Case Study: The Jordan Office Building BAS

Introduction
Melissa Morris is the facility manager for the B & A company and is responsible for running the Jordan Office Building, a 150,000 - square foot - commercial property in downtown San Francisco. The building is over 40 years old, and the building’s control systems have been replaced at various times over the years.

Melissa’s company, B & A, has done a comprehensive analysis of all of their facilities and determined that they can substantially increase their return on investment by installing an integrated BAS (Building Automation System) at each facility. This is an enormous undertaking as many of the company’s facilities have older equipment and unique technology structures.

As the facility manager for the Jordan Office Building, Melissa has been tasked with determining how to effectively implement the new BAS technology within budget guidelines and the constraints/opportunities presented by the existing systems at her facility.

The New Building Automation System
Melissa’s company realizes that the advanced management functionality of a BAS will reduce their energy costs, provide greater functionality, and produce a significant ROI (return-on-investment) for the owner. Therefore, Melissa issued a RFP, (request for proposals), to some leading BAS makers, reviewed the responses, and selected a vendor.

The BAS selected is a modern, computer-based system that is capable of controlling all major building systems through a single interface. The system is capable of controlling thousands of individual devices, and can be integrated with other systems through an integration interface. Melissa’s challenge is to determine how to best integrate these features with the Jordan Office Building’s existing systems.

BAS Implementation Planning: Capabilities vs. Cost
In order to achieve the best return on investment for the BAS, Melissa has to understand one very crucial aspect of upgrading to a BAS: How much automation will provide the optimal ROI (return on investment)? To determine the optimal level of control, Melissa will consider the following in relation to the Jordan Office Building systems and their integration into the BAS:

1. **Enhances safety of the facility?** If yes, it is highly desirable, even if it does not show ROI.
2. **Provides a return on investment?** The level of control must provide a reduction in costs that will offset the cost of implementation.
3. **Provides enhanced functionality?** If the control will make the facility more efficient, comfortable, and attractive to occupants, it may be desirable even if it does not provide an ROI.

Technologies for Facilities Management
BAS Case Study
Assume that you are Melissa Morris, the facility manager responsible for integrating the new BAS with the existing Jordan Office Building systems. Work with your group to determine the final BAS profile that Melissa should use for each system based on the criteria identified above and the following resources:

Jordan Office Building system profile table
*Technologies for Facilities Management* coursebook
Experience and knowledge of your peers

Please answer the following case study discussion questions as you work to determine the appropriate BAS profile for the Jordan Office Building:

**Case Study Discussion Questions:**

1. Why is determining the level of control for each system important?

2. Which of the following phases of the building automation process best describes the state of Melissa’s facility before the BAS implementation? The facility where you currently work? Explain.
   a. Separate, Nonautomated Systems
   b. Separate, Automated Systems (correct)
   c. Separate, Automated Systems with Centralized Automated Monitoring

3. How can a TCO, (Total Cost of Ownership), calculation assist Melissa in determining how to integrate her existing systems into the BAS? Would the results of the TCO calculation be the same if Melissa’s facility was brand new?

4. How might the new lighting control save money in Melissa’s facility?

5. Life safety system enhancements are highly desirable even if they do not provide an ROI. Is this statement accurate, and if yes, why?

**General Discussion Questions:**

1. How many people have had experience with BASs?

2. What were some of the challenges you faced while working to install or integrate the BAS at your facility?

3. What resources were most valuable to you while working through the implementation of a new BAS?

4. What three pieces of advice would you offer to another facility manager who is tasked with this type of project?
## Jordan Building Profile

<table>
<thead>
<tr>
<th>Jordan Building – Existing Systems</th>
<th>New BAS System Options</th>
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<tbody>
<tr>
<td><strong>Energy management system</strong></td>
<td><strong>Energy Management Optimization</strong>: The BAS can accommodate complex schedules, determine optimal boiler and chiller start times based on interior and exterior temperature readings, is capable of controlling hundreds of different dampers and other devices.</td>
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<tr>
<td>The energy management system was installed in 1996. It controls boiler and chiller start times, and the main air duct dampers that supply air to each floor of the building. The system cannot control areas smaller than an entire floor. It is a fairly basic system, and is not integrated with any other systems.</td>
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<tr>
<td><strong>Life safety system</strong></td>
<td>The BAS can interface with the building’s fire alarm system to coordinate actions in multiple systems when a fire alarm occurs.</td>
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<td>The building has a fire sprinkler system with conventional flow detection and a fire alarm system connected to a central station. The fire alarm system was installed in the early 1990s, and is fairly basic.</td>
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<tr>
<td><strong>Elevator control system</strong></td>
<td>The BAS is capable of controlling thousands of lighting fixtures or relays, and can accommodate complex schedules, occupancy sensors, and coordination with other systems.</td>
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<td>The elevators are controlled by a digital control system that was installed in the mid-1990s. It provides basic operation, but does not allow for complex scheduling or “learning” trends or cycles. It is not integrated with any other system.</td>
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<tr>
<td><strong>Lighting control system</strong></td>
<td>The BAS is capable of managing boiler and chiller functions in great detail, including sensing conditions in hundreds of locations within the system, indicating which components may need maintenance, and can report on energy efficiency of individual components.</td>
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<tr>
<td>This system controls building interior lighting by controlling power to lights with a set of relays in the electrical closet on each floor. The system turns lights on and off according to a timer schedule. The system is not capable of controlling floors individually, and must turn all the lights on or off at the same time. It is not integrated with any other system.</td>
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<tr>
<td><strong>HVAC system</strong></td>
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<tr>
<td>The HVAC control systems were installed in the mid-1980s, and provide basic control of boiler and chiller functions. They are not integrated with any other system.</td>
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Case Study Challenge

Students need to outline how Melissa will achieve the best return on investment for the BAS, in relation to each of the existing systems at the Jordan Office Building. Students should be able to describe how they would determine the answer to the following question in relation to upgrading to a BAS: How much automation will provide the optimal ROI (Return on Investment)?

Possible approaches Melissa could use for addressing the integration of the BAS:

In the case of lighting control systems, Melissa currently has an inefficient system that can only turn lights on and off in the entire building. Today, it is possible to control lighting on individual floors, groups of rooms, or single rooms with a BAS. This would save a significant amount of money, but would require the installation of a substantial amount of equipment. BAS-controlled relays and sensors would have to be installed in areas where the control was needed, and wiring would have to be run to the BAS.

Melissa may perform a TCO (Total Cost of Ownership) exercise, and calculate the costs of installation versus the savings. Melissa finds that the cost of retrofitting so she could control individual rooms would be so expensive that it would require many years for the savings to pay back the initial cost. (If Melissa were installing this level of control in a brand new building, the payback would be far quicker because the initial cost would only be marginally more than a non-BAS system; but the costs of retrofitting an older building in this scenario meant that this level of control would be more expensive.)

Melissa may settle on an approach that is in between the existing system and control of individual rooms. In this approach, the BAS would control each floor of the building according to an individual schedule. The schedule accommodates normal working hours as well as a phased work schedule for the cleaning crew at night. As the cleaning crew moves from floor to floor, the BAS turns on lights when they are scheduled to arrive and turns them off when their work on that floor is scheduled to be finished. If special accommodations for lighting were required, it is now a simple task to adjust the schedule in the BAS with a few clicks of a computer mouse. This level of control was easier to accomplish than individual rooms or groups of rooms because each floor already had a set of relays that controlled the lights on that floor. The BAS was wired to these relays, allowing it to control individual floors.

In addition to the lighting controls described above, Melissa has to decide what level of control she required in all the other systems, and how they would interact. To do this, Melissa examined each system’s existing functionality, the BASs functionality, and the cost for achieving various levels of control. Through this process, she will be able to find the optimal ROI for each of the other systems connected to the BAS.
Case Study Facilitator Guide/Notes

**Recommended BAS Final Configuration for the Jordon Office Building**

Here is a recommended final configuration for the new BAS at Melissa’s facility:

**Energy management optimization:** The BAS now controls all boiler and chiller schedules, and determines optimal boiler and chiller start times based on interior and exterior temperature readings. The BAS controls dampers on each floor according to the same occupancy schedule that controls the lighting system.

**Life safety system:** The BAS connects the building’s fire alarm system to the HVAC system to close dampers to shut down airflow in areas where sprinkler water flow is detected. This will help to reduce the spread of fire.

**Lighting control system:** The BAS now controls lighting more accurately and saves substantial wasted energy.

**HVAC:** The BAS now manages boiler and chiller functions. Sensors were added to the critical components of the HVAC system to monitor conditions and send alerts to the BAS. It now alerts engineers when filters need changing, or when bearings are heating up (a sign of impending failure), and other critical system conditions. The BAS allows the chief engineer to track his energy efficiency on a daily basis.

**Case Study Question Answers/Feedback**

Why is determining the level of control for each system important? *To ensure a good Return on Investment; to enhance safety in the facility; and to make the facility more efficient, comfortable, and attractive to occupants (Ch. 10)*

Which of the following phases of the building automation process best describes the state of Melissa’s facility before the BAS implementation? The facility where you currently work? Explain (Refer to Chapter 10 in the *Technologies* course book). *Separate, Automated Systems (Ch. 10: p. 10-8, 10-9. Each system in the Jordan Office Building had its own control mechanisms).*

How can a TCO, (Total Cost of Ownership), calculation assist Melissa in determining how to integrate her existing systems into the BAS? Would the results of the TCO calculation be the same if Melissa’s facility was brand new? *TCO can be used to compare the implementation costs to the savings that can be realized. If Melissa were installing this level of control in a brand new building, the payback would be far quicker because the initial cost would only be marginally more than a non-BAS system; but the costs of retrofitting an older building in this scenario meant that this level of control would be more expensive.*
Case Study Facilitator Guide/Notes

1. How can using the new lighting features of the BAS save money in Melissa’s facility? *Lights can now be controlled on a floor-by-floor basis, allowing them to be turned off when the floor is unoccupied.*

2. How might the new lighting control save money in Melissa’s facility? *Ability to control lighting on individual floors, groups of rooms, or single rooms.*

3. Why are life safety system enhancements highly desirable if they do not provide a ROI (return on investment)? *Multiple systems can be coordinated for faster emergency response thus reducing risks to facility tenants, employees and visitors.*

4. What may be some challenges that employees face as a result of the installation of a BAS? How can Melissa manage these challenges? *Parts resupply issues and staff training issues for new system management (Ch. 10: p. 10-18, 10-19)*

5. Discuss your group’s recommendations for Melissa’s building in terms of the existing systems and BAS features outlined in the “Jordan Building Profile” table.

This case study was created with the generous assistance of Thomas A. Condon, RPA, FMA, Senior Consultant at SDI in Chicago, Illinois. Tom served as the technical advisor on the 2008 edition of BOMI’s *Technologies for Facilities Management* coursebook.