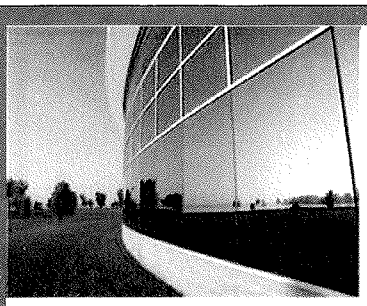
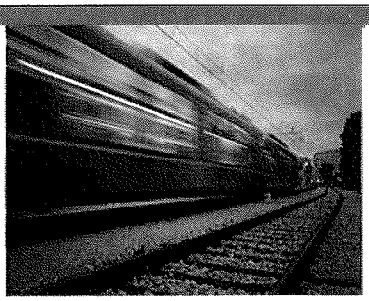






LONMARK® INTERNATIONAL

CASE STUDIES

These case studies highlight the value of open, interoperable solutions using LONWORKS technology and LONMARK standards and guidelines around the world.

About LONMARK International

LONMARK International is a non-profit trade and standards development association supporting the commercial, industrial, and residential control markets through open integrated systems.

We are a global membership organization created to promote and advance the business of efficient and effective integration of open, multi-vendor control systems utilizing ISO/IEC 14908-1 and related standards.

ISO/IEC have approved LONWORKS to the highest level of international standards recognition.

We provide certification, education, and promotion of interoperability standards for the benefit of manufacturers, integrators, and end users.

LONMARK is committed to energy efficiency through intelligent control.

LONMARK® INTERNATIONAL

CASE STUDY







LONWORKS Delivers Savings on Sunset Boulevard in Hollywood



The Building

The Sunset Millennium building is in the heart of the renowned, billboard saturated, Sunset Boulevard nucleus of trendy restaurants and exclusive nightclubs in Hollywood, Los Angeles. The lower levels of the building house a four story underground parking garage that can hold up to 1000 vehicles. The garage sees traffic 24 hours a day, seven days a week.

The Issue

When the building was constructed approximately 20 years ago, a carbon monoxide (CO) ventilation control system was installed in the garage to control fans based on automobile activity. This on/off system had stopped working a number of years ago. The building operator was frustrated with the system as it seemed to operate as a black box with absolutely no interface or instructions on how to understand, adjust, or troubleshoot the system. In its current inoperative state, the eight large ventilation fans in the building (242 hp) had been set to run continuously.

The new building owner estimated a cost of more than US$242,000 annually for over 1.5 million kWh of energy to operate the fans around the clock.

AirTest Solution

Using the existing conduit left by the non-working CO system, 41 brand new TR2000-LON LONWORKS CO sensors were installed throughout the garage leaving approximately one sensor for every 7000 square feet. The system layout and installation was developed by AirTest working with the building owner and the installing contractor.

An AirTest CN8000 LONWORKS controller was used to read the 41 sensors and then provide a control signal to adjust the speed of the fans. A major reason the LONWORKS system was selected for this installation was due to the ease of wiring the sensors together, hence a much lower cost of installing the network. The control also features an easy to use keypad and interface screen that allows:

- The user to see the readings on all sensors,
- The ability to adjust a number of operating parameters of the ventilation control system and VFD interface.
- A message center that reports on troubleshooting and maintenance issues, and indicates alarms and warnings if there is a malfunction.

As part of the project, eight variable frequency drives (VFDs) from AirTest were also installed on all fan motors. VFDs offer a number of advantages over the traditional method of turning fans on and off based on CO levels. These include:

- Fan motor and belt life is extended by eliminating the repeated hard start of fans. Instead, the VFDs gradually ramp up fan speed using a soft start.
- Operating the fans continuously at a 25% fan speed can save significant energy. The relationship between VFD fan speed and energy is exponential, meaning that a VFD operating at 25% speed will consume about 5 to 7% of the

energy normally consumed at full speed. The result is better ventilation and energy cost savings in excess of 90%.

- VFDs can also significantly reduce electrical demand. Fans are less likely to ramp up to full speed during periods of high automobile activity resulting in reduced demand charges. In the case of Sunset Millennium, the AirTest CN8000 controller will work with the VFDs to reduce the demand for electricity by at least 50% or 90 kW.
- A major benefit of running VFDs is the improved environment in the garage. The continuous operation of the fans at 25% speed will ensure that the garage air quality is enhanced and that a reservoir of fresh air will be circulated in the garage to readily absorb the exhaust combustion fumes from periodic automobile activity.

The Results

It is currently estimated that this US$160,000 installation will reduce fan energy usage by 90% and limit demand charges by at least 50%. Simple payback for the system is expected to be nine months. However, rebates from Southern California Edison covered 100% of the system cost making the AirTest Garage Ventilation system cash positive from the day it was turned on.

From an energy perspective, the annual energy savings are estimated to be 1.35 million kWh, which in California results in a reduction of greenhouse gas emissions of more than 1.8 million lbs of CO2 annually.

In terms of ongoing maintenance, the calibration of the sensors will have to be checked every two years, but with the continuous ventilation provided by the VFD's drift of the sensors is expected to be minimal because of the low levels of carbon monoxide that will be seen. After five years, the plug-in sensor element can be replaced for a nominal charge while keeping the LONWORKS transmitters in place.

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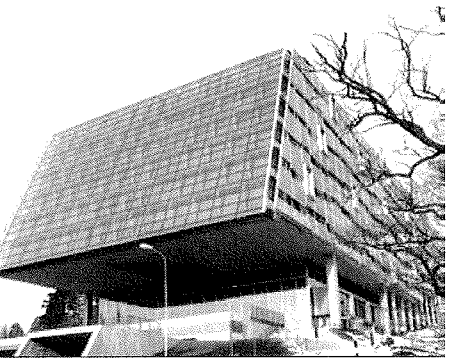
LONMARK INTERNATIONAL

CASE STUDY





LONWORKS Delivers Energy Savings to Sweden's Post Office HQ



The Swedish Post Office, Posten, which is one of Sweden's largest corporations, provides postal services to four and half million homes and 900,000 businesses daily. Employing more than 30,000 employees, the Swedish Post Office underwent considerable changes during the late nineties. A key part of this process included the concentration of the organization in a new head office.

Posten was looking for a building to serve as the shaping force for future operations in an environment designed to stimulate communication and creativity. Eight architectural firms were invited to compete to design the headquarters in Solna in Stockholm, Sweden. BSK Architects won the competition with a design for a building that preserved the landscape by following the natural terrain. The building is known as the "Thinktank" because of the series of small protruding rooms in the glass façade, the "think boxes", which are lit up at night. An intervening atrium separates two parallel office floor plates which are joined by footbridges and cocoons (secluded meeting rooms for up to 10 people).

More than 1000 people work in the building, which has a total floor area of 58,000 square meters. There are 1100 workstations on six floors providing a total of 25,000 square meters of open plan offices and the building also has parking for 450 cars. The project cost approximately SEK 800 million (EUR 84 million - US$ 135 million). It also includes a gym, a swimming pool, and several shops and restaurants.

The building is completely glazed from floor to roof with 10,200 square meters of glass, which provides an ideal opportunity to save energy by dimming the lights depending on the level of the daylight. The overall open office plan inspired many energy saving solutions and gave the opportunity to make the building "alive" during darkness by illuminating coloured walls inside. Systems integrator, Energo, was given overall responsibility for both design and programming of the building automation systems.

Challenges

Posten wanted a networked solution using LONWORKS technology giving the possibility for cooperation between different subsystems such as the lighting system, alarm handling, HVAC, sun shading, and scheduling. The most interesting part was the energy saving possibilities for the open plan office area. This included the use of movement detection for both lighting and HVAC and daylight dependent illumination. The goal was to use as few on/off light switches as possible because of the wear and tear on the fluorescent lamps and to decrease the number of lamp changes necessary.

Solution

LONWORKS technology was used to provide a complex lighting solution. At 7:00 a.m. the lights come on, brightening from 10% to 100%. At the same time, the movement detectors are turned off and the light sensors are turned on. During daytime the zones closest to the windows are daylight dependent, meaning that they dim or brighten based on the amount of natural light coming into the offices to provide a constant light level that is comfortable for the staff as well as energy efficient. At 7:00 p.m. the lights turn off, dimming to 10%. At the same time, the movement detectors are activated and the light sensors are deactivated. During night time, movement detectors turn on the lights in zones that are occupied. The lights remain on for an hour and then, if no one is present, dim down to 10% again.

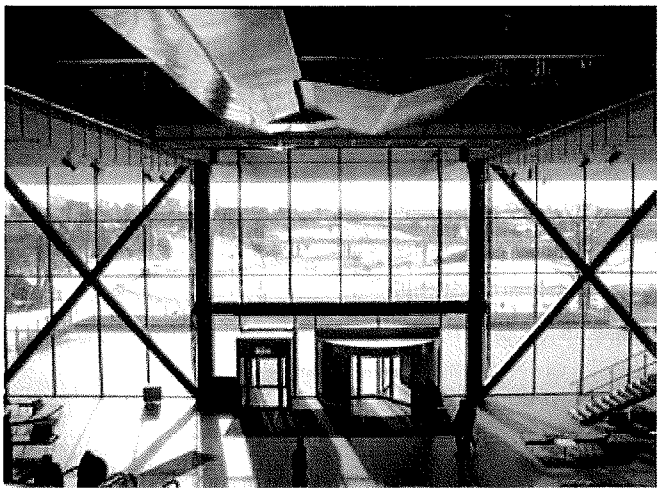
All conference rooms have movement detectors for air handling and also turn off the lights if the room has been empty for 30 minutes. Most importantly, once the light has been turned off it is necessary to manually switch on the light. This saves additional energy since the light does not turn on if someone just quickly enters the room.

Being familiar with LONWORKS as a tool, Energo was confident with the way it works. Its open architecture allows devices from multiple manufacturers to be incorporated into one unified system for better control and

efficiency. Some 3000 nodes were used, including LONMARK certified Tridonic FTTTLS and Capelon/CeTeLab Focus 1575 movement detectors. Other products incorporated were from Somfy as well as Time2Lon, Lexel/Gira push buttons, Liwo nanonode and Compwell AM2002-3106.

Benefits

The building contains 4100 luminaries and therefore any change in brightening or dimming the lights generates large savings. During the light times of the year the brightening of the lights is changed from 7:00 a.m. to 7:30 a.m. and the dimming time is changed from 7:00 p.m. to 5:00 p.m. due to Posten's shorter summer working hours. The movement detectors brighten the lights in occupied rooms if anyone works later than 5:00 p.m. These alternating brightening and dimming times provide energy savings of up to 14%.



The daylight dimming function generates savings that vary at different times of the year, especially so in the Nordic countries. Just changing the lighting level to 10% for as little as two hours a day makes a saving of 31,000 kWh per year. This translates into huge energy bill savings, especially with today's increasing energy prices.

The solution was created with a minimum of on/off switching, which increases the service life of the fluorescent lamps. The combination of a daylight-dependent office lighting system for the daytime and movement detection lighting during the night provides better lighting conditions for the staff as well as greater control over energy consumption. Fewer spare parts will be required due to the use of the same movement detectors for both lighting and HVAC. Furthermore, the lighting scheme has made the Posten Headquarters building a landmark in Sweden.

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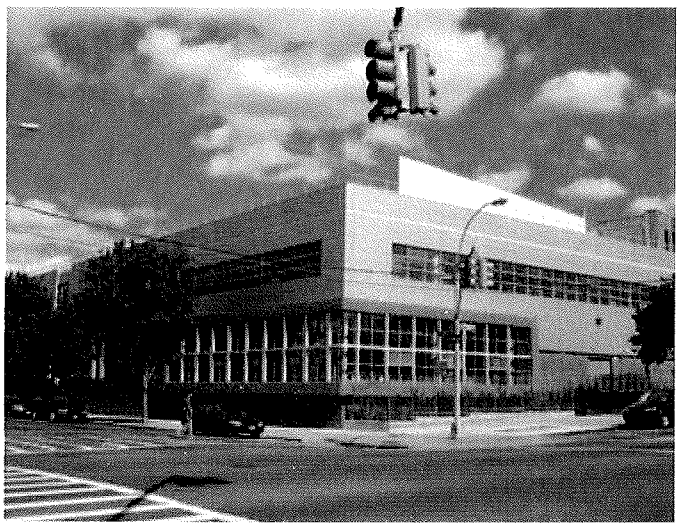
LONMARK® INTERNATIONAL

CASE STUDY





Putting "Children First" In New York



The aim of the New York City's Children First Project is "To create – from pre-school through high school – a public education system second to none" (Mayor Michael R. Bloomberg). This means the creation of over 1,400 top quality schools for all of New York's 1.1 million children. 1200 existing schools are being renovated and new schools are being built. The preliminary Capital Spending Plan for the project for the next five years for new construction is over four billion dollars.

Reducing the cost of design and construction through the use of standard materials and methods and current technology are basic objectives of the program. In order to be sure of applying standards and current technology in the area of building automation and control, New York City selected LON technology and solicited the services of a Master Systems Integrator to specify and oversee the implementation of the technology in the project. In a rigorous selection procedure, the School Construction Authority (SCA) awarded the contract to LONMARK Member, Control Technologies Inc.

Control Technologies Inc. is providing the design services, construction oversight, submittal review, commissioning and training to SCA personnel and to all A&E firms that provide design services to the SCA for school construction and renovation. The contract also requires CTI to design and install the user interface and connection services for each new school via the city's existing WAN to a central location in Queens and, finally, to design and implement the central host station, with alarm management, data archiving, remote monitoring, and other features.

Creating a Durable Competitive Environment

Using a building automation system based on open standards has helped to reduce the costs of the new constructions. Standard designs and operational sequences allow the reuse of code on the project. Specifying packaged, factory installed unitary controls and specifying and verifying the technical details of the interface to the overall building management system using an open, documented communications protocol results in lower jobsite labour costs, fewer mistakes, warrantee protection and an overall reduction in costs.

Furthermore, the open LON system ensures a durable competitive environment both during the project and beyond. When properly specified by a Master Systems Integrator and when properly implemented and documented, competitive bidding for system additions, alterations and service can be achieved, greatly enhancing the return on investment made on the system. In the Children First Project, life-cycle cost savings are anticipated due to competitive bidding for system additions; and service on schools can now be bid on a geographic or sub-district basis.

Interoperability and Efficiency

The schools' sub-systems such as lighting, access control, HVAC etc. are integrated into one, overall network for optimal operation and control. Since LON is based on open standards, it encourages the exchange of information not only between devices on the LON network, but also between the building automation system and higher level IT systems.

By using de facto standards (such as Wonderware), CTI connected the schools to non-real time

software packages such as maintenance management, time and attendance, master scheduling, business management and utility demand-response programs.

As a result, staff can now plan maintenance work more effectively and respond quicker to faults thanks to effective alarm management. The collection and analysis of energy consumption information from the LON network enables the SCA to plan its long term energy saving strategies. The central subsystem in Queens is being used as a measurement and verification tool for the implemented energy conservation methods, and as a central supervisory controller for district wide demand side management programs.

Keeping the Custodian Happy

A major impediment in the application of DDC controls in New York City schools prior to this project was the diversity of user interfaces supplied with stand-alone systems for school projects, and the system-specific training that was required for custodians in each location. It is common practice for custodians to be assigned to multiple locations, and if assigned to a single location, to be transferred between schools during their careers.

The new design uses a standard user environment – graphics, navigation, alarming and naming conventions are consistent regardless of the device's location. This contributes significantly to reducing training costs, and increasing the use of the system(s). Using standard software drivers that utilize the open LON communications protocol makes it possible to provide supervisory control and data acquisition over control systems manufactured by (currently) seven different suppliers of DDC product lines.

An Award Winning Project

With energy consumption and Green issues at the forefront of everyone's concerns, the SCA now has the systems and tools to implement Local law 86 – LEED Compliance in the City for Public Buildings. To date, four schools have been completed and a further 16 are scheduled for the coming year. Another 75 new schools have been budgeted and are already in the planning or construction stages. Control Technologies Inc. recently won the Networked Controls Leadership Award in the category of Leadership by Building Design Engineers for its work on the Children First project. The award was presented by HPAC Engineering Magazine and sponsored by the HVAC Products Division of Siemens Building Technologies Inc.

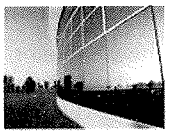
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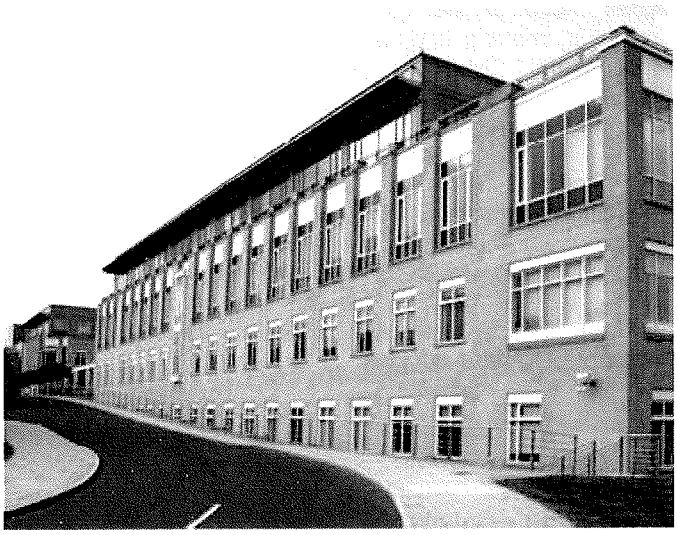
LONMARK INTERNATIONAL

CASE STUDY





Specialized Software Delivers a Flexible, Customized LON Solution in AEGON House



Corporations active in the pension and long term investment markets are constantly growing, merging, and taking new, innovative approaches to providing investment services. AEGON Scottish Equitable is one of the top pension, protection, investment, and annuities providers in the UK market. Headquartered in Edinburgh, Scotland, AEGON Scottish Equitable decided to update its main building to provide a more modern working environment, which would flexibly meet the changing office space requirements. AEGON believes an evolving market requires a dynamic company to meet its demand.

The headquarters' building control system was originally installed in the early 1990s and needed a facelift. The initial automation package was extensive, with several bespoke, nonintegrated systems to manage different areas of the building, making it difficult to fully support or expand. AEGON required a modern control solution which would provide the same degree of customization for the structure's different functions without necessitating extensive engineering. These requirements were met by a LON based control system that is easy for the client to maintain in the future due to its open, interoperable standards as well as manageable through AEGON's chosen front-end management interface, Apogee from Siemens.

The design solution called for the floor controls to be linked via a LONWORKS network, installed and managed using LNS®, while offering a seamless data integration via Siemens LMEC gateways onto a BACnet system which handles the interaction with the central AHU, boilers and chillers.

A unique challenge of the renovation project was that all work needed to be done while the offices were occupied, meaning the new system had to be installed mostly at night to avoid disturbing staff or disrupting the business.

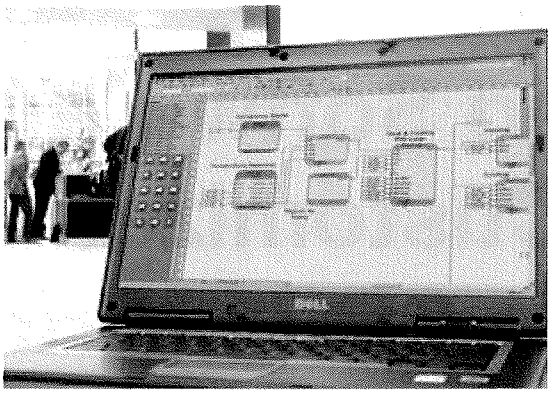
Fast integration was achieved with Newron System's LNS based management tool, NLFacilities, which provides a systematic means of building LONWORKS networks.

NL-Facilities uses a Modeller Database concept. In the planning stage, a LON expert creates a rules database, with models that define how specific LON devices should be bound and configured for different types of space (open plan area, meeting room, private office, etc.) within a building.

Using this database, the system integrator, Building Automation Solutions Ltd., could then design the control solution to meet the particular needs of each area of the building and use NL-Facilities to set up the network.

This ensures that the system is set up correctly and consistently, because the software follows the previously defined network rules. NL-Facilities also automates the binding and device configuration steps, helping the system integrator work more effectively. In the end, AEGON Scottish Equitable receives a specialized building control solution that is expertly installed and operating as quickly as possible.

During the refurbishment project new lighting controls with modern equipment were installed throughout the headquarters. LONMARK certified InfraLIGHT 200 Series lighting controllers and the InfraLIGHT 100 Series, developed by Infranet Partners, were deployed throughout AEGON House. These products were chosen particularly for their use of open LONMARK standards and Fast Connect™ modular cable adapters, which permitted the system integrator to mount the controllers quickly using existing sensors and luminaire installations. This also reduced the renovation costs for AEGON Scottish Equitable, because existing fixtures could remain intact.



Another important contribution to the modernization of the building are Siemens' LONMARK certified Desigo RXC31 fan box controllers. These modules provide tight control of both airflow and temperature to create the most comfortable working environment. In addition, Loytec L-IP and L-Switch infrastructure products integrate the system to a site-wide IP backbone. Operations and maintenance engineers can then quickly access information from the system via the Internet in order to efficiently handle any faults or repairs.

Even the various specialized HVAC systems, including under-floor heating and customized air conditioning units in the building's IT data center were updated with LON based control modules. InfraTROL 100S programmable controllers from Infranet Partners were programmed using STRATOSPHERE, the company's new Visio™ and LNS – based graphical programming software. The software enabled the system integrator to rapidly develop a complex program for the control and management of the specialized HVAC systems in a straightforward graphical format which adheres to the 61131-3 block programming standard and which is easy to maintain in the future. Should the engineer lose the tailor-made program from his PC, it can be directly downloaded from the individual devices, delivering a fail-safe solution.

STRATOSPHERE uses design templates to aid the fast implementation or change of control strategies throughout the building. The system is also future-proof because STRATOSPHERE uses LONMARK -compliant function blocks to define the entire control strategy and network connectivity used by the controllers, ensuring a fully interoperable, flexible system to meet the evolving needs of the building.

The LON based system designed with professional software provides a cost-effective, customized solution for AEGON Scottish Equitable. "We knew a project of this magnitude and complexity would represent a challenge," said David Blyth, Technical Manager, Calon Associates (Infranet Partners UK). "Fortunately, STRATOSPHERE hides much of the complexity behind a familiar user interface, making it easy to create and deploy bespoke applications. Similarly, NL-Facilities provides a user-friendly platform for large-scale integration, ensuring an expertly integrated system."

The concurrent use of software to help program and configure the network devices and especially the use of design templates, results in a reliable system which permits future changes to be made quickly and easy, translating into reduced maintenance and lifetime costs. With a total of 1500 LON nodes and products from four different manufacturers, the solution is a testament to the value of LON Open Systems.

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LONMARK® INTERNATIONAL

CASE STUDY





Boeing Future-Proofs its Long Beach Assembly Center with LONMARK Open Systems

The Boeing Company's commercial airplane facility at Long Beach, Calif., started as a production plant for military transports, bombers and fighters during World War II and grew into a manufacturing behemoth, with 20,000 workers and 7.6 million square feet of manufacturing, research and development, assembly and office space. As Boeing consolidated operations at the plant, they wanted to invest in a solution that would make the facility more efficient – "smarter" as well as smaller.

The Long Beach plant is dedicated to assembly of the Boeing 717-200, one of the newest members of the company's commercial jet airplane family. The 717-200 twinjet, introduced in October 1995, is an environmentally friendly plane in demand for the growing short-haul market worldwide. But until recently the assembly plant turning out these 21st Century jets was saddled with fi re alarm, energy management and other building systems that relied on an infrastructure dating back to the 1940s and '50s.

The Challenge

Boeing was very frustrated with the limitations of their legacy Energy Management System (EMS). This system locked facilities into one system, which required expensive gateways to connect to other manufacturer's equipment. This built-in obsolescence provided very limited access to the user interface, which required a software license fee for each computer tied to the system. Tired of being stuck with obsolete protocols, combined with increased pressure to control costs and optimize facility performance, Boeing decided that they needed to adopt an open system for their facilities.

The Solution

Boeing was attracted to the LONMARK open system because it is supported by hundreds of manufactures and would allow them to marry the best equipment and software from numerous suppliers, delivering "the best of the best." They recognized the power of competitive bidding on projects, so that multiple integrators could work on jobs. Best of all, maintenance could either be performed in-house or competitively bid by independent integrators. This new flexible system would eliminate expensive gateways to connect vendor equipment together, delivering a more flexible solution with lower implementation and support costs over time.

Boeing began the process of updating the plant's systems by replacing its copper cabling with a fiber optic network. Systems integrators connected the existing fire panels, smoke detectors and sprinklers in several buildings to a new central monitoring system using fiber optic routers to connect to the fire alarm system.

Next Boeing replaced their old, proprietary EMS system by selecting the "best of breed" products. The installation involved mixing and matching a variety of flexible controllers, VAV controllers, programmable controllers, variable frequency drives and other equipment from seven different suppliers.

The building's lights were on 24 hours a day, seven days a week. The lighting control system didn't work any more, and parts were impossible to get, so Boeing retrofitted the system with a new commercial off-the-shelf lighting control system.

The new open system was tied together with a web-based Graphical User Interface (GUI). Building occupants are able to view their space temperatures and override their lighting from their desktop computers. Maintenance and engineering have access to the web based graphical user interface that also provides links to all maintenance manuals and drawings.

"I am probably one of the biggest cheerleaders for open systems out there," said Jeff Haberman, Boeing's facilities engineer in Long Beach. "With all of the proprietary systems that we had, I always had the feeling that the controls manufacturers and integrators were in control. Going to open systems I now have control of

those systems. Moreover I can pick the best of the best and I can pick a company on the quality of their product and the quality of their service and expertise rather than being locked into one system.

The Results

"We have been able to do things with an open system that we never dreamt about doing with a proprietary system. For example, we now have the option to purchase equipment from different manufacturers and interface that equipment to provide such things as lighting control over our customers desktop computers, enabling users to control there own lighting. They can also monitor the space temperatures in their areas. Basically, when we were proprietary we couldn't do everything that we wanted to do. Now we have the option of doing whatever is within our imagination," continued Haberman.

"As for energy savings, we have been able to reduce our energy costs by between thirty-six and thirty-seven percent over the last eighteen months. And that is equated to a reduction of 215,000 dollars per aircraft. Which is pretty huge."

Boeing's commercial aircraft plant at Long Beach has an illustrious history, dating to its origins in 1941 at the start of World War II. Now, at the start of a new century, LONMARK open systems are helping make the plant a successful example of Boeing's ability to consolidate its operations efficiently to make its airplanes more competitive in the world marketplace.

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LONMARK INTERNATIONAL

CASE STUDY





Mardan Palace: 5++ Star Turkish Hotel Provides a Smart RF Solution Based on LONWORKS Technology

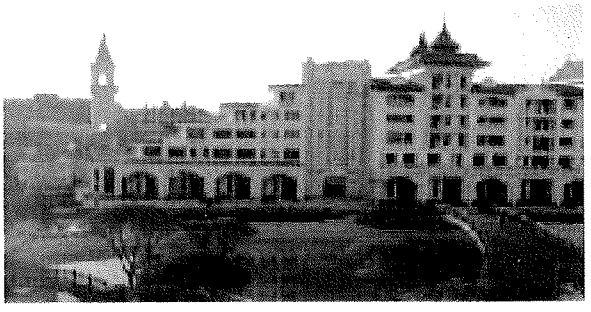
The Mardan Palace is located in Antalya, on the beautiful shore of the Mediterranean Sea: the fashionable southeast coast of Turkey. This recently opened hotel has been designed by a world famous international interior designer, with the intention to reflect the famous characteristics of the historically rich country of Turkey. It has been constructed by Turkey's Zafer Construction Company: around 2500 workers and engineers took part in the construction. Turkey is known for its impressive heritage and traditions, and Mardan Palace will stand out as an exquisite and true five star resort, combining rich culture with traditional architecture and modern amenities – a luxurious environment where guests can choose how to divide their time between sun, spa, and culture. Rooms: the hotel is comprised of 560 rooms and suites: 70% of all rooms are 60-70 square meters. Standard rooms are around 50 square meters and double bedrooms are around 200 square meters. In addition, there are 20 villas (each around 100 square meters) and king suites on the top floor of the hotel (each around 2500 square meters).



Services & Facilities

- Conference, meeting and banquet facilities with state-of-the-art technology
- Entertainment areas: amphitheatre, cinema, nightclub, shopping arcade etc.
- Aquatic adventures: a 16,000 square meters swimming pool, four aquariums (5000 fish from different seas: Pacific, Caribbean, Red Sea, etc.)
- Sport Facilities: tennis court, beach volleyball, bowling, squash court, golf, etc.)
- Restaurants: 13 select designed restaurant concepts (several countries)
- Children's facilities

The Challenge: Comfort and Technology in all Rooms



In each room, this new 5++ star hotel offers guests an advanced interactive multi-media system (flat screen LCD TVs, internet access) and also a comprehensive automatic control system for their comfort, allowing a flexible local command through a customized "multi-jobs" remote controller (lighting and HVAC functions). Attractive design and command reliability were required. No technical equipment is visible in the room in order to respect the high level of palace aesthetics. Radio frequency technology was consequently selected: the radio receivers are installed in a technical cabinet along with a LONWORKS interface in each room. On the other hand, LONWORKS was selected as the best technology to provide open and interoperable solutions which allow the use of other LON equipment for comfort control functions (lighting, climate, etc.).

The LONWORKS Solution & Key Benefits

The Dalilon® RF remote control system with the LONWORKS Dalilon interface combines a smart design and easy intuitive operating. Each guest command is translated by the Dalilon interface into a "SNVT" standard variable which is then sent onto the network to drive the associated comfort devices (lights, HVAC unit etc.).

The radio remote controllers are imprinted with the brand of the hotel and all keypads are customized for intuitive use.

- Temperature setting is controlled by two dedicated buttons (temperature up/down).
- Fan speed is controlled by a single dedicated button (1-2-3, slow-medium-fast).
- The main lighting circuit is controlled by two dedicated buttons (dim up/ dim down).
- Two single buttons allow turn-off of the main lighting circuit, or turn-off of the WC lights.
- A&B buttons allow selection of lighting predefined scenarios.

Equipment

- 15 infrared remote controllers – Dalilon
- 470 Karno® RF receivers
- 182 Dalilon RF receivers
- 855 RF remote controllers (grey design) – Dalilon
- 648 Network interface 230VAC, four channels – Dalilon

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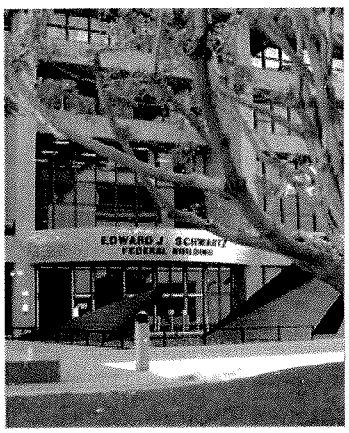
CASE STUDY







GSA Works with LON as Part of a Long-Term Energy Saving Strategy





Background

The General Services Administration (GSA) consists of the Federal Acquisition Service (FAS), the Public Buildings Service (PBS), and various Staff Offices, including the Office of Government wide Policy. GSA's mission is to "help federal agencies better serve the public by offering, at best value, superior workplaces, expert solutions, acquisition services and management policies."

PBS is the real estate branch of the United States Federal Government. It acts as the government's "landlord," meeting office and other space requirements of the federal workforce. PBS is responsible for providing, renovating, altering and maintaining the workspaces of around 1.1 million federal employees who work in over 1,500 government-owned buildings across the USA.

With so many buildings and estates under its control, it is little wonder that the Federal Government is the USA's largest energy consumer. Concerned about setting the right example, it places great importance on energy savings and effective building management and has charged each federal agency with the task of reducing energy consumption.

Presidential Executive Order 13423 (www.ofee.gov/eo/EO_13423.pdf) is the most recent and most stringent energy conservation order for federal agencies. It requires agencies to improve energy efficiency and reduce greenhouse gas emissions through a reduction of energy intensity by: (i) 3 percent annually through to the end of fiscal year 2015, or (ii) 30 percent by the end of fiscal year 2015, relative to the baseline of the agencies energy use in fiscal year 2003.

When GSA wanted to overhaul the building automation equipment in the Edward J Schwartz Federal Office Building (FOB) and US Courthouse (USC), they needed to install a system that would offer long-term energy savings. Additionally, GSA wanted a system that would provide the flexibility required by a constantly changing office environment.

The Challenge

The Federal Office and United States Courthouse buildings located at 880 Front Street consist of two buildings connected by an elevated bridge. The seven-story FOB has a floor space of approx. 605,000 m2 and contains 14 tenant units. The adjoining USC building is slightly smaller and houses 24 District and Magistrate court rooms. Both buildings still had predominantly pneumatic controls and some electric controls that were not integrated and prone to malfunction. The systems were inefficient and expensive to maintain. There was an obvious need for greater integration and data on energy consumption needed to be collected and analyzed for high level automation and energy conservation strategies. To reduce maintenance costs, there needed to be maintenance management at the regional level.

Another issue was the garage. Since the intake louvers are located near the loading dock, the fresh air intakes were affected by the trucks parking nearby. A gas detection system needed to be integrated in order to overcome the problem.

The Solution

When the GSA heard how open, interoperable building automation systems based on LON technology reduce long-term maintenance, energy and operating costs, they wanted to learn more. Timothy Cashman, GSA's San Diego based Project Manager, was one of the main driver's of the project from the owner's point of view. He previously attended Echelon's courses and recognized the system's abilities and advantages over other protocols and standards.

When he pointed out that the FTT-10 networks were topology friendly to allow GSA to stay on top of the constant changes in the floor plan, there was no longer any question. The implementation of the LON-based system was given the go-ahead and the system integrators, Quark Communications, based in Cardiff, CA, were awarded the contract to install the system.

Web Integration

In order to implement the Federal Government's order on energy efficient buildings, facility staff and managers needed access to detailed and easy- to-read information on energy consumption at the Front Street building. This has been achieved using the InetSupervisor web-based front end software from Quark Communications. Being able to monitor and analyze energy consumption trends is particularly important for optimizing energy consumption. This is why there are fi ve SQL databases in use on this project to store information and trends for up to 10 years.

The information is captured by WattNodes from Continental Control Systems and Variable Frequency Drives from ABB installed on all major pumps and fans. Via the web-based InetSupervisor, government facility personnel are able to access the energy information on the LON network and incorporate it into their own region-wide energy monitoring network. This was achieved by integrating the InetSupervisor with the government's energy servers, enabling staff to analyze the data and plan long term energy saving strategies. For technicians, it means that trends and pattern information are supplied right on the work order ticket. The LON system also simplifies and optimizes trouble-shooting and fault finding. Trend data is automatically analyzed and reports are generated that pinpoint any problems with the equipment. Armed with this information, technicians are able to deal with faults quickly and with minimal hassle.

Quark also installed the InetTEAM application to provide tenants with phone and web interfaces to the Building Management System (BMS) system. Agencies that lease the space in the buildings can now browse or phone the server. The server responds with plain English voice prompts and allows the Agencies to enter schedule overrides for after-hours services. The requests are logged and invoices are generated automatically resulting in a more efficient and effective billing system.

Energy Savings

A large amount of energy is often wasted when air-conditioning is kept running in unoccupied rooms and areas of a building. Previously, requests for after-hours HVAC required engineers to place a schedule override at the air-handler level which kept all associated zones in an occupied mode. This old approach made the air handlers condition all spaces regardless of whether they were being used. Now, the BMS ensures that air-conditioning is shut down after normal hours unless there is a request from the InetTEAM to enable the system for a special, after-hours event. The BMS reacts to the request by turning on the equipment at the desired time. It only uses the equipment that is necessary to condition the particular space and keeps all other zones closed to save energy. It also logs who made the request, how long the equipment was running and how much energy was used for later billing and reporting.

Wherever possible, the BMS uses cutting edge strategies to optimize energy consumption and reduce costs. The system monitors and optimizes the reset schedules in real time. The variable air flow handlers automatically reset static pressure based on demand for space and chilled water pumps maintain a variable pressure set point based on demand from the air handlers. Quark Communications also implemented additional, sophisticated energy conservation sequences using Echelon's LonBuilder and NodeBuilder tools. There are also wall-mounted touch screen panels to provide redundancy for scheduling tasks and the front-end interface in the event that the main server fails.

Other Benefits

For the garage, Quark Communications solved the problem of air quality by installing a CO and NOx monitoring system. Now, the dampers that provide fresh air are closed whenever the outside air quality is affected by the cars and trucks. The time periods are short and the system returns to normal operation in minutes as the air clears. Thanks to exhaust fans equipped with variable frequency drives, the new parking ventilation system also contributes to energy savings.

In addition to the energy savings, improved air quality and efficient maintenance and billing, the multi-vendor system consisting of devices from 6 different suppliers (as well as devices from the above mentioned suppliers, the LON network also includes 800 VAV controllers from Distech Controls and air handler controllers from Smart Controls) ensures that GSA benefits from an open, interoperable network that enables competition for parts, integration services and maintenance contracts. The system is also extremely scalable to meet future requirements with 10/100/1000 Mb backbones and over 1000 devices at present.

All of this means that the Federal Offices are well equipped to meet the Federal Government's directive on energy efficient buildings. While at the same time GSA has a system with flexibility that will make it easier for GSA employees to adapt to the different needs of the various tenants, both now and in the future.

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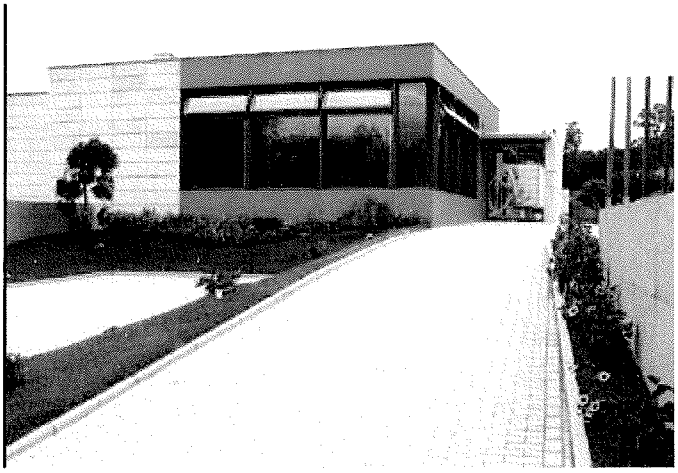
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CASE STUDY





LON Technology Ensures Patient Safety and Saves Energy at Ximará Geriatric



When architect Rafael Vale decided to make the Ximará Geriatric nursing home a sustainable, green complex he turned to Echelon's LON technology for inspiration. The 1400-square-meter building is nestled in the verdant and temperate Galicia region of northwest Spain, and Vale wanted to maximize the structure's orientation toward the sun by using solar panels and intelligent building automation. He envisioned a reliable building automation system (BAS) that would help ensure timely medical assistance and care for the home's elderly residents and optimize energy use in the complex. And he wanted the entire system to be managed and accessible through a user-friendly interface.

The Solution

System integrator Cogaprel, S.L. of Pontevedra, Spain, integrated a BAS based on LON technology – an open, extensible architecture that lets control devices from multiple manufacturers interact with each other. The flexibility of LON based systems lets integrators easily tailor solutions to customers' needs.

All building subsystems at Ximará Geriatric are now integrated and accessible, including heating, ventilation, and air conditioning (HVAC), indoor and outdoor lighting, medical emergency, fire/safety, security, and irrigation.

Cogaprel developed and installed management software to control the BAS. The nursing home staff accesses and monitors the entire facility through a user-friendly interface on an Apple iMac computer that requires no previous technical knowledge.

Saving Energy Naturally

The solution manages and controls the building's lighting through LON enabled light sensors and an Echelon *i*.LON® 100 e3 Internet Server. Using the server's automated scheduling program, lighting can be adjusted based on the time of day, the amount of natural light available, and the lighting needs of the residents.

The LON system also saves energy by connecting all the windows in the building to an automated motor that opens and closes them, providing natural daylight as well as ventilation. The motorized windows can be set open to various widths to allow uniform temperature and air circulation throughout the building. The motors also manage the window blinds according to weather conditions and season. In addition, solar panels are used in conjunction with the HVAC system to naturally heat the complex.

"The LON based system has significantly reduced our energy use," said Vale, who also owns Ximará. "It has enabled us to save 40 % in air conditioning and 25 % in heating, all the while maintaining comfortable humidity and temperature levels in the rooms, avoiding sharp changes in temperature which can affect the residents' health."

Residents enjoy a bio-garden that is watered by a LON based irrigation system with three watering settings. The smart irrigation system includes a seven-day calendar that can be programmed for each day of the week, and for specific plots in the garden. The system also uses outside temperature and humidity data to automatically adjust irrigation and thus, conserve water. For example, on rainy days, the system will not water the garden.

i.LON 100 Internet Server Ensures Patient Safety

Patient safety is a critical issue in the nursing home. The facility's alarm system for medical emergencies and fire/security issues allows staff to respond quickly to alerts. Vale and Cogaprel decided to use the *i*.LON 100 e3 Internet Server because of its high reliability. "The *i*.LON Internet Server operates autonomously; it works even if the iMac is shut off or if the system fails," says Jorge Rodriguez, Managing System Integrator at Cogaprel. "It also lets us remotely operate and maintain the system."

Each room is equipped with two emergency alarms. When patients need immediate help, they pull an alarm located on their bed's headboard or in the bathroom. This activates the *i*.LON Internet Server's alarm function, which turns on a blinking light above the patient's door to help nurses immediately locate the resident. It also sends a silent notification to the on-duty nurse's mobile phone, including information on the source of the alarm, a map of the facility, and the room location. In addition, the server sends e-mails to two different addresses for logging purposes. After attending to the situation, the nurse deactivates the patient's alarm by pushing the second alarm located in each room. The deactivation alarm sends information to the server, which shuts off all activated alarm functions and sends two new e-mails to record the response, date, time, and resolution of the emergency.

Technical alarms work in the same way. The building has emergency alarms located on the walls, and the *i*.LON Internet Server reacts to different alarms accordingly. For example, when the fire alarm is activated, the server automatically signals the window motors to close the windows, turn on the lights, and unlock the exit doors to let patients and staff quickly evacuate the facility. To disable technical alarms, the staff uses the iMac interface to reset the alarm to Sleep mode.

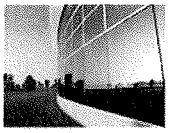
The LON system also monitors and maintains the water level in a large tank that Vale keeps on the premises specifically for fire-fighting use. Because Ximará is located in the tiny village of Salceda de caselas, it is important to maintain the 14,500 gallons of water in the tank for back-up emergency use, especially during the summer when forest fires can occur.

"The alarm system has dramatically reduced our staff's medical assistance reaction time," says Luz Paz, Geriatric Director of Ximará. "The entire system not only eases the nurses' workload but also provides a level of independence for our elderly residents, while ensuring the highest level of care."

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CASE STUDY





Hannah Montana Stage

"Quiet on the set, everyone....." the director announces. A second later, one loud ring of the bell, red light beacons flash outside the stage doors, huge cooling fans slow to a silent speed, "Rolling, and..... Action!" shouts the director on the stage of the Hannah Montana show in Hollywood, California. The actors perform the sketch they've rehearsed all week and the studio audience laughs after each gag. When the director shouts "Cut!", the bell rings twice, red light beacons become dark, and the supply fans ramp up to pump 140 tons of chilled air full speed onto the stage.

Traditional red light controls used in movie making are comprised of hardwired relay logic based systems. As performance sets are reconfigured, the co ntrols often require re-wiring and are difficult to integrate with the mechanical systems that cool the stage. At Tribune Studios in Hollywood, California, a new red light control system has been deployed based on open/ interoperable LONWORKS network technology that includes LONMARK certified control devices from four different manufacturers – Hubbell, Echelon, Yaskawa, and Functional Devices. Each device provides specific red light system control functionality and communication over a free-topology link power LP-10 twisted pair media channel.

When the sound engineer receives instruction from the director that the performance scene is about to commence, he presses one of three buttons on a hand-held Hubbell control pendant which then transmits a network variable message to a smart relay device made by Functional Devices that rings the 'Ready' bell once. A second 'Red Light' button on the pendant sends a network variable to additional Functional Devices wired to red light beacons outside stage entrances. The same network variable is received by an Echelon Lonpoint device which initiates a fan speed network variable sent to Yaskawa variable speed drives on four chilled water air handlers high above the stage floor. When the third 'All Clear' button is pressed, a network variable is sent onto the network, which rings the bell twice, shuts off the red-light beacons, and ramps the air handler fans up to a configurable speed level.

An *i*.LON100 internet server provides for web browser based monitoring and control of the system from the studio maintenance offices. Fan speeds during and after filming are easily adjusted through the web interface according to comfort and sound requirements. Additionally, maintenance technicians can quickly schedule cooling system operation as well as shut down operations when the performance wraps.



Prior to automation, the state of the HVAC plant on stage 5 was such that it had either a 100% on or 0%, with no load or demand control, and obviously drawing much more power than required. Since implementation of the automation system, the plant is cycling on demand, cutting power consumption (based on on/off time of the compressors) by as much as 50%.

Service calls in order to address temperature related discomfort have been reduced dramatically, as any issues can now be handled directly from a work station.

All the electrical gear, as well as the switch gear that controls the stage air conditioning, which historically has had some heat problems due to overloading or inefficient consumption, is now in excellent shape.

Albert Blondeel-Timmerman is the electrical foreman for Tribune Studios who specified an intelligent red light control system during construction of the Hannah Montana set. "Since production companies come and go often here at Tribune, we wanted a system that could be easily reconfigured without wiring changes" Albert commented. "Plus, we wanted a control system that provided low speed air conditioning during performances without creating noise issues. An added benefit was the remote user interface that allows us to monitor stage conditions and quickly respond to client requests."

"Our operating costs have risen steadily in the past few years," continues Albert, "mostly due to rising rates and 24-7 operations, so there is no documentation we can provide which clearly illustrates the effect on our

utility bills. But from 30 years experience, I can tell you that our retrofit program with high efficiency lights, and now our automation program have been the biggest factors in controlling costs and improving client service. Since implementation of the automation system, the plant is cycling on demand, cutting power consumption (based on on/off time of the compressors) by as much as 50%! In addition, we have virtually NO temperature related service calls on a stage where we used to have 4 or 5 every shoot day! We have also been able to use the stage's demand control plant to supplement the aging units on stage 4 (which were always insufficient for the load). This has helped us to avoid the expense of replacement of and additions to those units. We have also saved on labor by being able to effectively troubleshoot the units remotely from the graphic computer interface, so when we go to the rooftop, we already have materials and tools required to effect repairs.

"In building 21, we took existing units and transformed them into as close to a true multi-zone system as you can get with a DX system. This avoided the cost of installing individual units for post production space, which, at about US$10K per incident times 20 spaces, would have been cost prohibitive. We have essentially created a load sharing condition that allows us to get the maximum efficiency while maintaining client comfort and protecting valuable technical equipment. With the automated alarm system we have been able to address problems and make repairs without the client ever even knowing there was anything wrong, and avoiding costly damage to equipment. With more effective staging and demand control and the installation of static pressure controls we are using the equipment much more efficiently with an operational costs savings estimated to be about 10% to 25%. We have also seen a dramatic reduction in temperature related service calls, which we can now address in a few minutes from our work station", added Albert Blondeel-Timmerman.

Control Devices Included
Hubbell LX Series Switch station – four button
LONMARK certified
SIMLXSW4

Functional Devices LONMARK Relay
LONMARK Certified
RIB2401B-LN

Circon General Purpose Controller
LONMARK Certified
SCC310GPC

Echelon LonPoint
LONMARK Certified
DIO-10

Yaskawa Variable Speed Drive
TM-E7
LONMARK 6010 Functional Profile

Infrastructure Devices
Douglas Lighting Link Power Interface
Model ALC3-2800-750

Echelon i.LON100 Internet Server

Communication Channel
FT-10 Twisted Pair media
Free Topology wiring structure

Network Management Tool
LonMaker Integration Tool

Network Management Platform
LONWORKS Network Services

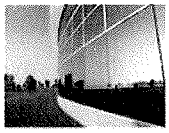
Human Machine Interface
Internet Explorer 6.0 web page

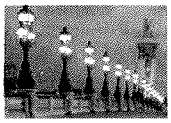
HMI development Tool
i.LON Vision and Macromedia Contribute

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LONMARK® INTERNATIONAL

CASE STUDY





TAC Finland Reduces Operating Costs at Tampere's First Indoor Commercial City



The Finnish winters may be long and dark, but a new indoor retail and leisure complex called Ideapark looks set to keep the inhabitants of Tampere and its environs both comfortable and entertained for the foreseeable future. The Finnish branch of TAC is in charge of all the building management and security systems for the new commercial city, in an ambitious performance-based contract that calls for a 25% reduction in the energy required for building operation.

Located in Lempäälä near the city of Tampere, Ideapark is the first indoor commercial city of its kind in Finland, providing products and services for homes, interior fashion and leisure. When its doors were first opened to the public in December 2006, Christmas shoppers could visit over 170 stores along 1.2 kilometers of shopping streets, and local residents could take advantage of all kinds of municipal services. Ideapark hosts 15 restaurants and cafés with a total of 1200 seats for patrons, it has an imitation Old City with narrow alleyways and fountains and a special Cultural Centre for children. For those who like to be 'outside' there is a verdant Central Park with a retractable roof system that can be opened in warmer weather. The park has an area that can be turned into a skating rink in winter. By the end of this year, sports enthusiasts will also be able to enjoy a swimming pool carved out of rock, a bowling hall, a climbing wall and an underground cross country skiing tunnel.

This ambitious project was first conceived by a trio of Finnish entrepreneurs, who bought the land upon which Ideapark is situated four years ago. By 2004, detailed plans were underway to create this impressive complex. Phase One was ready in December 2006, and the construction of two additional 'wings' is due to begin later this year.

TAC Finland first became involved in Ideapark as a technical consultant assisting with the planning phase. In 2005, the company was asked to fulfill a five-year Technical Facility Management contract. This means, among other things, that TAC is in charge of Ideapark's energy and security systems (including fi re alarm systems, access control and intrusion alarm systems), and has taken part in the decision-making process when choosing security and IT suppliers for the project.

One of the main reasons why Ideapark's owners were so interested in working with TAC was the company's ability to save energy in the existing building portfolio. TAC showed how it was possible to use LON-based building automation to reduce energy spending by 25% in comparison to current costs, the importance of which cannot be overstated. Lower running costs not only mean better operating profit in the short term, but also a superior return on the developers' investment when it is time to sell.

The promised 25% reduction in energy required for building operation is being achieved using TAC Finland's unique business model for building automation services – a model that not only lengthens the buildings' life expectancy but also secures a better working environment and a good atmosphere in the buildings. Key factors are the integration of the different building systems, analysis and active follow up of the results. TAC is taking advantage of LON technology by using LON-based

energy meters to measure, analyse and distribute energy reports to Ideapark's organisation.

Being involved at an early stage in this project, meant that TAC was able to integrate the building management and security systems properly. On the technical side that meant making sure the security and fire alarm systems could be connected to the TAC Vista TM Building Management System by OPC or LON. The use of third party LON equipment, such as LON frequency controllers in air handling units and LON pumps for heating and cooling, led to savings on electrical wiring, installation and labor costs. This equipment is versatile and it's always possible to get technical support or information if problems occur.

"An integrated, centrally controlled building security and management system delivers savings from the construction stage onwards," explains Teemu Hausen, Managing Director of TAC Finland. "For example, since Ideapark's different areas do not need their own electrical control boxes, savings are made on hardware and wiring, as well as the electrician's time and tools. Once in operation, the equipment is managed by experts who can apply their specialist knowledge to ensure optimal energy use. Continual fi ne tuning keeps energy wastage down to a minimum."

As part of its contract, TAC also selects and manages Ideapark's suppliers of IT services, security, fi re alarms, cleaning and waste disposal. Businesses that rent space in Ideapark can access all these different services via TAC if they so wish.

What has been the biggest challenge for TAC so far? "We are shooting at a moving target," says Jari Räikkönen of TAC Finland. "We have to keep revisiting our goals as the project prerequisites change and, for example, new tenants arrive. We never stop looking for improvements, checking the temperature and conditions in each area. It's an ongoing challenge." With steadily evolving requirements, it has been very important to assure tenants and visitors alike that the construction phase supports the business idea no matter what. The technical platform has been deliberately built to enable adaptation to new challenges that may come in the future.

The sheer size of Ideapark poses challenges too. For example, TAC is currently working on the underground cross country skiing area. There are two ski tracks – an outer track of 600 meters and an inner track of 450 meters. Ensuring comfortable conditions for visitors in such a setting is quite a task in itself. The Finnish law which requires all public buildings to include underground nuclear shelters, makes things more complicated. The swimming pool area can be used as one of the nuclear shelters. Jari concludes, "When designing the climate control system, we therefore had to think of both sets of needs.

"Ideapark will eventually cover a surface area the size of twenty football fields, costing approximately US$ 128.5 million to build. Toni Virkkunen, marketing director and co-owner of the Ideapark, expects six to eight million visitors per year, including both locals and tourists. Is this realistic? Within a thirty-minute drive of Ideapark, there are 500,000 homes, and 65% of the Finnish population (or 3.38 million people) live within a 200-kilometer radius of Ideapark.

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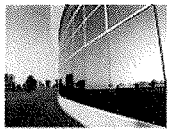
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CASE STUDY





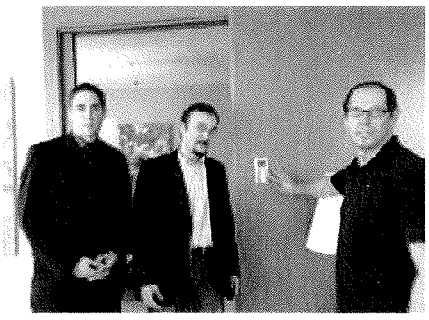
High Tech Behind a Traditional Front - Room Operating Panels by Thermokon in the Hotel Savoyen in Vienna



An impressive combination of classic and modern design characterizes the new Austria Trend Hotels Savoyen Vienna located on the edge of the wonderful Belvedere palace park in the middle of the embassy quarter of Vienna, Austria. The former building of the Austrian State Printing Trade, built in 1888 and 1892 according to the plans of Heinrich Köchlin, was fully rebuilt from 2006 to 2007 according to the construction plans of the famous architect, Prof. Dipl-Ing. Hofmann. The hotel integrates a part of the precious historical façade from the year 1892, and creates an architectonic bond between past and future. On the outside, the building has saved its historical face. Inside, however, a very modern hotel has been created.

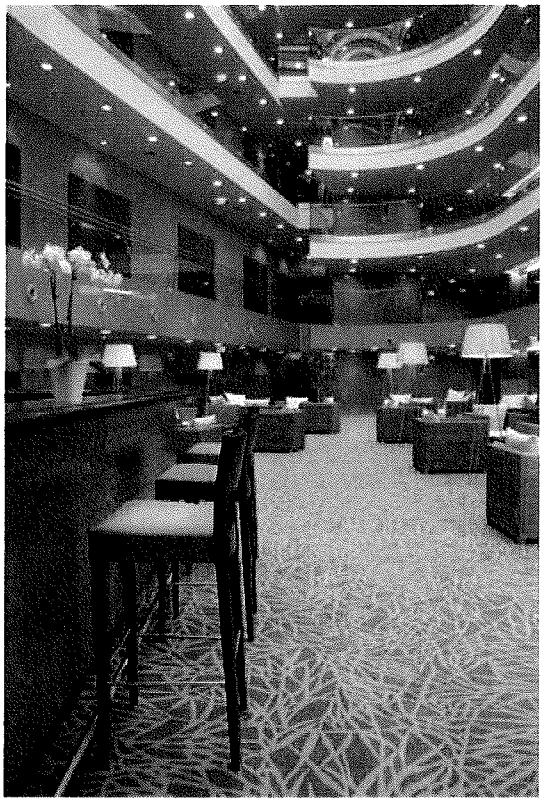
319 fashionably designed rooms, including 43 individually designed suites, win over guests with their classic modern architecture and sophisticated design. The heart of the building is the atrium which is flooded with light and spreads over six floors. It is the starting point of all the important areas of the hotel such as the ballroom, which is more than 1000 square meters, the seven variable seminar and conference rooms that range between 25 and 150 square meters, the atrium lounge, fitness, and wellness area as well as the hotel rooms. The bright conference rooms are equipped with the latest technology and offer the best conditions for all kinds of events.

To meet the requirements of a four-star-plus hotel, the sophisticated room operating panel WRF08 by Thermokon Sensortechnik with illuminated display for air conditioning, lighting and shutter control was selected. "Parameterization and design were decisive in choosing the WRF08," confirmed the project manager, Reinhard Idinger of Johnson Controls. All WRF08 room panels communicate via the LON field bus with the ADIRS 1035 modules, the AD-IRC 4245 control system of Johnson Controls, and the building control technology. The free topology selection of the LON network corresponded best to the architectural structures. Moreover, LON enables later extensions without having to pay any heed to the existing bus topology.



Alexander Herdlicka (Thermokon Austria), Mircea Cojocea (Hotel Savoyen) and Johann Steiner (Johnson Controls) during an on-site appointment

The bus system networks almost 400 room operating panels and 14,000 data points. All system statuses are visualized on the building control technology. The visualization is realized by the Metasys Operator Workstation (OWS) and Metasys M5 Facility Operator on a project PC. Even the room-reservation computer is connected to the building automation and shows the current occupancy status each day. Unoccupied rooms remain in a stand-by mode while in occupied rooms the room temperature is kept at night temperature (night lowering) as long as the guest is not in the room. As soon as the guests check in and the key card reader is activated, the heating is changed to standard operation. Thus, energy is saved and running costs are reduced.



"It is too early to make a summary of the energy savings after only nine months, but experience has shown that all the results are positive. The operation is very easy and the building control technology still offers many features to optimize the energy consumption. Personally, I would recommend the WRF08 panel at any time." Mircea Cojocea, technical manager of the Savoyen hotel, said. "Regarding the comparative values for energy efficiency - please contact me again in three years." An appointment has already been made.

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LONMARK INTERNATIONAL

CASE STUDY







Connolly Middle School Wins Governor's Award for Energy Efficiency

Connolly Middle School, located in Tempe, Arizona has won an Arizona Governor's Award for Energy Efficiency for 2005. These coveted awards are given annually to the government facilities that show the greatest energy improvement through implementation of innovative energy applications, which not only reduce energy expenses but improve the quality and comfort within the conditioned environment.

The award received by Connolly Middle School was based upon work completed by Source Refrigeration & HVAC, Inc. using the Distech Controls easyCONTROLS™ LONWORKS solution.

The Situation

Connolly Middle School, built in 1972, is typical of many schools of this era that are struggling with the management of aged mechanical systems pieced together with an array of add-ons and repairs. Connolly Middle School was not providing the comfort and air quality desired for a learning environment nor did they meet the energy efficiency expectations of a modern facility. The School's campus consists of 184,034 sq ft of conditioned spaces arranged in 6 separate buildings.

Each building has separate mechanical systems including centrifugal and reciprocating chillers along with multi-zone, VAV and constant volume air handling units all served with electric heat. Control systems were comprised of a mixture of pneumatic and stand alone DDC. Without any centralized control and monitoring, the aged HVAC system was running inefficiently resulting in numerous comfort complaints.

In an effort to streamline the process and to ensure that the School received a solution that met their needs and budget, the school's management elected to pursue a design build process with a selected group of HVAC contracting firms. This acquisition process provided for a quick and thorough assessment of the facility's needs with detailed proposals, allowing them to make the best choice of contractor and BAS solutions.

The Solution

The School management selected the proposal of Source Refrigeration & HVAC, a Distech Controls Open System Dealer. The solution focused on the air side system and controls as the areas that would provide the greatest improvement in environmental air quality and comfort and reduction in energy consumption. The evaluation of the central chillers, cooling towers and pumping systems, concluded that these systems, other than lacking good control, were basically solid, efficient systems. Source Refrigeration & HVAC thus designed a system retrofit that entailed the replacement and modernization of all of the air side equipment, including:

- Installation of 60 VAV boxes
- Installation of an energy recovery wheel to precondition the outside air
- Repairs and cleaning of AHUs and duct work
- Valve replacement and repair
- Installation of variable frequency drives on all major AHUs

The building automation system installation using Distech Controls easyCONTROLS LONWORKS® solution comprised a total of 650 points and 112 controllers. The control system included:

- Central plant control using ECU-88, EC- 12 (LONMARK® certified programmable controllers)
- AHU control using EC-12 and EC-8 and EC-67 (LONMARK certified programmable controllers)
- 85 VAV controls using EC-VAV-L (LONMARK certified configurable controllers)
- Rooftop unit control using EC-RTU-L (LONMARK certified configurable controllers)
- BTU meters
- Lonwatcher LONWORKS network management tool

- Programming using LNS® based plug-in for configuration and custom programming
- User interface – Web browser access as well as scheduling, trending, alarm management and normal user adjustments using an Echelon® *i*.LON® 100

Mike Ellis, of Source Refrigeration & HVAC comments: "We encountered just about everything you could expect in a 30+ year old school, so we had our work cut out for us. When we finished, we made sure that the quality of the environment was what each of us would demand for our children. A key component of that was the control system. It was critical that the school's maintenance staff be able to monitor and control the systems to insure that good air quality was always being delivered and energy efficiency Controls easyCONTROLS system was an integral part of that solution".

There were several key factors required of the control system that the BAS solution delivered on, such as:

- Provide for programming flexibility to insure that the necessary sequences could be obtained
- The ability to monitor and control the CO2 levels for air quality and energy efficiency
- Provide for precise comfort levels with user adjustment
- Web browser access and control to all points within the system with a custom designed, simple to use interface
- Provide a completely open system from controllers to software tools

Benefits

Connolly Middle Schools now has the exceptional environmental air quality the students need for learning and a substantial reduction in energy and maintenance cost. The energy savings for the first 6 months were over $58,000, a 34% reduction of previous costs.

John Dermer, Facility Maintenance Supervisor for the Tempe Elementary School District #3 adds: "We are pleased that we now can control and monitor the CO2 in the air at the school.... The recognition of the Governor's Award demonstrates that you can improve air quality and comfort and at the same time achieve substantial energy savings. We are very pleased with the decision we made in selecting Source Refrigeration & HVAC and Distech Controls."

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LONMARK® INTERNATIONAL

CASE STUDY





A Synergy of Intelligent Street Lighting and Energy Conservation in Gothenburg, Sweden



The city of Gothenburg is located on the West coast of Sweden where the Göta Älv River meets the sea. As Sweden's gateway to the West, Gothenburg is a major trading centre for Sweden and has maintained its ties to the shipping and trade industries for centuries. With a population of nearly a half of a million people, Gothenburg is Sweden's second largest city.

Built according to Dutch architecture the city is orderly planned with rectangular districts surrounded by old canals. Preserving its history and the living environment in the area has always been a main goal for the city council and these efforts are reflected in the city's extensive public transportation system and initiatives to reduce traffic accidents.

As part of the city's long term goal to incorporate a highly efficient traffic system to improve connections between city districts as well as provide for the city's ever growing transportation needs, Gothenburg decided to implement an intelligent street lighting system. Capelon, a specialist in LON systems using power line communication, developed a system for the control and monitoring of street luminaries in two of the city's districts, Tuveleden and Högsboleden.

Shedding light on energy conservation

The driving theme behind the project was an energy-saving streetlight scheme, where the system would continue to provide the most up-to-date technology and benefits for the city residents throughout its lifetime.

Together with the contractor, the Swedish National Road Administration (SNRA), the City of Gothenburg conducted rigorous tests to identify areas where Capleon's intelligent street lighting system would best benefit the city. In addition to reducing energy consumption and costs, decreasing carbon emissions was an important factor in choosing the street lighting system.

According to the European Lamp Companies Federation (ELC), one 500 W street lamp left burning for 7 hours during the night can produce up to 2 tonnes of CO_2 emissions per year – enough to fill 5 double-decker buses. At the same time, the street lighting scheme needed to provide safe driving conditions for traffic as well as offer lighting to prevent crime in the neighbourhoods.

LON as the solution

To meet the high demands for energy conservation, pollution reduction, and safety, a street lighting management system based on LON technology was installed. The LON network allows devices from different manufactures to communicate with each other for optimal control of the street lamps as well as to enable low cost system expansion and upgrading.

"The benefits of using the LON protocol are in its proven reliability and widespread applicability," said Tomas Niklasson, Marketing Manager at Capelon. "The open technology allows us, as a supplier, to focus on developing improved functionality of the system for our customers."

With 550 lamp controllers, the system will be installed in two stages. As part of the first stage, which was finished in April 2007, 300 lamps and ballasts were installed in Tuveleden. The second phase includes installing 250 streetlights in the district of Högsboleden and is scheduled to be completed this December.

Preventative monitoring

The City of Gothenburg wanted the ability to individually control and monitor each streetlight in order to detect lamp failures and allow lamp replacement and repairs to be completed in real-time, without affecting the safety of drivers and residents. To accomplish this, each street ballast is equipped with Capelon's LC-20D lamp controller, which monitors accumulated lamp burning hours, lamp and power voltage, total energy usage, and scheduling as well as produces alerts in case of lamp malfunction.

Reducing the need for emergency maintenance by replacing luminaries according to their lifetime and amount of hours burned as monitored by the LC-20D, this modern solution enables Gothenburg City to save on maintenance costs and prevent unsafe road conditions.

The streetlights can even be remotely controlled. A total of five MP-01 segment controllers from Capelon communicate with the LC-20Ds over a LON Power Line connection and are used to collect the data recorded by the lamp controllers and transfer the information via GPRS/Ethernet to a main computer.

From here, groups of lamps can be accessed and configured to different set-up modes for dimming and switching on or off, providing maximum ease of use for the system managers. In case of communication break down between the segment controller and lamp controllers, the LC-20D will automatically fall back on a pre-set mode providing a reliable street lighting scheme.

The results are in

The system also offers the highest level of functionality. The MP-01s automatically control turning the luminaries on or off and can adjust the dimming level based on time of day, position of the sun, and amount of natural light. This provides optimal lighting for drivers and pedestrians while conserving energy and reducing carbon emissions produced by the lamps. After just six months, energy consumption was reduced by an astounding 74%. Lamp lifetimes will also be extended as a result of their dimming, further reducing maintenance costs for the city.

As demonstrated by the City of Gothenburg, integrated street lighting can lower energy consumption, reduce carbon emissions and preserve the environment. Projects to install intelligent lamps and ballasts are becoming a widespread trend in cities across Europe.

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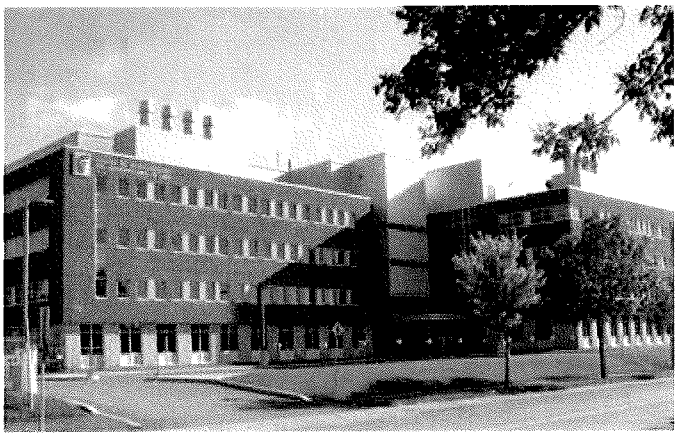
LONMARK® INTERNATIONAL

CASE STUDY





Complying with Strict Regulations at the Quebec Biotechnology Innovation Center



QBIC occupies 27,000 square feet in the Laval Biotechnology Development Centre (LBDC), a 128,000 square feet multi-tenant building located in the heart of Center of Biotechnology and Human Health of Metropolitan Montreal. It is occupied exclusively by companies active in research and development in biotechnology. QBIC offers eight fully furnished laboratory suites (bio-containment 2) including a type 2 reverse osmosis purified water system, natural gas, gaseous nitrogen network, central vacuum system, emergency electric circuits, sophisticated ventilation systems, security, biomedical, chemical and radioactive waste management services.

The Challenge

Since the QBIC is a new build, the integrators, ACCS Control-Tech, had to take into account progressive tenant occupation, while designing systems adapted to a 100% occupation rate. Furthermore, HVAC systems serving biotechnology facilities need to control and maintain the environments in order to ensure the health and safety of employees, to minimize process defects and to assure quality. Moreover, Biotechnology facilities have to comply with stringent regulations and provide a controlled environment with redundant systems to assure quality. The QBIC also required a centralized system to manage all sub-systems, including HVAC, laboratory equipment and lighting as well as the different spaces within the building, comprised of clean rooms, labs and office spaces.

The Solution

To integrate all subsystems and offer centralized management, ACCS created an open control system based on LONWORKS. Controls had to be adapted to the specific needs of laboratories and office spaces and were created around a strategy for:

- Temperature
- Humidity
- Air quality CO2 etc.
- Building pressure
- Air volume
- Variable air volume with 100% fresh air
- Variable speed drives
- Automatic lighting

The system is comprised of 90 Distech Controls' LNS® based free programmable controllers (EC-4, EC-8, EC-12, EC-VAV-C) for laboratory and HVAC control, and LNS based Douglas Lighting Controls products, for the lighting subsystem. The LONWORKS network was designed and commissioned using Distech Controls' Lonwatcher and the GUI and monitoring tools were created through the Londisplay tool.

The free programmable controllers provided the flexibility to manage the different components and mechanical systems such as the labs' chemical hoods and exhaust fans as well as the building's fresh air handlers and pumps. They also allowed programming of specific and unique sequences of operation, such as the air volume control strategy to maintain the laboratory at negative static pressure relative to the environment.

The free programmable controllers permit easy and quick modification to the control logic for adaptive energy saving strategies and recalibrations as tenant occupancy and needs change over time. The controllers were quickly programmed using LNS based plug-ins, which can be launched directly from Lonwatcher. The Lonwatcher network management tool allowed fast and cost efficient setup, commissioning and maintenance of the LONWORKS network.

Londisplay (GUI) allowed ACCS to create a custom visual interface for the building. They easily created a comprehensive graphical environment of the facility from top-level site plans to equipment details. Londisplay also gives the ability to display and interact with network data points and information, again for easy modification as occupancy grows. Alarming and data point logging were achieved through Lonwatcher.

Benefits

The flexibility of the LONWORKS system allows for simple and quick modification as interior arrangements are modified and added for each new tenant. With initial construction completed over two major phases, starting in 2002, the QBIC is now home to nine biotechnology firms. The centralization of all control logic and subsystems provides for high levels of reliability and flexibility of interaction between all subsystems, making the system easy to maintain and monitor. A significant benefit achieved for the QBIC is complete control over energy management and laboratory conditions. The building automation system permits a high precision control strategy, managing sensitive mechanical/electrical equipment while achieving high-energy efficiency.

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CASE STUDY





Web-based Integration Hits a New Dimension



Background

The University of North Carolina at Chapel Hill accepted its first student over 200 years ago, in 1795. The university offers over 100 fields of study to students who take advantage of the 14,800,000 square feet of academic, administrative, and housing facilities covering an impressive 729 acres in the beautiful and forest covered North Carolina landscape. What's more impressive is the 4,000,000 square feet of additional structures already planned and well under construction to be completed within the next five years.

The Project

CyrusPowered Products™, the on-demand Web applications division of Cyrus Technologies Inc., a Florida based systems integrator, achieved the task of integrating over 100 buildings, utilizing nine separate building control systems into one, cohesive, easy to manage Enterprise Building Management System (EBMS). Set to be completed this November, the new EBMS at UNC at Chapel Hill is the largest Web Services integration scheme of its kind.

"The project specification was very broad," explained Matt Horton, Vice President and General Manager, CyrusPowered Products, "encompass-sing multiple BAS and IT disciplines with the primary goal to bring the entire Chapel Hill campus under one EBMS based solely on XML/SOAP Web Services, utilizing the Web to create a consolidated, intuitive user interface." The entire system is ssentially accessible and manageable from anywhere in the world but is centrally housed in a state-of-the-art Building Operations Center, located directly on the university campus.

The Challenges

With a project of this size, there is guaranteed a wide range of customer demands and project challenges that must be met. As with any college, the UNC campus is comprised of an array of diverse facilities: lecture halls, laboratories, offices, housing, libraries, dining halls, and more, with over 80 additional buildings planned. Due to the distinctive uses of each structure, over the years, different BMS were installed to meet the unique requirements of each facility's management.

In essence, the nine dissimilar building control systems caused the bulk of obstacles Cyrus Technologies had to overcome to integrate Chapel Hills's campus into one management network. Some of the control systems were open, utilizing the LON platform and some were propriety solutions causing an overload of building automation system (BAS) protocols that were clogging the university network.

Further complicating the project was the university's inability to aggregate building control data and subsequently analyze the accumulated information. UNC facilities managers could not combine each control systems operation data, a result of the nine different protocols, creating "islands of data" whose constructive uses were severely truncated. Moreover, the university lacked a method to document data configuration across the network, posing the question of how to interpret collected building operation information.

Lastly, the nine BMS created an inconsistent management environment where human machine interfaces (HMI) were dissimilar. Each BAS had its own functionality and maintenance specification, irregular security levels, with complex and varied remote access to certain systems, and sparse Web accessibility.

UNC at Chapel Hill took this integration opportunity to define four central goals for the project:

- As a first priority, UNC wanted to eliminate the vast complexity of overseeing nine incongruent BAS.
- An improved and more consistent facility management interface for building managers was well over due. The new EBMS, under all circumstances, needed to offer managers a consistent building control interface for every

structure, regardless of the building's installed automation system.
- Additionally, the EBMS also needed to allow for future upgrades and additions to include Chapel Hill's 80 plus buildings to be completed during the next five years.
- Last, the university needed a method to interpret and store aggregate building operations data.

The Solution

"To achieve the goals of the project, we implemented into the EBMS a specially developed Campus Version of our online application HostedControls™ in conjunction with our database service Hosted Reports™, both of which are entirely Web-based," said Horton.

The complex solution included installing an Enterprise Class Server Farm, a collection of computer servers leveraged to accomplish the tasks far beyond the capabilities of just one server, a necessity in a project of this size. From here all BAS can be remotely controlled further simplifying full campus management.

Once the nine automation solutions at UNC were connected to the server farm in the Building Operation Center, Cyrus Technologies extended all building control networks with XML/SOAP Web Services Gateway protocol servers. In buildings controlled by LON based automation solutions, Echelon's LonMark certified *i*.LON 100 e3 Internet Servers were utilized to connect the building's devices to the infinite information available on the World Wide Web. Utilization of the Web allows the on-demand employment of information such as weather data and energy prices to be applied to the operation of the control systems, allowing university facilities managers to handle the BAS most efficiently.

In the Building Operations Center at UNC at Chapel Hill facilities managers can now oversee all building operations in the entire campus. HostedControls™ provides a consistent management process for all 100 structures in the network. "Once HostedControls™ is deployed, UNC will experience dramatic levels of freedom regarding the systems they specify at the building controls level. Plus, they will migrate to self-sufficiently in terms of IT integration, which puts them back in the driver's seat at the Enterprise level," said Horton.

What makes this project unique is the level of integration that was achieved – a total of 33,000 nodes were integrated. It would not be an EBMS without every aspect of the campus being integrated into the network, including:

- Electric, water, and steam meters,
- Campus network security,
- Alarm management, and
- A cohesive scheduling platform for all network systems.

Cyrus Technologies also implemented SCADA functionality between the EBMS and each building, allowing UNC building operations staff, where necessary, to override each BAS remotely from the Building Operations Center.

With all control solutions integrated and manageable within the EBMS, automation and control data from all facilities can now be collected, 24 hours a day, and stored in an OLAP environment housed within the HostedControls™ interface. Using Web-based trending and reporting tools available through the HostedReports™ software, facilities management staff can now access BAS information collected by the network and analyze the operations of each building's system. The benefits are numerous including, recognizing system weaknesses, energy consumption, areas where two or more building systems can be leverage together, etc.

With the campus at their fingertips UNC at Chapel Hill operations and energy management staff are ready to take on the new, fully integrated EBMS, particularly after being specially trained by Cyrus Tech-nologies on how to manage and take advantage of all the EBMS has to offer.

Benefits to LON

With LON open systems, the ability to specify a system to meet the facility's exact usage requirements is unrestricted. This includes choosing a solution with the best HMI. A consistent HMI can mean the difference between hours of training and memorizing the intricacies of the interface, to having an intuitive overview of the entire building control network where you can draw up desired information to make important system operation decisions. Combine a LON based BMS with a Web Services HMI to extend the building functions to the Internet and the possible business and economic advantages are endless.

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LONMARK® INTERNATIONAL

CASE STUDY







LONWORKS Control Technology Keeps Stadium Visitors Comfortable While Managing Operating Costs



Completed in a record-setting construction time of less than 2 years, the LTU Arena, is a new multi-purpose stadium in Düsseldorf, completed in January 2005. Soccer, American Football, sporting events, concerts and exhibitions are just some of the events that take place in this world-class venue, which holds 61,000 spectators.

The Challenge

Whether they're attending a soccer match or a rock concert, guests at an indoor stadium event shouldn't be distracted by uncomfortable temperatures, poorly ventilated air, or other environmental concerns. The owners of the LTU Arena sought a building solution that would keep visitors comfortable operating costs manageable and be easy to implement.

The Solution

Thanks to Echelon's LONWORKS control network technology, the stadium now boasts completely automated and intelligent HVAC and lighting systems that everyone can cheer about. Building automation management company ABB Gebäudetechnik AG, Langenfeld, Germany, developed the heating, ventilation, and air-conditioning (HVAC) system, and programmed and commissioned the lighting application. HGI GmbH, a system integrator in North Rhine, Westphalia, Germany, configured and implemented the control network infrastructure. Together, the two companies implemented the project within a year.

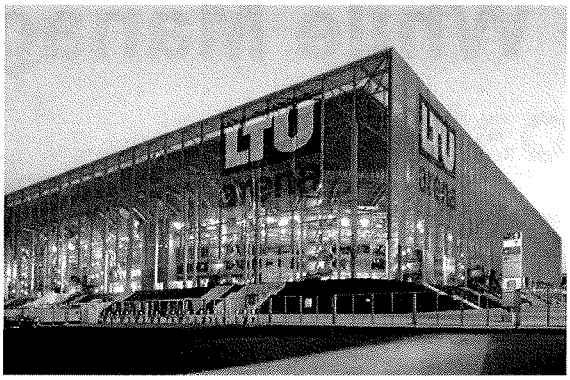
The LTU Arena is a showcase for Echelon's LONWORKS control networking technology – an open, extensible architecture that lets control devices from multiple manufacturers interact with each other. The arena's HVAC system keeps visitors comfortable year-round through a large network of central units and decentralized LONWORKS components that control, sense, and monitor over 20,000 I/O points. A combination of gas heaters, ventilators, and industrial heating panels – all enabled with LONWORKS technology – makes sure the indoor temperature never falls below 15°C in winter. To keep the stadium air healthy, more than 100 ventilators extract smoke and circulate over 900,000 cubic meters of fresh air per hour.

The lighting system integrates over 600 LONWORKS devices from multiple manufacturers – everything from controllers that can be programmed over the input-output port to touch panels that control lighting in the business clubhouse. The panels, which function as remote clients, are integrated with the BMS servers over the fiber optic backbone.

To keep summer events well lit, dome lights in the outer ring of the stadium roof are equipped with automatic sun-drapes that open and close based on the brightness of the sun. During winter, operators adjust the lighting manually.

75 single-room LONWORKS based controllers offer individual climate control for the arena's 50 private suites. This lets the stadium save energy by circulating air only to occupied suites. In addition, more than 200 water and electricity meters equipped with LONWORKS technology monitor how much energy is consumed by the HVAC and ighting systems. The meters transmit invoicing and optimization data to the BMS server, where it's recorded, archived, and evaluated.

At the core of the arena's control system are two Intranet-enabled BMS servers equipped with RAID system USV, a redundant power supply unit. The network is divided among five Echelon LNS databases. Global data, such as from a weather station, is sent over the domain coupler to all areas. A fiber optic Ethernet backbone provides fast and stable communication as intelligent IP routers connect LONWORKS FTT 10 components with the IT network. The entire arena is controlled and monitored through 20 technical centers; arena operators can easily access all data points via LAN or WAN.



HGI staff designed, manufactured, and assembled 150 switch cabinets and delivered them as ready-to-use product to ABB. More than 80 LONWORKS Direct Digital Control controllers (with the capacity to include 10 additional modules) manage the entire facility.

Results

The LTU Arena now has completely automated, intelligent HVAC and lighting systems that keep visitors comfortable and optimizes costs. Only an open system was able to meet all of these demands. The ability to easily integrate devices from multiple suppliers kept the project on schedule, and offers flexible options for future upgrades. The LONWORKS system also ensures optimal facility operation: Users can quickly access all systems and data via LAN or WAN, and intelligent metering manages energy use.

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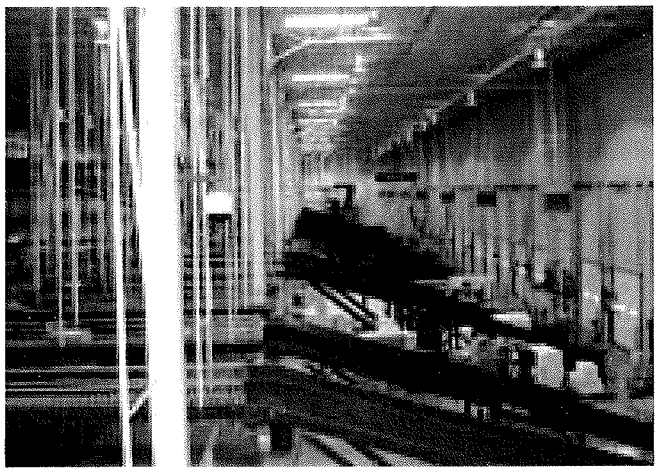
LONMARK® INTERNATIONAL

CASE STUDY





Energy Saving and Efficient Building Automation Triumph at the Eddie Bauer Groveport Distribution Center/Westmont Data Center



Background

Established in 1920 in Seattle, Eddie Bauer is a specialty retailer that sells high-quality casual sportswear and accessories for the modern outdoor lifestyle. Eddie Bauer products are available at approximately 380 stores throughout the United States and Canada, through catalogue sales, and online at www.eddiebauer.com. The company also participates in joint venture partnerships in Japan and Germany, and has licensing agreements across a variety of product categories.

Logistics, distribution, and computer operations are vital for any retail business. Distribution in the USA is handled at the company's 2 million square foot facility in Groveport, Ohio. The Ohio site is responsible for distributing merchandise to retail stores and direct operations, including direct-to-consumer shipping and return services.

Eddie Bauer's computer operations are housed in a 50,000 square foot facility in Westmont, Illinois, a suburb of Chicago.

The Challenge

Information from the site's different technical building systems needed to be captured and logged in real-time and available over the internet for monitoring and analysis purposes.

This included electrical information, critical fire pump pressures/runtimes, computer room temperature/humidity values, Liebert system status, com pressed air system values, IAQ systems covering CO, CO2, temperature and humidity reading from nose units. The building automation system therefore needed to be based on open standards that would allow the integration of different subsystems into one control network as well as integration into the company's IT infrastructure.

The choice for an open system would also meet the owner's demands for flexibility and the freedom to select "best of breed" devices from different manufacturers.

"We needed to have multiple vendor product integration in order to ensure we could purchase the most suitable device for our requirements," said Jim Annable, Facilities Director at Eddie Bauer. "We also wanted Web based data logging which was achieved with the LON network."

The Solution

Based on their previous experience with integrating large facilities, Advanced Control Systems, the Ohio-based systems integrator who won the contract for the Eddie Bauer project, suggested a building automation solution based on LON technology. At the core of the new system are the *i*.LON 100 Internet servers from Echelon.

These collect data published on the LON network and provide a web-based interface for monitoring and controlling the building management system.

Facility staff now has access to information from all of the building systems on the LON platform as well as from the Liebert devices on the site's existing MODBUS network.

The project consists of two main structures in geographically different locations, the Westmont Data Center in the state of Illinois and the Groveport Distribution Center in Ohio. Both facilities can share information on the same LON network, a huge benefit for multi-site projects. At the larger Groveport site electrical data is gathered and monitored through the iLon 100's. Kilowatt hours, wattage demand with timestamp and amp

usage are monitored and verified with the utility invoices Eddie Bauer receives.

With the recently completed LON network, the clothing manufacturer can predict electrical bills within a one percent error range allowing them to accurately budget monthly expenses. Furthermore, using the kilo wattage demand data with real time information, Eddie Bauer can target peak energy consumption time frames and work to reduce wattage consumption as well as lower overhead costs.

The solution also focused on to the HVAC system which had the most potential for energy saving for Eddie Bauer. At the Groveport Distribution facility open Echelon Analog Input, Digital Input modules, the distribution facility can monitor critical fire pump pressure, system air compressor runtimes and overall system pressure. The LonPoint AI modules manage system pressure by monitoring the air compressors' cycling in order to prevent faults and provide crucial diagnosis information in the event of a system failure. Honeywell's LONMARK certified T7350 Thermostats are used on all eight of the RTU's at the Westmont site. After installing the thermostats a number of failing air conditioning compressor stages in the HVAC system, which had previously gone unnoticed, were detected and repaired immediately. Additionally, the HVAC system is managed on a schedule to conserve energy during times when the facilities are not in use. As a result, Eddie Bauer was able to improve the efficiency and effectiveness of its HVAC, contributing to lower operational and maintenance costs.

Pure Choice's Nose 5 Monitors were installed to control air quality; Temperature, CO, CO2, VOC's, and humidity levels in both the Data center, and Distribution center. The levels are monitored and recorded by the *i*.LON 100 LONMARK certified devices to ensure a healthy work environment for Eddie Bauer employees. LONMARK certified EC-Displays by Distech are connected to the Nose 5 devices via two wire bus network in key areas such as the bar code printing department, where humidity can play a significant role in deteriorating package labels causing logistic problems with shipping merchandise. The air quality data collected from the Nose 5's and displayed on the EC-Display are also transmitted over the LON network for further processing. If the Nose 5's detect unhealthy CO or CO2 levels, or that areas have become too humid the information will be sent over the LON protocol to alert that the ventilation system is not supplying sufficient supply fresh air in the facilities.

With the reduction in energy usage and more efficient controls, Eddie Bauer should see returns on the new system within just one year. The life cycle of the open system will also provide cost savings. Eddie Bauer will benefit from reduced expenses relating to changes, upgrades, and additions to the network as well as the amount saved in utility expenses.

Summary

Eddie Bauer needed a system capable of integrating disparate systems (MODBUS/LON) and log data effectively to verify energy usage and manage the day-to-day operations of a 2 million ft2 facility in an open protocol web based environment.

"This was achieved with the LON network integrated at Westmont and Groveport," explains Jeff DeVore, CEM, Advanced Control Systems Inc. "Using a half dozen different LON manufacturers' products managed through *i*.LON 100's Eddie Bauer now has an open, cohesive BMS that delivers real time data that the company can use to reduce energy consumption and increase comfort levels."

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LONMARK® INTERNATIONAL

CASE STUDY





A Model for Energy Efficient Schools in Southern Sweden



With its new state-of-the-art integrated building management and security system, Klagshamn School near Malmö looks set to become the municipality's model for future school developments. TAC Sweden designed, installed and commissioned the LONWORKS networkbased system and will continue to manage it with a view to ongoing improvements in operational and energy efficiency.

Early in 2005, driven by a 40% increase in energy costs over the last four years, Malmö municipality decided to become more pro-active with regard to energy efficiency. At the same time, the city council recognized a need to improve school conditions – not only taking energy efficiency into consideration, but also the indoor climate, security and safety. Where better place to start than with a new school building at Klagshamn which was under construction at the time?

Peter Lindhqvist, spokesmen for Malmö local authority explains, "The cost of technical installations in buildings was on the rise, and we were looking for a cost-efficient solution. It made economic sense to go for TAC's integrated LONWORKS system rather than the usual three parallel systems. It also made practical sense, since with TAC as the single integrator on the project, we knew they would take full responsibility for ensuring that the system functions properly."

The Klagshamn installation, completed in the summer of 2006, uses a coordinated approach to achieve more efficient operations and thus, energy savings. Traditional building management systems that control heating and ventilation are fully integrated with the technical systems for lighting, access control and intrusion alarms. Gains have been achieved through the co-utilization of system components, the use of a single supplier to plan and build, and through the sharing of relevant information between traditionally separate systems.

"Since TAC got involved so early on in the design phase, we were able to propose a modern, holistic approach," says Staffan Ceder of TAC Sweden. He continues, "This meant we could minimize the number of components and really integrate the building management and security systems properly, leading to several new and customer focused features."

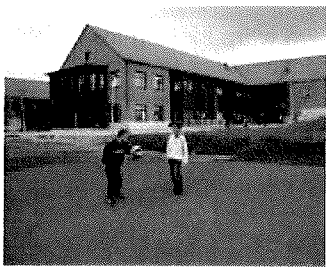
The Klagshamn System in Practice

The degree of integration achieved at Klagshamn School owes much to LONWORKS communication. For example, LONWORKS technology makes it possible to run a truly energy efficient heating and ventilation system. Every room has a presence detector connected to the intruder alarm system (TAC I/NET). The intruder alarm system communicates over a TAC Xenta 527 which transforms the signals to LONWORKS SNVT, and relays that information to the LONMARK certified TAC Xenta controllers in the HVAC system, thereby minimizing the heating and ventilation system's energy consumption when a room is unoccupied.

Programmed to maintain pre-set conditions, the system also enables ongoing energy savings. At 7.30am all classrooms are automatically set to economy-mode,

which means a temperature of 19 degrees Celsius and minimal airflow. When someone enters the room, the presence detector registers this and automatically sets the room to comfort-mode, increasing the airflow and raising the temperature to 21 degrees Celsius.

Should students decide to study with the windows open, the intruder alarm system registers this fact and communicates it to the heating and ventilation system. After one minute, the room goes on stand-by mode, and ventilation and radiators are turned off to save energy. When the windows are closed again, it takes another minute before the system goes back on comfort- mode. During the day, sensors continually measure the temperature and carbon monoxide levels, optimize the airflow and adjust the radiators to maintain a pre-set temperature and the correct carbon monoxide balance.



The Klagshamn system employs LONWORKS communication on many of the devices used for measuring electricity, energy and water as well as those used to control the indoor climate and lighting. This leads to all sorts of savings. For example, communication of presence information between the security system and the lighting system means classroom lights are automatically switched off twenty minutes after the classroom has been vacated. In the evenings, as the alarm system is switched on in one segment of the school at a time, the lighting in that section is automatically switched off.

The multi-usage of components such as presence detectors, magnetic door and window contacts normally only considered relevant to the security system, also brings efficiency gains. For example, the same detectors which are used to operate the ventilation system during the daytime operate for the intrusion alarm system at night.

When the school day ends at 4pm, the magnetic contacts holding the main doors open are released so they all shut automatically. This makes life easy for the school caretaker, since doors do not have to be checked and closed manually to prevent alarms, and the building is ready to be locked up completely. To make sure everyone inside the building knows closure is imminent, a message is broadcasted over the PA-system. If they need to enter the building outside school hours, pupils and staff can use their access card and PIN code.

While LONWORKS based meters are used for measuring consumption of electricity, energy and water, the TAC Vista FM program is used for reporting and following up on all data. This suite of Facility Management software solutions, built around an integrated database, gives a window into the cost and performance of a building. Using clear, readable presentations and charts, it collects and reports the information needed to manage operational, system and technical data throughout the building's lifecycle.

Accessible either from the school itself or remotely via a web interface, TAC Vista FM makes management of the Klagshamn system easy. A TAC Vista Workstation is located at the school while the TAC Vista Server is located at Malmö municipality's facility-surveillance room. TAC engineers can connect to the server from their office or any place with an Internet connection.

How does all this impact on students at Klagshamn School? Apart from being able to study in a safe and comfortable environment, they also benefit from e.g. perfectly synchronized wall clocks – also using LONWORKS communication - so there's no longer any excuse for being late for class! And thanks to a central display screen in the canteen, students can keep an eye on their school's daily energy usage. What better way to raise awareness among the upcoming generation and ensure that the energy-saving efforts made today will be perpetuated in the future?

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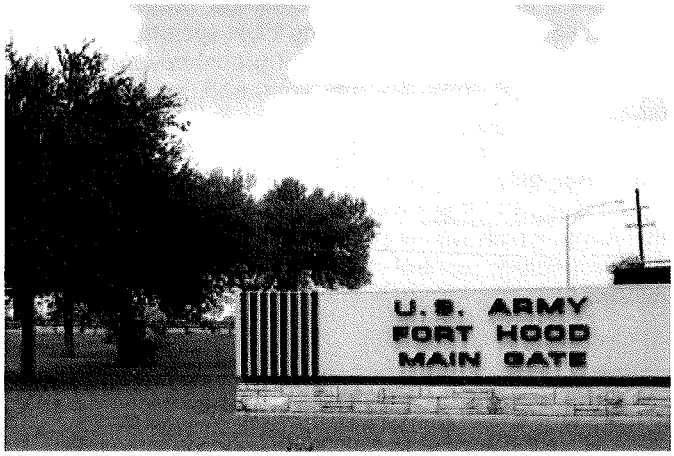
CASE STUDY







Fort Hood Leverages Technology to Manage Water, HVAC



Fort Hood, Texas, has leveraged technology and resources to manage installation-wide facilities and utilities through a Web-based system that is the first to be successfully implemented in the Army. The Fort Hood Energy Management Office has been working with the Construction Engineering Research Laboratory (CERL) of the U.S. Army Corps of Engineers (USACE) Engineer Research Development Center to implement an open communications system using LON technology, to serve as a single operating platform for facilities and utilities management. The utility management and control system (UMCS) is the Army's first that strictly adheres to guidelines developed by USACE and serves as the benchmark for the Army.

Through advanced energy technologies, the energy team is able to use the LON system to log in at a computer workstation and monitor, control and manage the heating, ventilation air conditioning and the water distribution systems on Fort Hood. The technology employs features that allow the operator to set schedules, change operating temperatures, turn equipment on and off, run diagnostics and identify systems that are not operating properly. The operator also receives notification of any alarms when signing in. He or she is alerted when equipment is not operating properly and can navigate through the Web-based system to investigate and take corrective measures.

Fort Hood, like other Army installations, has several different brands of direct digital control (DDC) systems in its facilities. As buildings were constructed or expanded, multiple proprietary systems were procured. With each proprietary system, additional software and hardware was needed for maintenance and operation making it challenging for Fort Hood to efficiently manage its incompatible systems.

Other options were researched, and USACE looked into an open communications protocol. With an open system information could be transmitted between different controls systems, achieving interoperability.

Fort Hood decided in 2001 to make LON the platform for its control systems. At that time, the post was entering negotiations for an Energy Savings Performance Contract (ESPC) to help conserve and manage energy use. As part of the ESPC, Johnson Controls installed new controllers with LON technology and a central operating station complete with servers to link facilities to a centralized workstation using the open communications protocol.

In addition to using the ESPC vehicle to improve HVAC controls, the ESPC will serve as a primary tool to achieve the revised energy reduction goals as mandated by Executive Order (EO) 13423, Strengthening Federal, Environmental, Energy and Transportation Management. The new EO requires that agencies improve energy efficiency and reduce greenhouse gases by reducing energy intensity by 3 % per year through 2015 or by 30 % by the end of fiscal year 2015.

Fort Hood continues to implement LON technology in existing and new facilities. Currently, the installation is managing 37 facilities with Circon, Distech, Honeywell, and Johnson Controls products in the system and is in the process of integrating 56 more buildings.

As part of the ESPC, Fort Hood gained a systems integrator, who works to integrate and transition LON compatible DDC units into the system. The systems integrator is a "no-cost" resource that is paid for by Fort Hood's energy savings.

Along with managing HVAC systems, the UMCS is serving as the primary collection point for building utilities metered data. This data is used in various ways, such as developing trends for energy use to assist in determining valid energy reduction projects or strategies.

"The data may also be used for billing reimbursable customers and to incite competition among organizations to be the best at conserving energy," said Bobby Lynn, Directorate of Public Works Energy Management Team leader. "It's clear that you can't manage what you don't measure."

Fort Hood also worked with CERL to develop a new tool to monitor the operating times of equipment on the system.

"The operating time is imperative to efficiency for Fort Hood," said Richard Strohl, DPW engineering technician. Whether equipment is operating when it should or when it shouldn't, captured data helps to evaluate the energy consumption, the dollar cost and the environmental impact of that consumption.

"The energy team is looking to use that as a tool to measure those impacts and find ways to be more conservative in the operation of our systems," Strohl said. "Reasonably, within 5 years, Fort Hood should have the majority of its large facilities integrated. Fort Hood has already started to expand the UMCS to include utilities like water distribution and electric distribution that will also soon be monitored through the Web-based system."

The open communication system has made the installation very flexible in this arena. Eliminating supervisory control devices from the building provides Fort Hood with a flat peerto- peer architecture that is open and interoperable. Integrating facilities and utilities into a single system improves efficiencies that are monitored and measured, and provides information on improving processes and operations to continue reducing energy consumption and emissions. The LON system allows Fort Hood to measure the reduction of greenhouse gases and track historical data on run time and consumption to improve efficiency.

"This is cutting edge technology that will help Fort Hood not only reduce energy waste and save dollars," Strohl said, "but it will also provide a standard platform to the Army, which will help reduce the Army's dependency on proprietary control systems that cost the Army millions."

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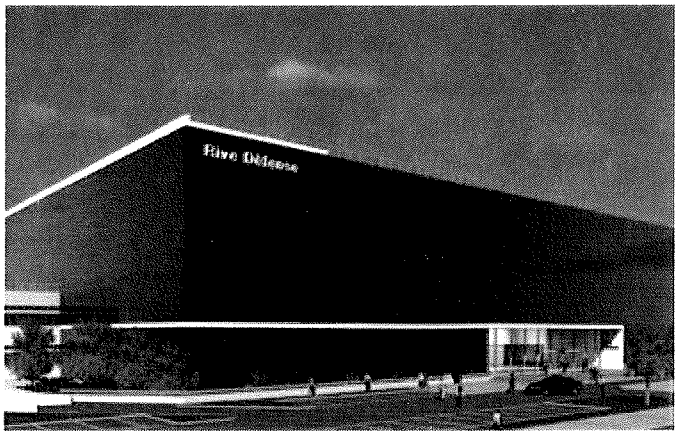
CASE STUDY







Improve the ROI of Commercial Buildings Using Flexible LONWORKS Office Automation



In Europe, space is tight and density is quite important. Buildings are no longer purchased by owners or companies. They are purchased by cash-makers and pure financial investors. The ROI is very important: the quicker it happens the better it is. A fully flexible LONWORKS room automation really increases the ROI of your building by maximizing rental revenue.

Located in Nanterre, near Paris, in the business area of La Défense, the Rives Défense office building is 47,000 m². As well as offices, it also includes conference rooms, private dining rooms, an auditorium and a fitness centre. The building has a strong architectural identity, based on transparency and lighting, especially noticeable on the inside decoration which was the work of the French designer, Alberto Pinto. The project consisted of extensive renovation work and an extension of the building complex. LONMARK certified products were specified, including Honeywell's XL12 and ZAPP (for lights, HVAC and control of blinds), and Newron System's NLFacilities, LNS Turbo Edition software manager tool for ensuring easy site management for non-skilled technicians who, for example, need to reconfigure the office layout according to wall position: a highly useful feature for minimizing inter rental time.

What did the Building Owner Want?

Buildings are becoming increasingly expensive. With less and less space in large cities, ground prices are extremely high and large companies can no longer afford to pay them. Today, only private equity companies can afford to pay the huge bill and a building is considered as a share! This is a profit driven market and buildings are an investment.

Here, the investor, HRO Group, wanted to renovate and expand an existing building with the latest technology in order to minimize maintenance costs and protect its investment. The renting turn over is important and this investor wanted to minimize the inter rental time period. For instance, if you do not rent 40,000 m² a week you lose 250,000 Euros!

So HRO asked Honeywell for a flexible and scalable solution to minimize the time needed to change the layout of the building. Honeywell chose the NLFacilities software from Newron System on the grounds that it enables every configuration – even the most complicated one – to be realized easily by a non-skilled technician within a very short period of time. The building tenant can save days on re-configuration thus minimizing the period of time the building stands empty and enabling HRO to maximize revenue. The rental revenue / maintenance costs ratio is optimized.

What is the Impact on Integration?

The graphical approach of NLFacilities hides the technology and allows a more intuitive way of integrating sites, even for people with little or no LONWORKS knowledge. Another key feature of NLFacilities is modelling LONWORKS expertise through zone templates: these templates include LONWORKS integration, bindings, configurations and graphic templates. These models are stored in a library providing solution templates: the more you integrate, the more solution templates you have and the less extra work needs to be done.

Modelling also allows the integrator to (re)use the expert's work on a remote site, the expert works at

distance and can manage several job sites from a single location: The expertise is centralized. In addition, it is possible to build the Scada whilst integrating the site.

Simplified Maintenance and Protected Investments

For the building manager, NLFacilities Runtime provides simplified maintenance. Once again, the graphical approach, by hiding the technology, offers an intuitive working method. The flexibility offered by the "easy to change" zones protects the investment by reducing the period between two rents. NLFacilities Runtime provides simple graphical operations to repair and replace devices, to change zones and move walls. The LONWORKS system also generates signifi cant energy savings: As Norbert Pageot, LONWORKS expert systems integrator, who worked on the LONWORKS network functionalities explains: "The unballasting functionalities of the XL12 control the lighting according to an external natural light threshold, which saves a lot of lighting costs". The zone functionalities of NLFacilities also allow savings on power control of air treatment via the "easy to use" occupied / unoccupied switch function.

In the End - The Customer is Happy

For the user, the simplicity of the ZAPP system is a real added value. This intuitive and easy to use remote control will help him/her control the lighting and the temperature in the office.

All these functionalities made the LONWORKS open system the best solution for the Rives Défense building. SFR, the second French mobile phone operator, has already rented over 37,000 m² of office space. By choosing a flexible and money saving technology, the building owners are sure to improve their return on investment, using highly interoperable products and software. When the building was sold last year, professionals qualified its 6% yield rate as "exceptional" (Source: BusinessImmo, June 2005).

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CASE STUDY





LON Technology Gives Fireworks Company More Bang for its Bucks

It's not unusual for a fireworks display to be choreographed to music. The companies that stage fireworks events, however, typically rely on expensive and proprietary commercial firing systems that are difficult – if not impossible – to expand or modify. Sonning Fireworks, a small company based in Sonning, England, wanted to design an advanced firing system that was expandable, safe, and cost-effective. The company achieved its goals using Echelon's LON control networking technology, an open, extensible architecture that lets devices from multiple vendors interact with each other. Its new portable firing system, called LONFire, connects fireworks to a LONWORKS based remote control system that has diagnostic and timing features. The fireworks are connected to channels and controlled via nodes. LONFire can fire 42 electric igniters per node (an igniter lights the fuse on the explosive). The system currently uses 10 nodes, but its capacity is virtually limitless, thanks to the expandability of LON systems. To network the system, Sonning used Echelon's FTT- 10 Free Topology Twisted Pair Transceivers. Echelon's free topology (FT) wiring supports any type of wiring method, so it reduces system installation time and costs. It also makes networks easy to expand because it has no restrictions on wire routing, splicing, and node placement. In addition, FT signalling supports communication over long distances – an important feature for Sonning, which needed to ensure safety in the field.



Robust, Flexible Framework

"LON technology gave us a robust and flexible framework in which to develop our firing system," says Sonning system designer and integrator Chris Clarke. "This let us concentrate on writing the firing system functionality rather than writing and debugging the complete system architecture."

To ensure a safe and trouble-free show, LONFire performs automatic tests to confirm that the fireworks are correctly connected to the system. This lets Sonning quickly detect any problems and fix them proactively, rather than discover them mid-show. Once the system is cleared for operation, the software downloads the show to the nodes as numbered events and then sends firing instructions to the nodes via the LON technology. Software developed by Sonning synchronizes the fireworks display to music. LONFire displays the music on screen, in either a waveform or spectral analysis, to let Sonning employees pinpoint exactly at what point in the music they want to fire the explosives.

Key Benefits:

- Automatic system diagnosis ensures safe, trouble-free shows that are perfectly synchronized to music
- Thanks to the expandability of LON systems, LONFire's capacity is virtually limitless.
- LONFire was developed at nearly half the cost of a proprietary system

The Sky's the Limit

Thanks to LON technology, Sonning was able to develop LONFire for nearly half of the cost of a proprietary commercial system. Clarke estimates that Sonning will recover its costs over two large shows. Not only is LONFire more inexpensive than large commercial systems, but it can also provide many extra features at a fraction of the cost of its competitors. Because LONFire can easily integrate with entertainment industry standard protocols such as DMX (which controls intelligent lighting, video, and lasers), Sonning can add features such as lights, video, lasers, and flames to its shows. With LON technology, the sky's the limit, says Clarke. "My ultimate aim for the system is to fire multiple, simultaneous shows at different locations, connecting the firing systems over a secure VPN over the Internet," he says. "This would be a first in the fireworks industry."

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