

BACnet[®] for Research Space

By **Terry W. Hoffmann**

The Biodesign Institute at Arizona State University is a research and education initiative designed to integrate research in systems biology and neurobiology with advances in computing, optoelectronics, the structure and synthesis of biologically produced materials, and directed molecular assembly at meso- to nanoscales. It sees its mission as being to improve human health and quality of life through use-inspired biosystems research and effective multidisciplinary partnerships.

Complementing that ambitious goal is an equally ambitious facilities construction plan. The institute aims to occupy 1 million ft² of advanced research space. The first module of 250,000 ft² (23 226 m²) opened on the eastern end of ASU's historic Tempe campus in the Phoenix metropolitan area in December 2004. Three additional modules are planned.

Building A, which opened in December 2004, houses eight research initiatives that are essentially active 24-7, as well as offices. The institute's multidisciplinary approach to research drove the design of this four-story facility. The top three floors of offices and labs look through interior windows onto a three-story atrium. The labs themselves feature an unconventional

open design meant to encourage interaction between the scientists from different disciplines who work there. The open lab design with the nearby offices make proper ventilation and building controls essential, particularly when considering the institute's research initiatives include developing plant-based therapeutics that could provide immunity to HIV/AIDS, pursuing a molecular-based universal cancer vaccine, developing tools to detect odorless gases that could be used in bioterrorism attacks and uncovering microbes that destroy environmental pollutants.

The Biodesign Institute's offices are located on one side of the atrium, occupying about 25% of Building A, and use recirculated air. The lab environments occupy the rest of the building and use 100% outside air, distributed to lab spaces through high-performance air valves that are applied in supply and exhaust air ducts. The open lab setup presents challenges, not the least of which is the importance of maintaining proper pressurization, to minimize the spread of any agents beyond the area where they are



Arizona State University's Biodesign Institute uses BACnet to help optimize building systems.

being studied. Another challenge is that research and experiments are being conducted in the facility 24/7, which means constant demands on the ventilation system. Any troubleshooting of alarms has to happen around the clock.

A number of the research stations have 6 in. (152 mm) diameter flexible snorkels positioned over work surfaces as needed, to draw in and then vent air. The more sophisticated research stations have airflow regulated by controls. Air is distributed to general spaces through air valves applied in both supply and exhaust valves. The air valves are an alternative to traditional dampers that provide more precise regulation. These valves work in conjunction with valves applied to fume hoods at each research station.

When the research station is in use, with the glass front or sash raised, those controls pull air from it at a face velocity of 100 fpm (0.5 m/s) and then vent it outside the building through strobic exhaust fans located on the institute's roof.

BACnet is used to integrate the laboratory volume controls to the balance of the systems that control the 100% outside air fans and the high velocity strobic exhaust system. All controls in the building are integrated into a cohesive system by the building management system. The building management system also integrates the Biodesign Institute into the campus-wide facility management system.

Tom Mason, facilities project coordinator for the Biodesign Institute, said that, for purposes of monitoring and troubleshooting, ASU facility managers wanted the fume hood controls

integrated into the facility and campus-wide system. Since both manufacturer's systems use the BACnet communication protocol, integration was straightforward. The supervisory engines can automatically discover points in any BACnet system, thus no need existed to recreate a database of points on the building management system. The fume hood solution also uses a LonTalk subnetwork to tie all valves together in a local control strategy. The individual air valves use this local network for communication and for aggregation at the laboratory level. All information is then communicated to the building management system via BACnet.

That integration has helped ASU leverage its facility management staff because most of the staff is familiar with the manufacturer's system. If a fume hood in the lab goes to alarm, that alarm goes through BACnet to the manufacturer's BAS and can be monitored at many operator workstations on campus, Mason explained.

If the alarm occurs after-hours, the system's Web-based capabilities will e-mail the operator on call and allow that person to determine whether the researcher simply opened the sash too far, or left it up when they walked away, or if it's something more serious. The alarm also is relayed to the person at the fume hood doing the experiment.

The system has worked well, according to Mason, with the open BACnet protocol helping to optimize the institute's building systems.

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