Why Upgrade Your Pneumatic Control System

The question has been raised regarding the benefits and payback of upgrading an existing pneumatic control system to a direct digital control system (DDC) and potentially related system improvements. The following information will provide a general discussion on this issue.

First, like most system upgrades today, a big part of the picture is the addition of centralized data gathering and the ability to use newly available information to monitor and optimize the control of the building systems. Instead of many independent control operations operating on their own, the typical DDC approach provides a means to integrate all the available information in a way that allows better and more efficient control. A typical list of benefits follows for reference:

*Improved comfort	*Web or remote access	*Resolved operating problems
*Reduced complaints	*Continuous monitoring	*Identified failed components
*Enhanced productivity	*Ability to trend data	*Reduced maintenance cost
*Reduced absenteeism	*Provided failure alarms	*Replaced outdated equipment
*Improved ventilation	*Energy savings	*More parts availability
*Optimized controls	*Graphical interface	*Better support

The general benefit is summarized in the following comment from Lawrence Berkley Lab in California:

Solid-state sensors and controllers used in DDC systems have considerable energy-efficiency advantages over conventional pneumatic systems. Substantial advantages are realized in calibration and maintenance, but the critical value lies in the accuracy and reliability of the DDC systems. These features can yield operational energy savings of 15% and greater when compared to the conventional pneumatic system. The inherently precise positioning of valves and dampers with EMCS control loops and blocks are responsible for these energy savings. For instance, to realize the energy-savings opportunity offered by VAV fume hoods, an 8:1 turndown ratio of the exhaust airflow is required. Pneumatic airflow systems typically lose accuracy at 25% of their span, resulting in the capability of only a 4:1 turndown ratio. Solid-state DDC systems provide the degree of precise airflow measurement and control that enables the operation of these VAV systems.

The sensors and controllers for pneumatic systems bleed compressed air through very small orifices to monitor temperatures and make control decisions. These devices lose accuracy and need to be recalibrated several times a year to be effective; any contaminants in the control air supply (oil and water carryover, etc.) can cause these devices to fail. Since there is no central monitoring of the control processes, the failure is undetected, and building performance and occupant comfort suffer.

On the other hand, the newer DDC systems use electronic controllers and sensors and computerized operating processes, which maintain accuracy for years and offer enhanced control options. The central monitoring system often identifies failed components and provides feedback of the control system performance that allows the building operators to identify problems early and often make corrections before the building occupants know there is a problem.

Pneumatic control devices also use this compressed air to provide the “muscle” necessary to operate the actuators that move dampers and control valves, which is still a viable option, but electric actuators are now available for most applications and offer enhanced performance. If electric actuators can be justified, they avoid the need for another component (and potential failure) to convert the DDC control signal to pneumatic actuation and are typically more accurate and reliable. The end goal for many building operators is to fully replace all pneumatic control devices and actuators, which allow the deletion of the required air compressor, air dryer, oil and moisture filters, etc., and related maintenance issues.

In summary, these types of control system upgrades often produce energy savings, but often the real payback is in improved temperature control, ventilation, comfort, employee performance, and reduced absenteeism. Additional savings in maintenance should also be considered, and remote monitoring can allow the selected control company to identify and resolve issues very efficiently and cost effectively.

This kind of upgrade is akin to buying a new car to replace a 30-year-old model. The old model continues to get harder to find parts and failure issues become more frequent while the new car requires limited maintenance and many enhanced features. The new features available on a car today provide better safety, comfort, fuel efficiency, and an enormous amount of usable information to optimize performance. The proposed control system upgrade is relatively similar and would provide a low maintenance solution with many benefits.