

High Flying Efficiency

Optimizing Airport Operations Through Retro-Commissioning

By William Tippin, DM CMC

Airports are like cities—they operate 24/7 and consume a tremendous amount of energy while producing a considerable amount of waste. In fact, an airport's operations and maintenance (O&M budget) constitutes a significant portion of its overall budget. It is under constant review, particularly in today's energy conscious and heightened regulatory environment.

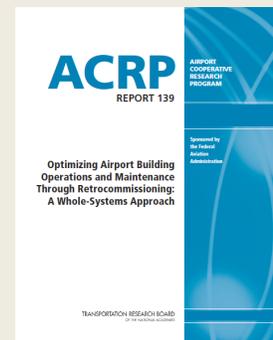
Modern airport facilities regularly document the working order of airport assets with a facility condition assessment (FCA). Typically, the FCA helps establish facilities maintenance and capital budgets and prioritize projects. However, rarely do FCA's diagnose systems performance. That's the role of retro-commissioning, which should be seen as part of the facilities O&M program.

Whether an airport facility manager is in search of operational cost savings, regulatory compliance, performance improvements, or all three, retro-commissioning—combined with whole-building systems O&M optimization—results in recognizable improvements.

Industry experience has proven that retro-commissioning reduces operating costs and improves occupant comfort, satisfaction, and productivity. NV5 recently worked closely with the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP) to write a report documenting the best practices for airport O&M optimization and the steps to delivering a successful retro-commissioning plan.

ACRP Report 139:
Optimizing Airport Building
Operations and Maintenance
through Retro-commissioning:
A Whole-Systems Approach

The guidebook offers airport industry practitioners a whole-building systems lifecycle approach to operations and maintenance (O&M) optimization that suits their unique needs.



O&M Best Practices

For the purposes of this discussion, we'll focus on energy management, energy audits, and retro-commissioning: three distinct, yet interconnected, O&M activities.

As ACRP defines it, energy management refers to the tracking and trending of energy use on a routine (i.e., daily, monthly, and annual) basis. The goal of any energy system, from HVAC to lighting, is to provide comfort and productivity to the occupants.

It's up to the facility manager to find a way to achieve those goals while balancing energy costs. Energy is provided through power purchase agreements and, when necessary, supplemental sources.

An effective energy management program includes utility benchmarking and energy audits. These will help streamline expenses by identifying opportunities for maximizing energy efficiency and reducing energy costs.

Many building operators use energy audits to make better short-term and long-term energy management decisions as well. In some cases, the audits are required by law.

The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) defines three different levels of energy audit in its Procedures for Commercial Building Energy Audits:

- Level 1: Walkthrough Analysis
- Level 2: Energy Survey Analysis and
- Level 3: Detailed Analysis of Capital Intensive Measures

In short, an energy audit analyzes a facility's energy consumption and recommends energy conservation measures to reduce energy consumption at a facility.

For instance, as documented in the ACRP report, Colorado Springs Airport conducted a Level 1 energy audit in 2012. In this case, the engineer performed a thorough site investigation, walked through equipment rooms, and reviewed the building automation control documentation. The energy audit findings provided recommendations for simple, low cost fixes, such as increasing the use of air handler return fans, and optimizing the chilled water pump usage. It also identified more costly capital measures, such as replacing cooling towers and concourse lighting.

What's missing in an energy audit such as the one completed by the Colorado Springs Airport is the correction and validation of system performance—the audit is simply that, a documentation of areas that need improvement. It's typically a hands-off evaluation that includes a report with recommendations that rely on the maintenance staff to implement and incorporate into a capital plan.

Retro-commissioning is the hands-on corrective action component of a comprehensive energy management program.

Hands-On Benefits

Retro-commissioning, as stated in the ACRP report, “involves investigating, correcting, and validating existing building performance as required to support the facility's mission.” The process uncovers and resolves problems that were created in the original installation, or as a result of age.

Typically, a retro-commissioning process incorporates three phases: planning, investigation, and implementation.

The planning phase allows the retro-commissioning team to develop the project execution strategies and proposed project schedule. The plan will likely include a site survey and the development of a condition assessment strategy, as well as performance testing plan procedures.

The investigation phase is where the team evaluates the existing operating parameters of the site or structure such as temperature, humidity, pressure, timed events, and CO2 levels. It also puts in place the data collection procedures of continued diagnostic monitoring throughout the retro-commissioning effort to evaluate system performance and improvements. At the end of the investigation phase, the team will provide a retro-commissioning report to document all efforts and provide specific recommendations for corrective actions. The implementation phase of retro-commissioning allows the team to execute low-cost and approved items found during their investigation. They will also develop a systems manual that describes the installed equipment, baseline operations, and the O&M practices necessary to keep the building operating properly. They also conduct staff training, as needed.

Retro-Commissioning at Work

In 2010, as documented in the ACRP 139 report, the Massachusetts Port Authority (Massport) initiated an energy efficiency investigation at Boston Logan International Airport (Logan). Part of the investigation was to evaluate current energy performance, identify

recommendations for improvement, and implement energy initiatives to improve efficiency and help Massport meet its energy goals. The initiatives ranged from lighting, HVAC, and controls upgrades, to cogeneration and renewable energy projects. Early in the contract, NV5 recommended and Massport authorized a retro-commissioning investigation of the central plant at Logan as a way to identify low-cost and no-cost changes that would improve plant operations and performance, and reduce energy consumption and greenhouse gas emissions. The central plant accounts for more than 50% of Massport's energy costs and greenhouse gas emissions (from buildings).

The investigation phase site visits allowed the retro-commissioning team to learn how the equipment was operated, to gather data on the equipment, and to selectively test different operating scenarios. Massport operations staff also provided records of the automated operating logs. The team conducted a systematic review and documentation of the existing operations to identify areas where the facility did not operate as intended, or where more efficient equipment or techniques could be applied, and then to identify methods to bring its energy efficiency to higher standards. The process focused on major energy-consuming equipment such as boilers, chillers, pumps, and associated distribution and end-use systems. The final investigation report noted findings, recommendations, and plan implementation for selected measures.

Subsequently, Massport selected certain projects for design and implementation under a capital project, and others to be implemented by the operations staff in conjunction with vendor term contracts.

The fee for the investigation phase of the project was approximately \$120,000, which included a holistic review of the airport's chilled water and steam/high temperature hot water (HTHW) generation and distribution systems throughout the airport, extensive field investigations and testing, and hydraulic modeling of the airport's chilled water system.

Nine energy efficiency measures were recommended for implementation, including upgrades to chilled water, steam/ HTHW, HVAC, and metering systems. NV5 recommended changes to the existing chilled water distribution system to significantly improve efficiency. The hydraulic system changes helped the existing system achieve significant energy savings and saved Massport approximately \$1 million by not having to buy a proposed new capital chilled water system.

Continuing Improvement

Improvement doesn't stop once your facility has gone through an optimization and retro-commissioning process!

Continued verification and monitoring is vital. Data acquisition and analysis software can help manage systems that operate outside of defined parameters. By establishing operating rules within the data acquisition and analysis software, facilities staff can manage critical operating parameters that affect system performance and energy consumption. This will help the facility to successfully achieve predicted energy profiles. Finally, consider regular external 'audits' or periodic site-visit reviews by technical experts to perform system checkups and, much like retro-commissioning, correct deficiencies. Periodic visits are critical to providing both accountability and positive feedback for superior results.

One final note — training and technology can further support airport building operations and maintenance. A well-documented and facilitated staff training and development program provides knowledge and continuing education skills, even as it enhances careers and likely improves job retention. Technology, in the form of building information modeling, is fast becoming standard practice in the industry. For a facility manager, these intelligent 3D models contain a vast amount of valuable data beyond the geometric location of systems in a structure. They often include maintenance and energy manuals, and specifications data. They are the ideal source for building maintenance scheduling and system analysis, asset



management, space management and even disaster planning. If your organization is planning a capital project, make sure your facilities manager has a seat at the table so that the right data is incorporated into the building information model to support operations and maintenance.

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