



Zero-Gravity Research Facility

The Zero-Gravity Research Facility was built in 1966 to provide scientists with a method to perform low-gravity experiments on Earth.

Experiments are dropped down a shaft and experience near-weightless conditions while in free fall. The shaft is evacuated to eliminate air drag.

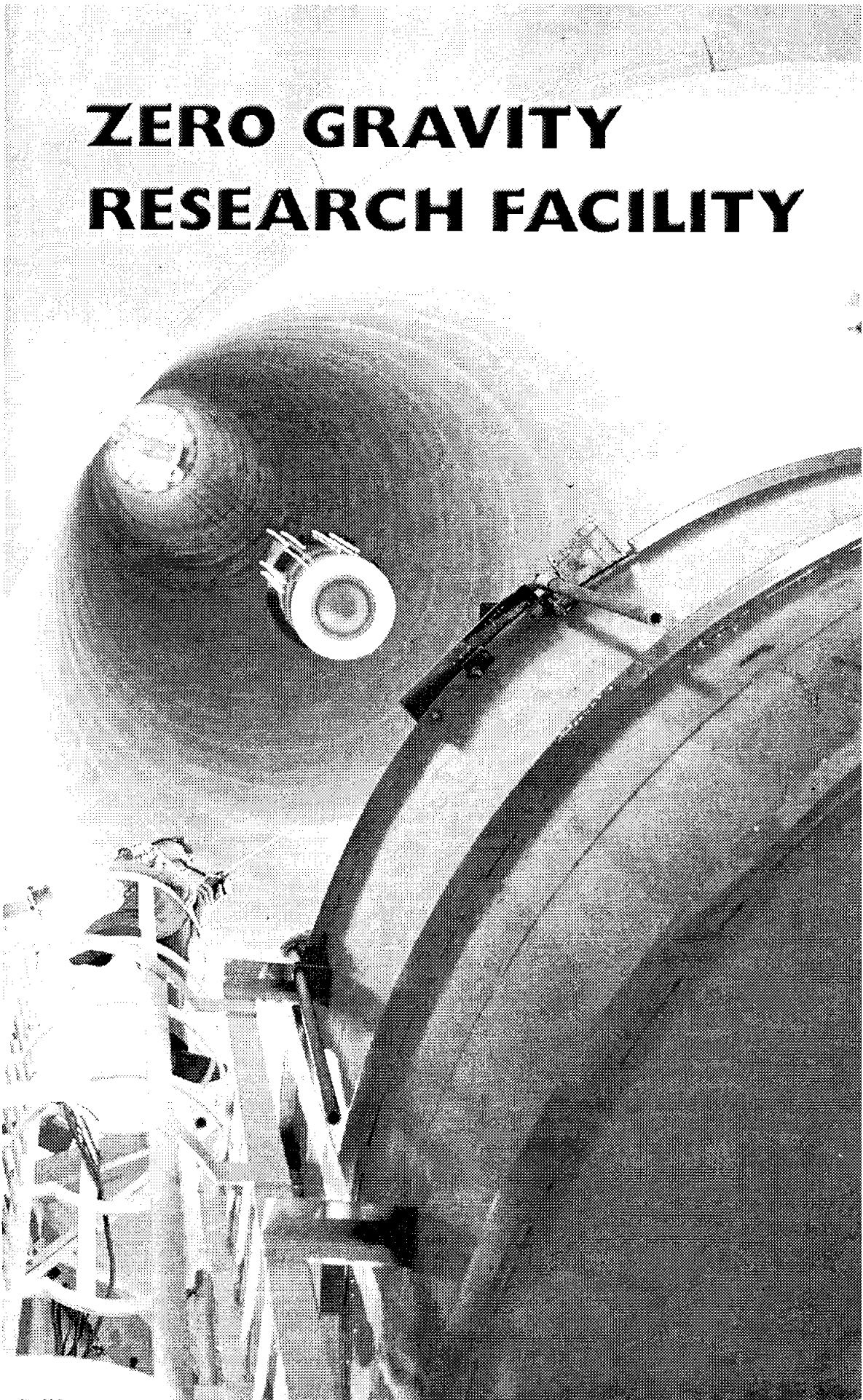
The facility supports investigators sponsored by NASA's Microgravity Science Division.

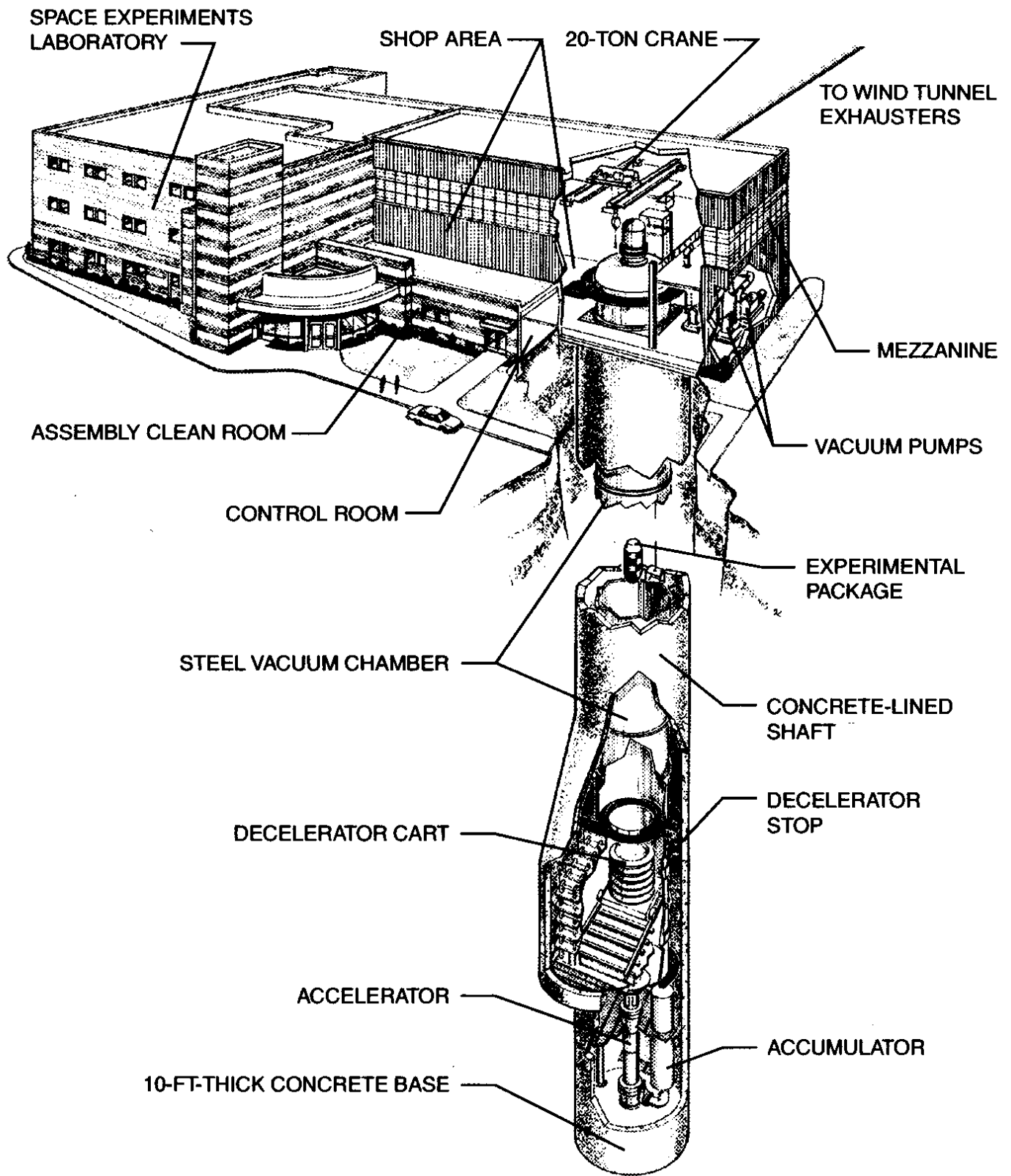
Facility characteristics

Overall depth	155 m
Free-fall distance	132 m
Free-fall duration	5.18 sec
Acceleration level	0.000001 g
Max. vehicle weight	1131 kg
Vehicle size	1-m diam, 3.7 m high

<http://microgravity.grc.nasa.gov/>

ZERO GRAVITY RESEARCH FACILITY





BOTTOM OF SHAFT 510 FT BELOW GROUND LEVEL

The Glenn Zero Gravity Research Facility continues to be the nation's most modern research tool for exploring weightlessness, or microgravity, here on Earth. A microgravity state of 5.18 sec can be achieved with no initial disturbances. Allowing an experiment vehicle to free fall a distance of 433 ft (132 m) produces a microgravity state for 5.18 sec.

Reducing the test chamber pressure to 0.01 torr (0.01-mm Hg) lowers air drag on the falling vehicle to less than 0.00001 g. Four booster pumps and one vacuum pump located in the facility are staged in series with the Center's central exhaust system. The chamber vacuum pump down time is about 1 hr.

The shaft of the facility extends 510 ft (155.4 m) below ground level. The shaft is 28.5 ft. (8.7 m) in diameter and is separated from the surrounding earth by an 18-in- (.46-m-) thick concrete liner. The shaft contains a steel vacuum chamber that is 20 ft (6.1 m) in diameter and 477 ft (145.4 m) in depth. An elevator enables personnel to travel the entire depth of the shaft.

Experiment packages weighing up to 2500 lb (1134 kg) and as little as 500 lbs (226.7 kg) can be accommodated. Experiments can be up to 3.5 ft (1.1 m) in diameter and 12 ft (3.7 m) in length.

At the end of the free-fall period, the experiment vehicle is traveling approximately 114 mph. The vehicle is stopped at a mean rate of 35 g in the decelerator cart. The decelerator cart is 12 ft (3.7 m) in diameter and 20 ft (6.1 m) in depth. It weighs in excess of 22 tons (19,958 kg). The cart is filled with small pellets of expanded polystyrene. The frictional flow of these pellets around the experiment vehicle absorbs the kinetic energy of the falling experiment and stops the vehicle in a distance of 15 ft (4.5 m).

The facility was designed with an accelerator at the bottom of the shaft. The accelerator could project a package upward from the bottom of the chamber such that the package would travel the length of the chamber twice producing 10 sec of microgravity. The accelerator imparted a 40-g acceleration on the experiment vehicle to propel it to within inches of the top of the chamber. The accelerator is not currently used and is presently in a standby status.

A clean room, with an area of 315 ft² (29.3 m²), is also part of the facility. It is used to assemble experiment hardware used both in the facility and aboard the Space Shuttle and International Space Station. This area is operated as a Class 10,000 clean room. That is, each cubic foot of air in the room contains less than 10,000 dust particles. The clean room can be upgraded to the next higher level, Class 100, if required. The clean room operates at a positive pressure of 0.3 in. (0.022-in. Hg) of water, a temperature of 72 °F (22.2 °C) and a relative humidity of 45 percent. The room is equipped with an ultrasonic cleaner for experiment preparation.

Since becoming operational in 1966, more than 3000 tests have been conducted in the Zero Gravity Research Facility. These tests have investigated areas concerning cryogenic propellant management, fluid transfer, combustion, heat transfer, and material science. The use of this facility has allowed the testing of space-bound hardware to verify its operation in a microgravity environment prior to sending it into space. The programs supported during the years include Apollo, Mars Lander, Skylab, Centaur, and at present the Microgravity Science Program on the Space Shuttle and International Space Station.

Facility Facts:

Overall depth:	510 ft	155 m
Free-fall distance:	433 ft	132 m
Free-fall duration:	5.18 sec	
Acceleration (microgravity) level:	0.00001 g	
Velocity at impact:	114 mph	183 km/hr
Average deceleration rate:	35 g	
Peak deceleration rate:	65 g	
Maximum vehicle weight:	2500 lb	1134 kg



National Aeronautics and
Space Administration

Glenn Research Center
Cleveland, Ohio 44135-3191
216-433-4000