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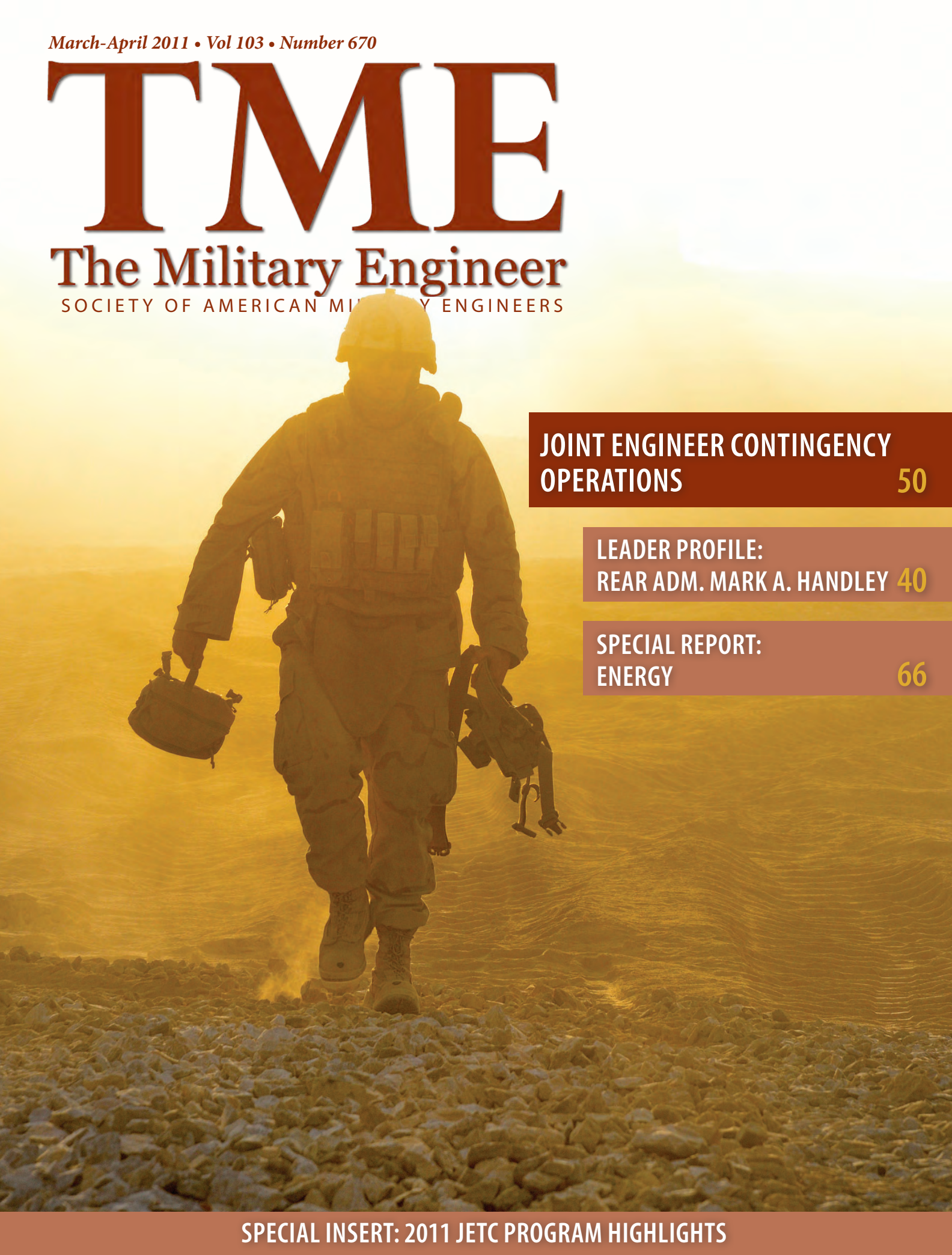

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Customizing Lighting Control

The Department of State's Office of Facilities Management Services has successfully tailored lighting control solutions based on building type, use and other factors.

BY ANDY WAKEFIELD, M.SAME

PHOTOS COURTESY LUTRON ELECTRONICS

Daylight harvesting and other energy-efficiency strategies implemented at the Department of State's Building 84 in Charleston, S.C., save more than 60,000-KWh per year.

The stateside operations of the U.S. Department of State comprise numerous buildings covering more than 6-million-ft^2, all of which is managed by the Office of Facilities Management Services (FMS). FMS serves as the operational backbone of the Department of State and is responsible for maintenance, repair, small renovations and efficiency of these facilities. As greater emphasis is placed on making the government more energy efficient, lighting control is seen as a key strategy for creating more efficient buildings.

Achieving greater energy efficiency is a primary goal of Donald Traff, Division Chief of the FMS Domestic Environmental and Safety Division. And because keeping the lights on is the single highest operating expense for a typical office building, higher even than HVAC, Traff focused first on improving lighting systems. The initiative wasn't driven by executive orders or department mandates but an inherent need to reduce energy use and costs. This provided the FMS team with greater flexibility and freedom to design and execute the best solution, but it also meant increased scrutiny and pressure to succeed, which would help ensure future lighting projects would receive funding.

GROUNDED WITH RESEARCH

Traff started analyzing data covering two months of research on possible lighting control strategies. Armed with the insight of having worked at one of America's largest lighting manufacturers, combined with knowledge from years of work with building controls, he was able to understand the range of technical solutions available with lighting control. To gain further knowledge of each supplier's capabilities and determine which solutions would be most appropriate for his facilities, Traff visited several lighting control manufacturers to witness demonstrations and evaluate options.

During his visits, Traff ascertained the quality of the products, interviewed the engineers, assessed the type of technical support the various companies would offer and discussed installation strategies specific to State Department buildings and projects. Traff learned about the products and software inside and out. With a greater understanding of the equipment and its capabilities, he was able to better design the application of the systems.

"We largely based our selection on the ability to implement a complete lighting system, from dimmer switches and ballasts to state-of-the-art software and controls," Traff said. "We chose a system that could be easily configured to provide us the maximum number of energy savings strategies per application."

THE FIRST RETROFIT

Traff and his team selected the Harry S. Truman Building, the main State Department facility in Washington, D.C., for its first retrofit project. The building's main corridor spans two city blocks and contains more than 150 lighting fixtures. But that's just a sliver of the building, which contains 34,000 fluorescent lights with ballasts in its 2.6-million-ft^2 structure. The limited space of the corridor was ideal for the first retrofit because the project would not interfere with the 8,000-plus employees who work in the building's offices. Also, fewer elements of a larger integrated lighting control system could be "tested" on site in the corridor.

In total, dimmable ballasts were incorporated into 156 lighting fixtures, testing fluorescent dimming as a lighting strategy. Dual-technology (infrared and ultrasonic) sensors were installed and programmed to detect when sections of the corridor are empty and shut off the lights until someone enters the space, testing occupancy sensing as a lighting strategy. The long corridor was split into four zones, and occupancy sensors were placed to provide uniform coverage throughout the extended hallway. New high-performance lamps also were installed at a color temperature that enhanced the wall colors to provide a more pleasing appearance.

By replacing this legacy lighting system with new fixtures, dimming ballasts and occupancy sensors, one State Department building garage saved more than 400,000-KWh, or about $64,000 in electricity costs, annually—an estimated 83 percent energy savings from the baseline.

The optimal light level was defined to balance energy efficiency with occupant comfort and safety. During the day, lights are at 30 percent of full output when the corridor is occupied, achieving a 70 percent reduction in energy from the baseline. The sensors automatically turn the lights down to 10 percent after five minutes of inactivity, providing additional savings. At night, lights are set to 10 percent and increase when employees or security workers enter the corridor. Despite using only two lighting strategies, this system still saves 30,000-KWh from the legacy lighting in the corridor.

In achieving an immediate 70 percent lighting energy savings, FMS also dimmed the corridor lights using a high-end trim feature that allowed the maximum light level to be set to a value of less than 100 percent. The human eye can barely distinguish between a 100 percent light level and an 80 percent light level, for example, and setting lights to less than 100 percent can significantly reduce energy costs.

Unexpectedly, building employees noticed and commented on the lighting improvements. In the 18 months since the corridor light project was completed, FMS has yet to receive a negative comment.

TESTING THE SYSTEM

The success of the Harry S. Truman Building corridor paved the way for other lighting projects. To gain concrete reporting and metrics, Traff wanted to expand the lighting-control strategies beyond using high-end trim, scheduling, and occupancy and vacancy sensing, and incorporate greater control and reporting mechanisms.

Using the Washington, D.C., FMS offices as the next test site, Traff and his team implemented as many lighting-control solutions as possible in the 7,000-ft^2 space. This time the goal was to measurably save energy by maximizing the use of daylight and minimizing energy waste in spaces with multiple functions: individual offices, open cube space and conference rooms. With an expected two-year return on investment, there are several key components of the fully integrated lighting control system at FMS, including:

Lighting-control software. State-of-the-art lighting control software enables FMS personnel to configure, control, manage, monitor and report on lighting usage from a central location to minimize maintenance and operating costs and achieve optimal energy performance. The system manages both electric light and daylight to simplify operations and improve the comfort and productivity of building occupants. The same software can be easily scaled to control the entire building in the future as the new lighting technology is more widely installed.

Light-level tuning. Dimmable ballasts were retrofitted throughout the space and programmed at 60 percent of full output, reducing energy and setting the appropriate light level for each space.

Daylight harvesting. Large windows naturally illuminate the space, allowing lights to be further dimmed when it is bright outside.

Occupancy sensing. Ultrasonic infrared sensors turn lights off when a space is empty and turn lights on when a person enters the space.

Personal light control. Although typical lighting is ideal for paperwork, it is usually two to three times brighter than is ideal for computer work. Localized dimming controls provide additional opportunities for individuals to reduce the amount of light in a space, creating a more ideal workspace for different tasks.

Controllable window shades. Solar-adaptive shading software automatically adjusts window shades based on the sun's position throughout the day. This capability effectively manages light, reduces glare, increases solar heat and decreases heat loss to save lighting and HVAC energy costs.

Scheduling. The lights are programmed using an astronomic time clock to control light relative to sunrise and sunset, as well as to specific office hours.

"The complexity and sophistication of a lighting system depends on the type and use of a building"

COOKIE CUTTERS ARE FOR BAKING

The complexity and sophistication of a lighting system depends on the type and use of a building; a parking garage is a simpler structure than an office building. Solutions and systems also can differ for retrofit installations or new construction. In short, no lighting control project can be done using a cookie-cutter approach.

The early successes of FMS are only the beginning. According to Traff, achieving greater energy efficiency will continue to be a primary goal for the many facilities under his division's oversight.

"The consensus is that there is no comparison to our legacy lighting systems. The dimming capability created a better environment. We have reporting where we didn't have reporting, and we have control where we didn't have control. Our goal is to use the metrics the lighting-control system provides to secure funding each fiscal year to incorporate more systems into each of our buildings."

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