

The Rise of Core Laboratories

Core Resources Influence Lab Planning and Design

During the last decade, one of the greatest changes related to lab planning and design is the increasingly prominent role played by core resources. This includes multi-million dollar, state-of-the-art research equipment such as atomic level resolution microscopes, high-field spectrometers, and nanotechnology fabrication equipment to name just a few examples. Specially-trained workers are then needed to run and interpret this sophisticated equipment, which is housed in core laboratories devoted specifically to these workers and tools.

“Accommodating core resources has had a major impact on how research buildings are planned, designed, and operated,” says Dr. Richard Rietz, an independent strategic lab planner based in Helena, Mt. “It’s now common that whole buildings are justified solely on the core labs and what they capabilities they bring.”

He adds that as much as 90 percent of science today relies on core capabilities and, in many fields, experiments, and analyses cannot be done without them.

“In the ’80s and early ’90s there were really only a few different types of core laboratories related mostly to new techniques in x-ray crystallography, NMR imaging, electron microscopy, and DNA and gene sequencing,” says Rietz. “Now however due to explosive growth in technology advances, there are easily as many as 30 different types of core labs, ranging from bio-containment areas, to atomic level characterization rooms, to high-powered simulation and visualization labs.”

While the term “core laboratory” enjoys widespread use within the facilities industry, it is still somewhat imprecise and can fluctuate based on the type of science being performed or the definition given to it by the funding agencies or planners involved.

Rietz defines a “core laboratory” as a shared resource, often expensive, containing capabilities (tools, techniques, people skills) that can be shared by many users and is applicable to multiple experiments or studies. Core laboratories can also be categorized by specialized MEP considerations for parallel computing, chemical scale-up and pilot plants, or by tools such as instrumentation, fabrication devices, scale-up equipment and other specialized devices.

During the Tradeline *Research Buildings 2007* conference held in May, Rietz outlined several key characteristics of core laboratories including examples of labs he feels embody these traits.

Large Square Footage

“Core labs often occupy as much as 25 percent of a building, which is a huge increase in square footage compared to an average of five percent of program space typically devoted to core labs during the ’90s,” says Rietz. “This increase can be attributed to the

size and quantity of equipment in use, as well as the number of workers needed to run and interpret the equipment.”

He points to the Molecular Foundry built in 2006 at Lawrence Berkeley National Laboratory (LBNL) as an example of a facility with entire floorplates dedicated to specialized core labs. Managed by the University of California, LBNL is one of the oldest national labs operated by the U.S. Department of Energy. The Foundry provides users with instruments, techniques, and collaborators to enhance their studies of nanoscale materials. Researchers can submit proposals requesting free access to the state-of-the-art instruments and techniques, and to the highly skilled staff.

In order to accommodate and isolate two huge core laboratories, LBNL stacked the building horizontally by locating each core lab on its own level. The first floor is devoted to a core lab for studies in atomic scale imaging and manipulation, while the second floor core lab specializes in nanofabrication. Levels four, five, and six of the Molecular Foundry house more traditional laboratories.

Rietz also cites the 187,000-sf Birck Nanotechnology Center at Purdue University in West Lafayette Ind., as an example of a facility built entirely around its multi-million dollar core equipment, including a molecular beam epitaxy (MBE) and an x-ray photoluminescence spectrometer (XPS). Completed in 2005, the Center also includes a 25,000-sf cleanroom with research space rated at 1, 10, and 100 microparticles per cubic foot, an extraordinary level of cleanliness for an academic facility.

Unique Settings and Subjects

“Acquiring the type of specialized equipment used within core laboratories demands a huge capital commitment,” says Rietz. “Because of these high equipment costs and related design and mechanical and electrical considerations, core labs can cost as much as six times more to construct than average lab space.”

Since very few institutions can afford more than one of any core resource, the labs that contain these resources are often extremely unique, and may even be one of a kind.

“The University of Wisconsin recently built a huge lab that looks more like a basketball court than a typical lab,” says Rietz. “They needed this large space to house its ultra-high field NMR machine, a \$20 million piece of equipment that was the first of its kind in Wisconsin and among only a few within the United States.”

As another example of unique core resources Rietz points to the USCD California Institute for Telecommunications and Information Technology (Calit2) that was built to accommodate three separate core elements, a nano and microfabrication module, a highly complicated media center with specialized projection equipment, and a software and communication visualization development lab.

“Calit2 is probably one of the more interesting buildings to come along in this decade because it encompasses very different kinds of science such as media arts, telecommunications, visualization, and microfabrication,” says Rietz. “Because the technologies require such distinct equipment, it was approached as three separate facilities. The end result is actually a collection of cores connected by both interior and exterior pedestrian walkways.”

Central Focus

Another extremely unique core laboratory that Rietz highlights is the marine research core lab within the Cape Cod-based Woods Hole Oceanographic Institution, which recently completed an extensive \$50-million renovation.

“Woods Hole illustrates several characteristics of core resources,” says Rietz. “First, it has an extremely unique core lab: the marine necropsy facility. There are very few other marine research facilities with the capacity to handle extremely large mammals such as whales and dolphins. Second, the lab workers who previously spent more time in bench labs now find their central focus to be within core labs. This is where the key data is produced. Third, the whole facility was designed around this core laboratory.

“This is a 180^o shift from the past when it was more common for researchers to be housed primarily in bench lab settings and visit core labs only for specialized analytical data,” he continues.

Assorted Solutions

As core laboratories demand more centralized attention, Rietz observes that architectural teams often start by designing the core lab first and planning the rest of the facility around the core.

“Core capabilities have become so important and enabling that much of today’s science cannot be done without them,” says Rietz. “Funding of science projects and core capabilities are now intertwined and in most cases far outweigh other design priorities. Many lab buildings are justified just on the core labs that are created.”

He adds that although core labs often share built-in conundrums such as no standard widths-depths-heights and high energy consumption rates, there are numerous design solutions available to facility planners looking to incorporate core capabilities.

Among the architectural solutions cited by Rietz include the use of zone planning that could include “grey” (i.e. unprogrammed) spaces, or stacking core zones either horizontally or vertically. He also points to the use of dedicated floorplates or, when budget and space permit, the use of entire buildings devoted to housing core equipment and researchers.

“Although core laboratories can be difficult to deal with, they can no longer be treated as a one-time thing,” says Rietz. “Core laboratories are here to stay and, if the last decade is any indication, they will only continue to gain importance.”

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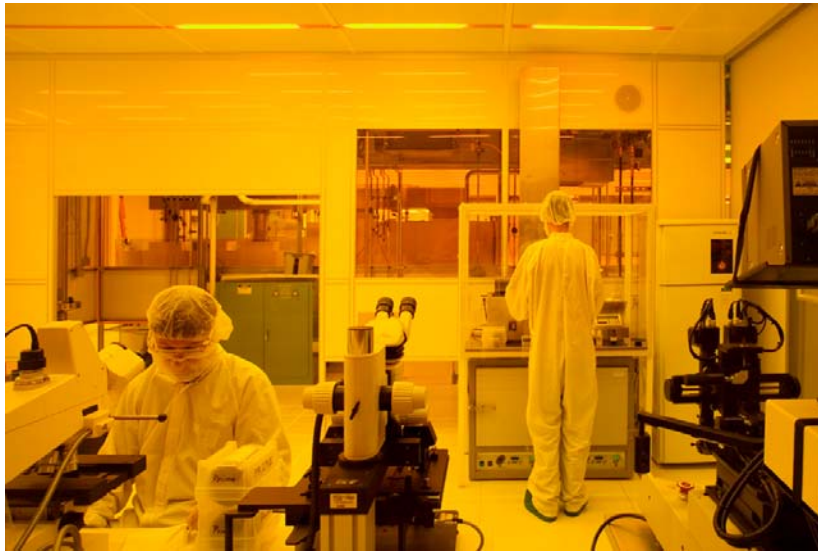
Biography:

Richard Rietz is a Ph.D., scientist who, for the past 22 years, has been an independent strategic planner for science buildings. Rietz prepares laboratory programs, as well as capital plans and space strategies for both corporate and academic organizations. Some of his recent assignments have included projects for Allergan Pharmaceuticals, Gilead Sciences, Novartis Vaccines and Diagnostics, Quest Diagnostics, and the Wisconsin Alumni Research Foundation. In addition to working on these kinds of projects, Rietz also continually studies how laboratories are planned, managed, and used, and what makes some lab buildings more successful than others.

This article is based on Rietz’s presentation at the Tradeline *Research Buildings 2007* conference held in May.

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The Molecular Foundry at Lawrence Berkeley National Laboratory is an example of a facility that dedicated whole floorplates to specialized core functions, including atomic scale imaging and nanofabrication. Shown here is the atomic scale imaging and manipulation core facility on Level 1. *(Photo courtesy of Smith Group, San Francisco, copyright 2007, C. Wakely.)*



The Woods Hole Oceanographic Institution includes a unique marine research core laboratory with the capacity to handle extremely large mammals such as whales and dolphins. Shown here is the marine necropsy receiving area within the lab. *(Photo courtesy of Ellenzweig Associates, Cambridge, Mass., copyright 2007, Anton Grassi.)*