Inside the Applied Research Building: Assembling balloons and simulating space

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In this story, the first of a two-part series about the Applied Research Building, learn about a laboratory for assembling high-altitude balloons, a chamber that simulates conditions in space, and an echo-free room for testing antennae performance. In the second part of the series, learn about the ARB’s Imaging Technology Laboratory, Mission Operations Center and Advanced Manufacturing Laboratory.

A year from now, the futuristic Applied Research Building – the $85 million, three-story structure going up at the southeast corner of East Helen Street and North Highland Avenue – is scheduled to open its doors.

The 89,000-square-foot building, expected to be completed in January 2023, will provide new research capabilities with state-of-the-art equipment and technology. Inside will be teams conducting interdisciplinary research that advances applied physical sciences and engineering, including the University of Arizona Space Institute.

State-of-the-art? Cutting-edge? Futuristic? The terms have become cliché when speaking of most new facilities. But when speaking of the ARB, the terms are spot on.

High-bay payload laboratory

With 40-foot ceilings similar to those found in warehouses, the ARB’s high-bay payload laboratory will offer teams of scientists and engineers a dedicated space to assemble high-altitude stratospheric balloons such as the University of Arizona-led, NASA-funded GUSTO mission.

These high-altitude balloons are used for critical everyday operations such as providing accurate weather data by measuring and transmitting information on atmospheric pressure, temperature, humidity, and wind speed. They can also be used for more sophisticated scientific exploration, as in the case of GUSTO, which will send a balloon to near-space, carrying a telescope that will study the interstellar medium – the gas and dust between the stars, from which all stars and planets originate.

Large-scale thermal vacuum chamber

The ARB will allow researchers to seamlessly take nanosatellites from conception to completion all under one roof, with dedicated spaces for designing, building and testing. These nanosatellites, often called CubeSats, represent the next generation of technology for space exploration and scientific investigation.

A CubeSat is about the size of a cereal box, though the smallest are 4-inch cubes weighing less than 3 pounds. CubeSats have become increasingly popular in space exploration over the last two decades, with NASA launching its first CubeSat, GeneSat, in late 2006. In 2018, an $18 million NASA mission called Mars Cube One launched two CubeSats to Mars.

The primary benefit of miniaturized satellites is cost efficiency: They are less expensive to build than traditional satellites and, because of their compact size, they can also piggyback on rockets carrying other spacecraft.

While the average temperature in Tucson during January is 66 degrees Fahrenheit, temperatures on Mars average about minus 81 degrees Fahrenheit. All materials – even aluminum and titanium, both of which are commonly used to fabricate CubeSats – perform differently under different conditions, so satellites must be put to the test in a controlled environment on Earth before being launched into space.

The facility will simulate both the pressure and temperature conditions in space to test the performance of all components and subsystems of these satellites. Temporarily stored at the UA Tech Park at Rita Road, the thermal vacuum chamber was transported across town by semitractor-trailer and lowered into position by a crane on Nov. 10 so that the building could be constructed around it.

Anechoic chamber

The ARB will also be equipped with a nonreflective, echo-free room called an anechoic (a-nih-KOH-ik) chamber. The chamber will be built with radio-wave-absorbing material applied to the walls, ceiling and floor. The absorptive material – a carbon-filled foam that looks like long, narrow pyramids with sharp tips – is designed to keep sound waves from bouncing.

The conditions of the anechoic chamber will allow researchers to test satellite antennae for their command, control and data relay performance.
Beyond these facilities, the ARB will also house more laboratories, clean rooms, faculty offices, collaboration spaces, conference rooms and a large, dynamic testing lab for testing the performance of a range of objects, from airplane wings to sensors.

To watch progress at the Applied Research Building construction site in real time, visit the ARB project page [2] on the Planning, Design and Construction website. The page has views from a live webcam, 3-D models showing progress since ground was broken, and drone videos.

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