NASA Facts

National Aeronautics and
Space Administration

Marshall Space Flight Center
Huntsville, Alabama 35812

Cutting-Edge Propulsion Research and Testing

The Propulsion Research Laboratory at NASA's Marshall Center

The Propulsion Research Laboratory at NASA's Marshall Space Flight Center,Huntsville, Ala., is a state-of-the-art research facility capable of supporting a broad range of propulsion and technology development activities.

Opened in 2004, the laboratory allows engineers and scientists from NASA, industry, academia and other government agencies to pool their skills in an accessible but safely isolated location. Its primary purpose is to further NASA's mission of space exploration, centralizing cutting-edge research intended to improve access to orbit and open the space frontier for ambitious exploration. The Propulsion Research Laboratory provides a unique capability for meeting the space propulsion and technology needs of tomorrow.

The facility, featuring more than 66,000 square feet of laboratory space, offers a flexible, multifunctional environment that promotes sharing of equipment and human resources among numerous research efforts. The laboratory can accommodate work in a variety of propulsion technologies, from advanced chemical fuels to plasma-based and electromagnetic thrusters and high-energy nuclear electric systems, and can handle technologies requiring special protective measures during testing.

The facility is divided into 11 key lab areas. Five are designed for general lab functions. The others feature highbays -- large, high-ceiling workspaces designed to accommodate overhead lifting cranes, multi-megawatt power access, large-capacity vacuum chambers and other multipurpose

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experimental and test equipment. The facility's dedicated power substation provides 7.5 to 10 megawatts of continuous electrical power, while a 500-kilowatt diesel generator serves as a backup in the event of power grid outages.

Most labs contain oxygen sensors, and provide access to nitrogen and high-purity air at a gauged pressure of 125 pounds per square inch. The highbays and larger rooms with rollup doors also offer access to 5,000 pounds per square inch of gauged-pressure nitrogen and 3,500 pounds per square inch of gauged-pressure high-purity air. Many lab areas are connected to an integrated, water cooling system that can deliver a system-wide total of 600 gallons per minute. Work areas typically include sinks, cabinets, laboratory consoles and 8-by-8-foot access doors. The facility's main corridors are 12-feet wide, easily accommodating forklifts and other large pieces of equipment. The 8-inch-thick cement floor is designed to handle heavy loads.

Two large conference areas are available for large meetings, classes and seminars, and may be divided, using folding walls, to produce four medium-sized conference rooms. A small conference room in the main office area is wired for videoconferencing. All conference rooms provide computer access, and the entire building is served by wireless local area networks and telecon units.

The lab complex also houses a state-of-the-art visitors' gallery, which provides real-time TV coverage of active experiments throughout the building on a 20-by-20-foot projection screen. Engaging, interactive educational displays arranged throughout the gallery further illustrate the work of the laboratory, and its importance to NASA's mission in space.

Key Laboratories

The largest of the facility's laboratories is designed for experiments involving pulsed-power and high-energy propulsion systems using plasma -- superheated, electrically charged gases -- or other advanced energies. This space features an 80-by-120-foot high-bay, 51 feet in height, which includes a floor trench for utility lines and a 40-by-40-foot mezzanine offering additional experiment space. An integrated, 20-foot-long vacuum chamber, 9-feet in diameter, includes a variety of pumps for various experiment needs. The high-bay can access two megawatts of continuous, 480-volt power, and houses more than 100 capacitor banks capable of delivering 1.5 mega-joules of pulsed power.

A smaller, screened area of the room enables isolation of electromagnetic interference during experimentation -- a key requirement to prevent disruption of computers and video monitoring systems during experiments involving electromagnetic energy.

The lab also includes a central, single-point ground, which extends 40 feet under the building to safely dissipate large electrical charges that may be created during testing. Built-in fiber optic communication lines enable high-speed data acquisition. The 16-foot-tall, 18-foot-wide exterior rollup door allows large experiment rigs and equipment to be moved in and out of the bay. Two bridge cranes, each with a hook height of 40 feet and load capacity of 15 tons, handle transport of heavy equipment. Portable concrete shields are available to protect personnel and equipment during potentially hazardous testing.

A second primary lab is configured for the study and development of advanced chemical fuels, propellants and compounds. The room includes three divided areas: a 22-by-45-foot main room and two 10-by-10-foot test cells for evaluating chemical reactions and combustion. All three areas are surrounded by 12-inch-thick, reinforced concrete walls. The laboratory also features fume hoods and a glovebox, a sealed container with built-in gloves for handling experiments in a neutral environment. The flooring of the room is grounded against electrostatic discharge.

Scientists are developing and testing propulsion systems using simulated nuclear sources in a third main laboratory, which can accommodate a variety of activities. This lab features a 60-by-60-foot high-bay with a 30-foot ceiling. A 15-by-20-foot rollup door leads outside. The main room provides two megawatts of continuous, 480-volt power, and can deliver significant power for thermal tests and simulation of nuclear heat sources. There is a 9-foot-diameter, 20-foot-long vacuum chamber in the main room. A 5-ton bridge crane, with a hook height of 20 feet, is available for moving equipment and hardware. This lab also includes four large support areas for conducting a variety of smaller-scale experiments.

The fourth primary lab is designed to handle experiments in space propulsion and power. The main room is 60-feet wide, 60-feet long and 30-feet tall, and houses a 5-ton bridge crane with a 20-foot hook height. Two rollup doors provide external access, and a special loading and leveling dock handle special test equipment shipped to the laboratory from other research facilities. Three 20-by-48-foot support rooms with 12-foot-tall ceilings offer space for a variety of experiment activities and office space.

The largest continuous power supply in the Propulsion Research Laboratory complex is found in the fifth primary lab, which can access up to four megawatts of power to support high-power electric thruster and advanced materials research, development and testing. The main room is 60-feet wide, 80-feet long and 30-feet tall, and contains the complex's largest vacuum chamber, 20-feet long and 12 feet in diameter. The room also will have a 1-megawatt arc heater and .5-megawatt radio frequency generators, which produce frequencies capable of rapidly heating metals to high temperatures. The overhead bridge crane can carry a 10-ton load. Twin 16-by-18-foot rollup doors provide outside egress, and like the other main labs, experiment utility access is provided via floor trenches. Two support rooms are available for small-scale research and support activities.

The sixth large-scale lab was designed for solar energy testing, and is equally well-suited for evaluating deployment of large space structures, from orbital platforms to solar sails. The 40-by-40-foot high-bay has a ceiling height of 51 feet and a 40-by-40-foot folding door that can be opened to allow continuous daylight testing of solar power and propulsion systems. Solar intensity in this lab can reach a maximum 1,000 watts per square meter. The unique air-conditioning system in this lab is designed to minimize air disturbances, in order to accommodate inflatable solar research structures up to 10 meters in diameter. The high-bay is grounded to protect equipment and hardware against accidental electrical discharges, and two smaller rooms provide small-scale testing and office space.

Support and Staging Labs

The complex also contains five general lab areas that can be used for smaller experiments, and as staging areas and offices. The first, designed for management of the facility's diagnostic equipment, provides calibration and storage of sophisticated lab instruments such as high-speed cameras, diagnostic lasers and spectrometers. The lab consists of a 35-by-36-foot operations center and two smaller rooms, one containing a lead-shielded area suitable for calibrating equipment involving X-ray sources. The second lab area includes a 60-by-60-foot main room with a 30-foot-high ceiling and four smaller support areas -- one capable of maintaining 15-percent humidity for extended periods of time, supporting chemical propulsion research. The lab is equipped for testing the combustion qualities of various chemicals and materials, and features a snorkel and exhaust system to safely expel noxious gases and smoke. Underground ductwork enables the lab to accommodate future incorporation of a two-megawatt power distribution system.

The third general area is configured to serve as storage space, offices and multipurpose experiment areas. It includes a 35-by-30-foot main lab space with a 30-foot ceiling, plus nine smaller, versatile testing and support chambers. The fourth lab, a staging area to support operations throughout the complex, includes a complete workshop with lathes, milling machines and welding equipment. It has a 5-ton bridge crane, several smaller rooms and a 10-foot-wide, 12-foot-tall exterior access door. One of the support rooms is designed with a glovebox and special fire retardation system, ideal for work on liquid metal heat pipes and heat exchanger systems used to simulate nuclear fission power systems. The last of the general labs is an electronics workshop for supporting experiment controls and data acquisition needs throughout the complex. It consists of a 28-by-47-foot workshop area and four support rooms, including a special-access darkroom and another containing a milling machine to build electronic circuit boards.

NASA welcomes inquiries from industry, academia and government organizations seeking premium sites to pursue their own investigation of the propulsion and power solutions that could take human beings to new worlds in the decades to come, and forever change life here on Earth.

For more information about the Propulsion Research Laboratory, visit:

http://www1.nasa.gov/centers/marshall

For information about how the lab facility can meet your organization's research needs, contact Dr. George Schmidt of Marshall's Propulsion Systems Department at (256) 544-7240 or George.Schmidt@nasa.gov.

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