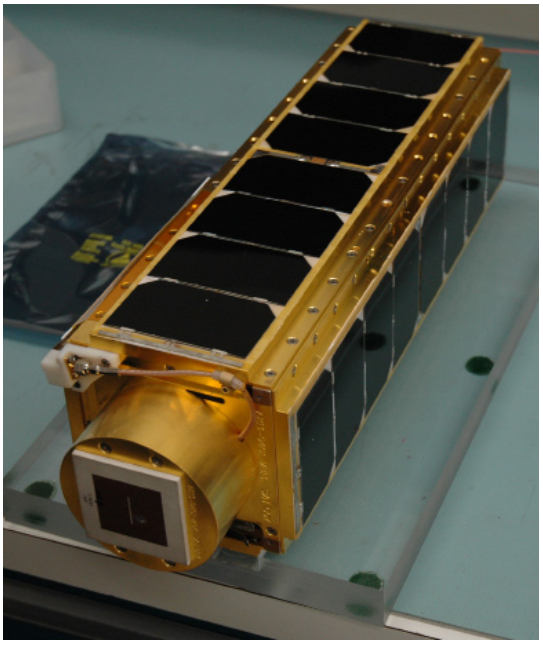
Mission Overview

PharmaSat showcases NASA's achievements using cutting-edge satellite hardware from a technology development program led by the Small Spacecraft Division at NASA's Ames Research Center, Moffett Field, Calif. NASA designed and developed the next generation, miniaturized triple-cube satellite, or "cubesat," spaceflight system for biological payloads that PharmaSat employs. NASA collaborated with industries and universities in Silicon Valley and California to support mission operations.

PharmaSat gives NASA an opportunity to conduct research in microgravity without using resources dedicated to the International Space Station or during space shuttle flights, which helps NASA reduce costs and crew flight time.

Spacecraft

PharmaSat builds on NASA's successful GeneSat-1 mission, which launched in 2006. GeneSat-1 combined innovative strategies to miniaturize and integrate hardware into a self-powered, free-flying satellite, weighing about 10 pounds, capable of providing life-support, monitoring and analysis capabilities for E. coli microorganisms in space. After years in orbit, GeneSat-1 continues to transmit a beacon to Earth.

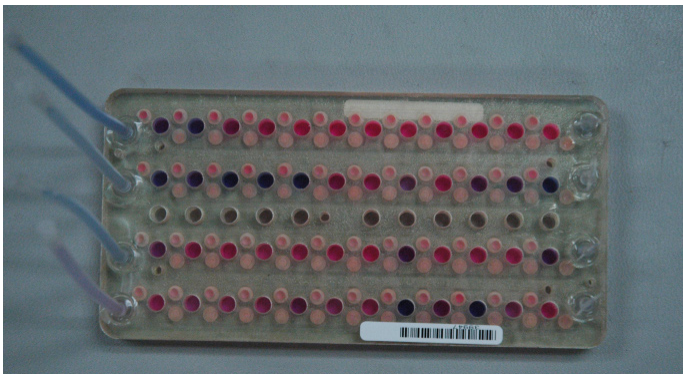


The satellite payload sits fully assembled, covered in shiny solar panels.
(NASA/ARC/Christopher Beasley)

PharmaSat is constructed from off-the-shelf commercial and NASA-designed parts to create a fully self-contained, automated, stable, space science laboratory with innovative environment and power control techniques; sensors to monitor the levels of pressure, temperature and acceleration; and a communications system able to regularly transmit data back to Earth for scientific analysis.

PharmaSat's main technology subsystems include:

- An optical sensor system to detect the health and size of the yeast populations;
- A microfluidics system consisting of an eight-by-four inch plastic card with 48 small holes, or "fluidics microwells," which house four separate sample groups of yeast, and a network of small tubes to feed the yeast simple sugars and dose them with an anti-fungal agent; and
- A miniature environmental control and power control system.



A fluidics card containing yeast and Alamar Blue.
NASA Ames Research Center

Scientific Objectives

The PharmaSat mission's five scientific objectives include:

- Provide life support, such as sugars the yeast can consume, and environmental control, such as temperature, for yeast growth in 48 independent micro-wells;
- Administer three groups of growing yeast with an antifungal agent at three distinct dosage levels, and one control yeast group with no antifungal dosage;
- Track the yeast population density and health in each microwell before, during and after administering the antifungal by using an optical density sensor and Alamar Blue, an agent that turns the yeast varying shades of blue and pink as they consume the sugars;
- Transmit the yeast population and health data, and PharmaSat's system status data to Earth for analysis;
- Measure and determine the effect microgravity has on yeast resistance to an antifungal agent.

Relevance to Exploration Systems and Space Operations

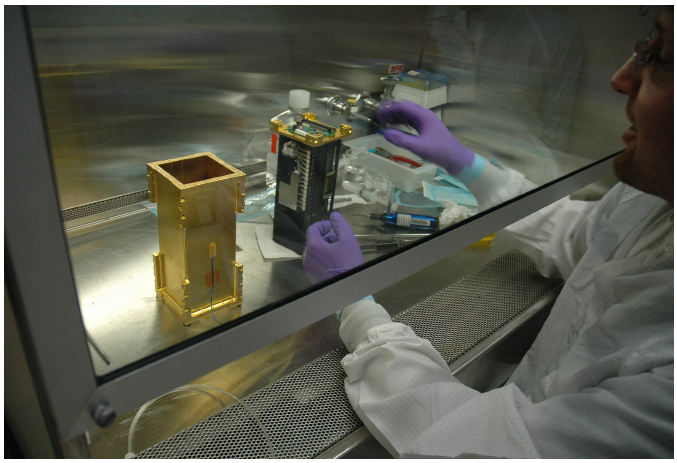
NASA makes every effort to ensure the safety of its crew during space missions and is very interested in the long-term effects of human exposure to microgravity such as bone density loss, muscle atrophy and a stressed immune system. On Earth, medical knowledge is derived from detailed understanding of biological mechanisms at the molecular level.

PharmaSat provides a means to study biological changes of a well-understood microorganism in the space environment. Such knowledge will be key to the development of potential countermeasures to the detrimental effects of long-duration space travel.

The PharmaSat Team

NASA Ames Small Spacecraft Division, will manage the PharmaSat mission for the NASA Exploration Systems Mission Directorate at NASA's Headquarters in Washington.
David Niesel, at the Univerisity of Texas Medical Branch Department of Microbiology and Immunology, Galveston, Texas, is the co-investigator for PharmaSat;
Elwood Agasid of NASA's Ames, is the PharmaSat project manager;
Karolyn Ronzano, of NASA's Ames, is the PharmaSat deputy project manager.
The Santa Clara University, Santa Clara, Calif.; and the California Polytechnic State University San Luis Obispo, Calif., also contributed to the project.

For More Information



Christopher Beasley, NASA Ames mechanical engineer, assembles the satellite payload and prepares to place it in a gold pressure vessel.
NASA Ames Research Center

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