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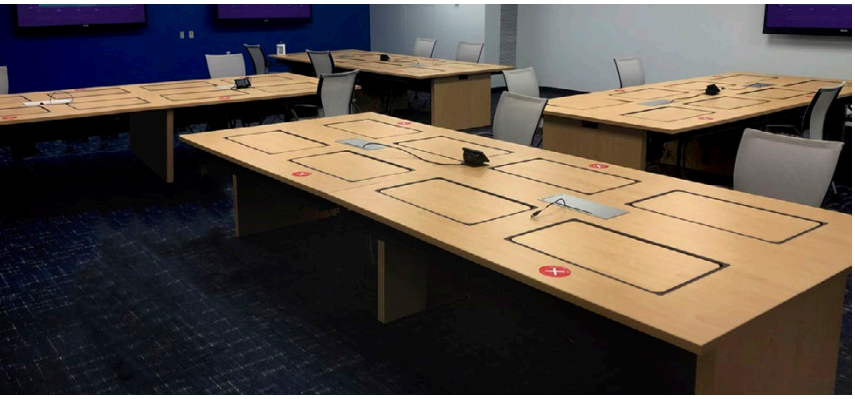

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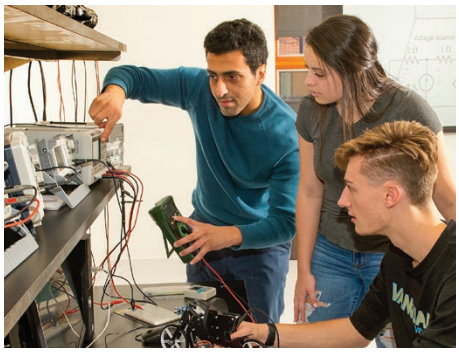

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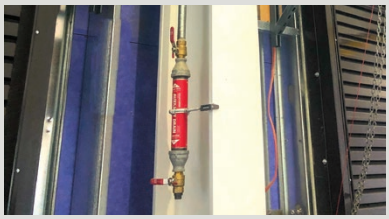

EDITOR'S LETTER

Can you believe it? We are already two months into 2022. If you are like me, you set a few resolutions going into 2022. So far, I have stuck to the ones I made. Keeping my resolutions has not always been easy—even this short time into the new year—but I have always liked a challenge. I'm sure that many of our readers do, as well.

On this resolution journey, I have endeavored to look at things I have done, including how I handled them and if I could have done better. Not surprisingly, I am finding that I could have handled many things better. When these situations arise, my first action is to go to that person, state that I was wrong, and make whatever amends that I can. I have at times offered an explanation as to why I messed up, but never as an excuse. This strategy does wonders. I have found it allows others to see me as human; it affirms their value, as well. One of my goals is to be a little better each day and to let the people in my life know how valuable they are. While I have not been perfect in this goal, I am working on continual improvement, not trying to attain immediate perfection.

As I write this, I anticipate the privilege of having dinner with my daughter and her boyfriend tomorrow. This time together is a privilege for many reasons and another opportunity to let my loved ones know that they are important and valued to me. We all have people that we touch, and hopefully they see us as sources of encouragement and as people who love them, warts and all. If 2021 taught me anything, it was this: we might not know what will happen tomorrow, but if we live in the present and value the time we get with our loved ones, friends, and associates, we can be a positive force in our small part of the universe.

Many times in 2021, friends and loved ones might not have known all that was going on in my life, but their kind words, shared laughs, and arms around my shoulder came at the right time and touched me when I needed them. My resolution is to provide that support for my friends—and even for random strangers that I meet. We might not know the struggles people are going through, so rather than waiting for an opportunity, I want to make these habits integral parts of my daily approach to all personal interactions.

Today as you read this, my hope is that you think of all the lives you continue to touch across your beautiful campuses and that you think about spreading your kindness to the students, faculty, and staff that you encounter. Your campuses are our future, and I would love to see the future be one of kindness, love, and support to all. What about you?

Thank you, as always, for letting us be a part of your day—

Ed Bauer

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Engineering is Global at the University of Mount Union

by Cynthia Mwenja, PhD

Hans Tritico, Assistant Professor of Civil Engineering at the University of Mount Union, is a water resources engineer who studies the impacts of dams and fish passages to guide regulatory decisions regarding these structures. He also teaches the innovative Global Engineering class at Mount Union, in which students design and build a project in another country using civil engineering approaches informed by active orientation to the country's culture and language.

Mount Union established its engineering program twelve years ago, with a vision for developing students who could offer unique strengths to the field. The five engineering degree programs continue to rest on the four pillars used for the school's development, each working in concert with the others to contribute complementary assets to this distinctive curriculum. One pillar, "Building Effective Leaders and Communicators," relies on the school's core curriculum of a broad-based liberal arts education. Mount Union Civil Engineering 2016 graduate Taylor Cline—now a Lead Project Engineer at CESO—says that she did not appreciate this aspect of the course of study until much later. At the time, she says, she thought, "This is dumb; I don't need these classes," but now she is thankful for required to take courses in a variety of disciplines. She says that she often consciously draws on the liberal arts values expressed in Mount Union's mission of preparing students for "fulfilling lives, meaningful work, and responsible citizenship."

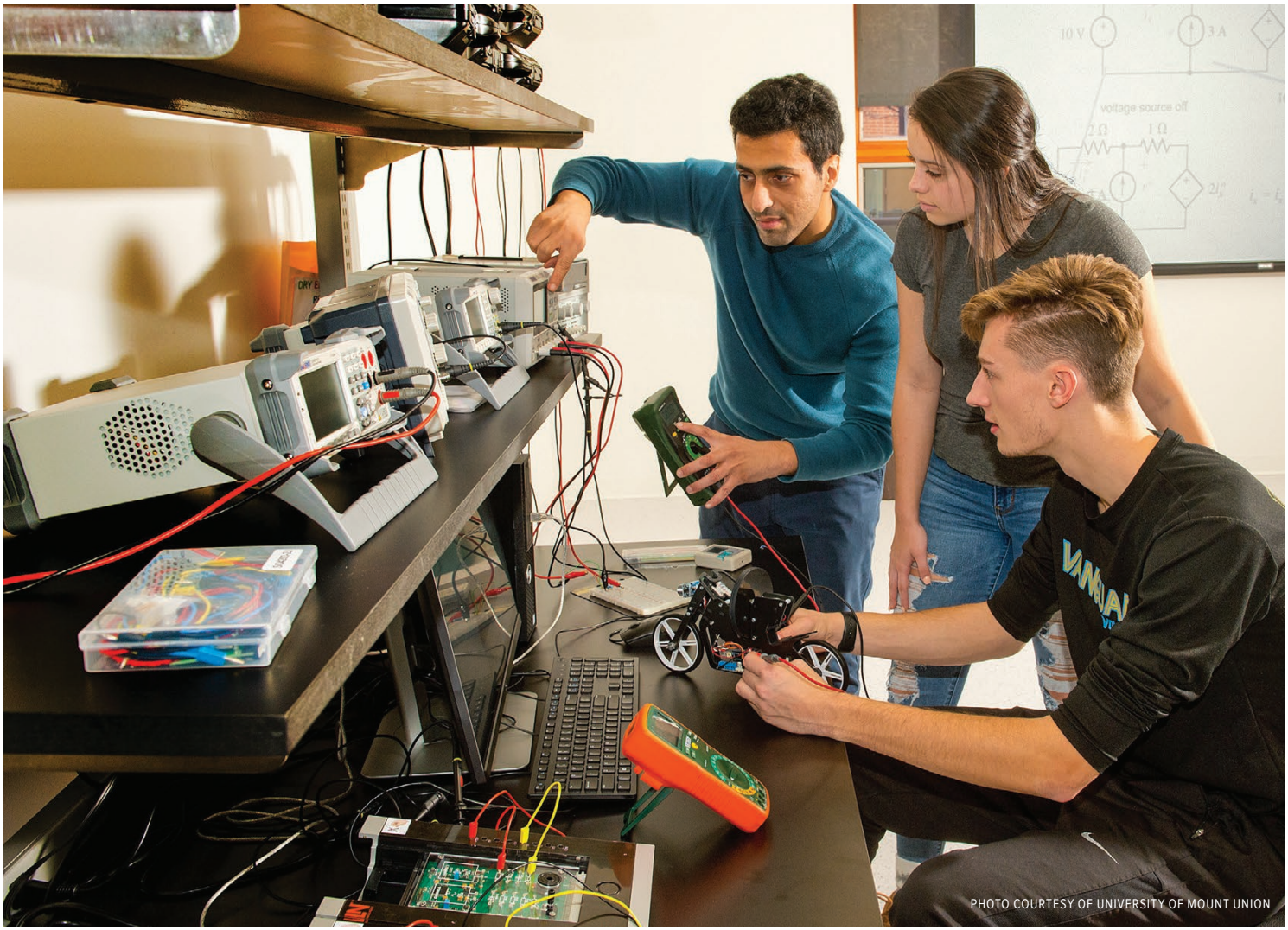
Another of the engineering program's pillars, "Integrating Engineering Knowledge with Essential Business Skills," is expressed in two ways. First, the School of Engineering shares a building with the School of Business, so interactions with that program are facilitated by proximity. Additionally, two classes integrate engineering and business content: first-year engineering and a product design course. These classes give Mount Union engineering students a broader base of preparation than just applied sciences. The next pillar, "Providing Extensive Hands-on, Real World Engineering," requires that all classes in the school include a lab or design project. Lastly, the pillar of "Requiring International Engineering Field Experience" relates to Mount Union's existing strong study abroad program, and the Global Engineering class is a required part of the course of study for every engineering student.

Global Engineering Class

Tritico has taught Mount Union's Global Engineering Class for five years; a co-teacher has joined him for the past three. Lecture topics in the class include subjects such as global ethics, international trade, cultural attitudes, and attention to the availability of materials and design components in specific locations. Tritico says that the course continues to be refined year after year, but the current iteration includes one class day each week focused on lecture and hands-on work, while another class day centers on studying the culture and language of the country the class will visit that term. Tritico says that he certainly never envisioned teaching language and culture as an engineering professor, but the subject matter is exciting and different. He adds that this aspect of the class demonstrates a practical reality of the professional field: engineers who get contracts or jobs in different countries must learn local communication skills and cultural norms in order to effectively complete their work. Students earn three credit hours for the on-campus portion of the class; an additional credit hour is earned for the international part of the course. While previous classes have gone to Belize, students in this year's class will go to either Brazil or Nigeria, and the school has future plans for a group to go to Abu Dhabi in the United Arab Emirates.

Class Projects

The required Global Engineering class, with its international travel component, centers on a design/ build project. This class is generally taken in the junior year, and until the Covid



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pandemic began, every graduate had worked internationally, due to this class. The Spring 2020 class had to cancel its planned trip; they pivoted to an international speaker series in which alums and other engineers shared experiences of working across five continents. The program again had to make contingency plans for Spring 2021. Instead of students traveling to Brazil, representatives from the Juara Foundation joined students at a camp not far from campus for twenty-four days. After the students built the prototype, the Juara Foundation representatives learned how to build the structure, then went to Brazil and tried to build a replica.

This spring's class has been approved for travel. Tritico will take two groups on separate ten-day trips to work with Juara in Brazil, while another professor will take a group to Nigeria to complete a similar project. This year's Global Engineering students have built on the work of the Spring 2021 group to further improve the design of a self-contained solar-powered remote-sensing station. Tritico describes the building as a "picnic structure with a roof and a box for the electronics." The current class is now trying to design a more mobile structure that can be loaded in a pickup truck for easier transport along the rough rural roads.

The design includes a weather station, microphones to identify animals, and a seismograph, so it draws on multiple types of engineering specialties. The station also connects with the internet over a distance of about a mile—and across a lake. This connection allows the collected data to easily be made available online, where it will be stored in a password-accessible website. Because the station is designed to perform many tasks simultaneously, this year's students are trying to decrease the size of the structure to minimize power usage, as well.

This year's Global Engineering students have built on the work of the Spring 2021 group to further improve the design of a self-contained solar-powered remote-sensing station. Tritico describes the building as a "picnic structure with a roof and a box for the electronics." The current class is now trying to design a more mobile structure that can be loaded in a pickup truck for easier transport along the rough rural roads.

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Juara Foundation

Established in 2014, the Juara Foundation is a non-profit based in the Pantanal—the world's largest wetlands—which connects Brazilian citizens with international scientists. Juara's Board President, Ethan Shirley, coordinates projects with several universities as part of his job responsibilities. Tritico did sabbatical work in the Brazilian city where Juara is based, and a mutual colleague introduced him to Shirley. Once Tritico heard about Juara's projects, he became interested in developing a collaboration between Juara and Mount Union.

Shirley says that international engineering generally—and Juara's work specifically—comes down to one word: "multi-disciplinarity." Juara's projects draw on expertise of engineers, scientists, biologists, and even musicians. The music program grew out of visit to a Brazilian orphanage that had a room full of unused musical instruments. Some people involved with Juara happened to be musicians, so they started a music program that has grown to serve over a hundred kids and has sparked the creation of other youth music programs, as well.

Shirley points to multiple connections between music and environmental science. Juara has had hydrologists who work with the sound of water flow, and other scientists who have taught the student musicians about the science of sound.

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Additionally, he points out that the best way to find animals in the wild is often through hearing them first. The remote-sensing station project that Tritico is overseeing relates to these ideas by recording bio-acoustics through time, at levels both within and below the human hearing range.

Shirley appreciates working with the Mount Union students because of the breadth of their preparation, both in the liberal arts and in the School of Engineering. Every real-world project needs a different skill set, he says, and those skills need to extend further than issues of design and re-design. Successful engineers need to be able to mockup their designs and consider the material and cultural contexts of the project. In these ways, Shirley says, "Multi-disciplinarity is crucial to being a successful engineer."

Additionally, Shirley appreciates the attention Tritico gives to the cultural aspects of engineering. With increasing globalization, he points out, even local jobs become international by default—people may now be based in one country but work with colleagues all over the world. Engineers need to be ready to work productively with people from different cultures rather than trying to impose a singular set of cultural norms on others. These considerations extend to building designs and materials, too; effective choices in one location may not be practical in another. Since Mount Union's students have the opportunity to learn these realities while still in school, they will be better prepared for their careers.

Intersections of Liberal Arts and Engineering

While the Global Engineering class was the biggest factor in Cline's decision to attend Mount Union, she now realizes that she benefitted from many aspects of the liberal arts model, particularly the small class sizes and ability to really get to know her professors. Cline says that, as her advisor, Tritico was "always there, always helpful, and always cared about stuff outside of school." Tritico talked with Cline many times to help her figure out which engineering specialization would be right for her. Her Global Engineering class project was an aquaponics design for a school in Belize; she took part in

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Tritico's Global Engineering Class lecture topics include subjects such as global ethics, international trade, cultural attitudes, and attention to the availability of materials and design components in specific locations.

designing the storage tanks. She says that getting to travel and both design and build a project was fantastic experience that let her see all the aspects of the field—"how it actually works," as she says.

Crucially, she and her team learned one of their biggest lessons on the first day in the country: civil engineers must be flexible and able to re-think their designs on the fly. In this case, the team had to scratch the entire plan they had worked on all semester because the materials they needed were not available. They ended up cutting and shaping rain barrels that were locally available, and the new plan ended up being cheaper and more practical.

While Cline now specializes in traffic engineering—so her current professional work is quite different from the work she completed in Belize—she still draws on mindsets she learned from Tritico and the other Mount Union engineering professors. Cline appreciates the way Tritico challenges students to consider solutions from multiple angles and to think in ways that may be unconventional or uncomfortable. Cline has also sought out other opportunities to travel internationally for engineering work; she traveled to Calcutta to participate in various aspects of designing a child development center, including cost estimation, site preparation, and designing the water and sanitary systems.

In the Global Engineering class, Tritico provides a rich, multi-faceted--and ultimately highly practical--experience that his students can draw on as they begin their own careers. While every engineering project is unique, each one relies on widely applicable skills of flexible thinking and considering cultural context when choosing materials and designs. With his thoughtful and ambitious course design, Tritico holds the space for his students to not just learn these skills intellectually but to embody them in working at Mount Union and beyond.

ABOUT THE AUTHOR: Dr. Cynthia Mwenja teaches Composition and Rhetoric at the University of Montevallo.

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MAINTENANCE AND TECHNOLOGY

Prevent Flooding with Proper Auxiliary Drain Maintenance

by George McHugh

As temperatures drop below freezing, private universities are at risk for compromised life safety, facility damage, and slip and fall liability from frozen fire sprinkler system flooding. University administrators and facility managers can prevent these issues with a proper maintenance plan for auxiliary drains. Knowing where all the auxiliary drains on dry fire sprinkler systems are located and performing preventative maintenance on a timely schedule can save a facility thousands of dollars every winter.

Dry fire sprinkler systems protect areas that cannot be kept over 40° Fahrenheit, such as parking garages, stadiums, overhangs on building entrances, and more. Despite the name "dry," condensation forms in the sprinkler pipes of these systems and—by design—will accumulate in assemblies known as auxiliary drains, low-point drains, or drum drips.

Emptying the condensation accumulated in auxiliary drains is a vital part of fall and winter maintenance. Freezing temperatures can freeze and expand the water, which can break the auxiliary drain. A broken auxiliary drain will release the air pressure in the dry system, thereby activating the system and causing flooding, property damage, and an unprotected facility while the system is being repaired.

Facility managers can prevent this damage with a simple and consistent maintenance plan; all this plan requires is locating all the facility's auxiliary drains and keeping them empty.

Step One: Locating Auxiliary Drains

What do auxiliary drains look like, and where can facilities personnel find them? Maintenance personnel can refer to building codes for some of the answers. NFPA 13: Standard for the Installation of Sprinkler Systems describes an auxiliary drain as two 1" valves, a 2" by 12" condensate nipple, and a plug or cap. Essentially, this assembly looks like a piece of pipe with valves that have handles on either end. The code also requires the auxiliary drains to be labeled, so there should be a hanging sign or other identifying marker that says, "auxiliary drain." The exact look may vary from system to system, as some systems use consistent, pre-assembled drains and others use extra components assembled in the field. Some installers leave a plug or cap on the bottom, while others attach a drain line.

Locating every auxiliary drain can sometimes be more difficult than knowing how to identify them. The number of drains on a system varies, and

a single drain missed is all that is needed to cause a break. Auxiliary drains are part of dry or pre-action systems which, as mentioned above, protect areas such as stadiums and parking garages where the temperature cannot stay above 40°F. The drains are required to be in accessible areas, meaning there should be no barriers to prevent service.

The code also requires a sign or map listing the number and locations of all auxiliary drains in the system. However, many system designers, installers, and code enforcers in the industry are unaware of this requirement. If a university's system does have this sign, it should be located near the dry valve, which should be in a heated room or enclosure with other equipment for that system. If a campus system does not have this sign, facility personnel will either have to ask the system installer or attempt to manually locate all of the drains.

To aid in the process of locating drains, some manufacturers offer water detector devices. These devices can easily be installed on each drain to send visual and/or audio alerts and remote notification when a drain needs service. These alerts simplify drain location and, with proper attention, prevent personnel from overlooking drains.

Step Two: Performing Drain Maintenance

Once personnel locate a drain, how should they perform maintenance? This process is simple, but careful attention should be paid to the order of the steps. The upper and lower valves on the drain should never be open at the same time. Having both open compromises system pressure and activates the system as if it were tripped. Here are the basic steps for maintenance personnel to follow:

1. Close the upper valve.
2. If there is one, remove the plug or cap at the bottom of the drain.
3. Open the lower valve.
   NOTE: Unless the drain is attached to a drain line, maintenance personnel should have a bucket ready to catch drainage.
4. Allow any accumulated water to drain.
5. Close the lower valve, open the upper valve, and allow for additional water to accumulate.
6. Repeat step 5 until no more water drains from the valve.
7. Close the lower valve and replace the plug or cap (if there is one).
8. Open the upper valve.

This process should always end with the lower valve closed and the upper valve opened to allow for the proper accumulation of more condensation.

Step Three: Service Frequency

NFPA 25: Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems provides requirements on when to service drains: after system operation and in preparation for cold weather. After the system operates and is reset, there will be residual traces of water left in the pipes to drain. When preparing for cold weather, water removal prevents freezing.

In both circumstances, the code requires emptying drains daily to start. If several days in a row reveal no water accumulation, the frequency could be lengthened to once every few days or once every week, for example.

However, when temperatures fluctuate between below and above freezing, daily emptying may be the best option. Temperature fluctuations below and above freezing are the biggest cause for broken auxiliary drains, due to uneven thawing and re-freezing of the water.

Step Four: Simplifying the Plan

While the physical act of emptying an auxiliary drain is simple, there is potential for human error in locating every drain and performing maintenance with the correct frequency. Some auxiliary drain accessories on the market, like the water detector mentioned above, can simplify this process.

Flood elimination devices can be installed as a fail-safe above the auxiliary drain to prevent a flood should the drain break. These devices detect a sudden rush of pressurized water and restrict the flow to the drain to eliminate the flooding that would normally occur.

Heated cabinets that encase the drains in a temperature-controlled environment provide more flexibility in draining schedule. With an energy-efficient heater to prevent the drain from freezing, daily draining is not necessary. Self-maintaining and automatic options also decrease the need for manual service.

Heat trace wiring is also an option. Typically used as a method to protect small sections of wet pipe systems from freezing if they need to traverse unconditioned areas, it can also be used on dry systems. It is, however, the most expensive option to install, maintain, and operate for campuses that are trying to keep an entire system or multiple auxiliary drains safely above freezing temperatures.

A Solid Plan to Save Money

Proper auxiliary drain maintenance keeps a university's dry fire sprinkler system in working order to best protect lives and property from fire damage. Such maintenance also saves thousands of dollars in facility damage by preventing freezing and flooding. Whether following this maintenance guide or relying on some accessories to help, administrators and facility managers can protect their university's personnel, property, and budget with a solid plan for preventative auxiliary drain maintenance.

ABOUT THE AUTHOR: George McHugh and his family have been involved in the fire sprinkler industry since the founding of AGF, and the introduction of the AGF TESTANDRAIN valve more than 30 years ago. Currently serving as vice president of AGF Manufacturing, McHugh is responsible for the development, introduction, and manufacture of specialized valves and unique products specifically designed for the fire sprinkler industry. AGF is involved in NFSA, NFPA, SFPE, ASPE, and AFSA. McHugh is a strong proponent of domestic manufacturing and looks forward to serving the fire sprinkler industry and continuing the tradition of service started by his father, George McHugh III.

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SELECTING LIFE SCIENCE ENCLOSURES

by David Wasescha

The importance of life-science research is at an all-time high. With the pandemic producing new research goals—and aided by new funding—labs are rapidly finding new ways to conduct science. Complicating the situation are inflationary pressures created by the pandemic, driving the cost of science to entirely new levels. Many of these costs are unavoidable.

Frequently, producing cutting-edge discoveries requires the use of costly facilities and instruments. Instruments such as analyzers and microscopes can cost more than a pandemic-priced home, and renovations of laboratory spaces to provide high flexibility have become the norm. Despite the high costs, these elements help to push forward our knowledge and understanding of science and human health.

Within the walls of these growing life-sciences laboratory spaces are not just million-dollar instruments and flexible seating, but critical enclosures and hoods that support scientists each day. The centerpiece of nearly any bioscience-focused laboratory is the biosafety cabinet, or BSC. As decision-makers consider biosafety cabinets for campus laboratories, they must keep long-term goals in mind. These goals may include a focus on sustainability, as well as maintaining a level of flexibility that ensures product relevance for current and future challenges.

Understanding the Science

By and large, the criteria for properly handling life-science samples have not significantly changed for the last several decades. Cells, viruses, and other biologically significant structures are often fragile and may be easily contaminated, so they must be handled in a sterile environment. If samples are not protected, the worst enemy of a life-science researcher is likely to occur: contamination. Even the slightest contamination of biological samples may create significant disruptions to a laboratory's research focus, potentially ruining years of findings with one simple mistake.

To protect sensitive life-science work, samples at risk for contamination are typically handled in laboratory hoods that produce High Efficiency Particulate Air (HEPA) filtered air into the hood's internal working area. Enclosures that provide only clean HEPA-filtered air are known as Laminar Flow Hoods or Clean Benches. Clean Benches provide a clean, sterile work area but offer no protection to researchers from hazardous samples, so therefore have limited use. These enclosures are regularly used for simple non-hazardous work, including polymerase chain reaction (PCR) experiments.

Because of the high interest in medically-significant research, investigators often utilize human cells to model biochemical or physiological behaviors and to evaluate drug candidates in vitro at a fraction of the cost of in vivo testing. Human cells are biohazardous and pathogenic in nature and must be handled in a sterile enclosure that simultaneously contains hazards to protect researchers. The most common enclosure offering both product and personnel protection is the Class II Biosafety Cabinet.

Class II biosafety cabinets are the workbench of the life scientist. They are safety devices, sterility devices, and benchtops, all contained in a large stainless steel enclosure. To provide user and sample protection, biosafety cabinets utilize an interior blower that draws air into the hood and purifies the air through HEPA filters before returning air to the work area of the hood or back into the lab. Because of the importance and prevalence of Class II biosafety cabinets in life-science laboratories, recognizing the impact these products can have towards meeting sustainability goals, accelerating science, and providing flexibility as research changes will ensure that campus research is well-supported.

Sustainable Operation

For some laboratory hoods, such as ducted chemical-fume hoods, operating costs are quite extreme because of their requirement to exhaust tempered air from the research facility. Due to high costs associated with chemical fume hoods, many cost-saving means have been generated, including the following: implementing high performance (low flow) models, reducing daily operating time where possible, installing intelligent exhaust control systems to limit air usage, and employing "shut the sash" energy-efficiency campaigns when high-density fume hoods are installed.

One clear challenge for sustainability concerns is that operational efficiencies are not as obvious with biosafety cabinets. Biosafety cabinets typically recirculate air back into the room, and this self-contained design consumes very little energy over the life of a cabinet. A typical non-ducted biosafety cabinet has zero impact to building HVAC costs. Operationally, a typical 4' biosafety cabinet consumes 200 watts, or 1.6 kWh in an eight-hour workday. Annually, a BSC costs around $50 if operated daily for eight hours. This cost is minimal when compared to a fume hood, which may cost thousands of dollars to run per year. But evaluating a biosafety cabinet's sustainability contributions goes beyond baseline energy consumption figures. With operational costs for biosafety cabinets so low, sustainable operation can be recognized not in energy savings, but in reducing the wastefulness of the biosafety cabinet's components and service requirements. Selecting biosafety cabinets with a cost-effective price point typically results in more frequent and costly HEPA filter replacements—a service that places a toxic sterilizing gas into the biosafety cabinet, generates biohazardous waste for incineration, and generates emissions from the visit of a servicer. These blind costs are difficult to record, yet they directly impact the sustainability impact of a cabinet at a facility.

Research is constantly changing and growing, and with those changes come shifting needs and expectations from equipment in the lab. Biosafety cabinets are no exception. As safety devices, biosafety cabinets have historically had limited flexibility.

Flexibility

Research is constantly changing and growing, and with those changes come shifting needs and expectations from equipment in the lab. Biosafety cabinets are no exception. As safety devices, biosafety cabinets have historically had limited flexibility. Many life-science laboratory employees have become frustrated with the process of identifying a singular Class II biosafety cabinet for their laboratory because BSCs come in multiple configurations, depending on application. Common questions asked during the selection of a biosafety cabinet include: Class I or a Class II? What is the difference between Class II Type A2 and Type B2 BSCs? Do I need to vent my biosafety cabinet at all? Can I convert my cabinet between recirculating and ducted designs? The questions go on and on.

Today, biosafety cabinets are designed to last multiple decades, so the decision to purchase a biosafety cabinet is an exceptionally long-term

commitment. Fortunately, an easy choice exists: the Type C1 biosafety cabinet. Class II, Type C1 BSCs provide all of the safety and comfort of a standard biosafety cabinet. Personnel and product protection are provided. Furthermore, Type C1 BSCs are flexible and may be converted between recirculating A mode and B mode, which is a configuration that allows for safe handling with chemical fumes used in microbiological procedures. This flexibility can eliminate frustration when purchasing a biosafety cabinet, because the Type C1 is suitable for any application a researcher may encounter in the laboratory. Facilities personnel responsible for selecting biosafety cabinets can rest assured, knowing that providing Type C1 BSCs to their scientific community will satisfy all research needs.

Planning for Automation

The prevalence of automation systems in laboratories, particularly liquid handlers that eliminate laborious bench tasks, is increasing exponentially due to decreases in cost and increases in availability. With automation comes large instruments that carry out work previously performed by laboratory research associates, including work that is biohazardous in nature. The vast majority of automation systems are large and do not fit into standard biosafety cabinets, but larger automation-specific biosafety cabinets are available and must be considered when planning a facility's overall ability to support advanced scientific discovery. Decision-makers should consult with automated instrument manufacturers, biosafety cabinet manufacturers, and the campus safety office to ensure seamless integration of these complicated devices within the campus facilities.

Navigating Next Steps

Selecting biosafety cabinets requires careful planning prior to execution. With any safety product, planners need to engage their support networks before rushing to purchase, first by consulting with the campus biosafety office for guidance on specific requirements or configurations recommended for biosafety cabinets in the campus facility. Planners should also engage in-house and vendor technical resources to understand all available options, including those that best fit campus research interests. And most importantly, decision-makers should evaluate how a biosafety cabinet purchase will support not only current needs, but also important discoveries in the years to come.

ABOUT THE AUTHOR: David Wasescha, Director of Biosafety Products, Labconco Corporation, oversees Labconco's applications and product management groups for life-science enclosures. For several years David has been involved in the design, testing, and use of laminar flow products, including Class II biosafety cabinets. He is a member of both the American Biological Safety Association International (ABSA) and the Controlled Environment Testing Association (CETA) and is also involved with the NSF/ANSI Standard 49 Joint Committee on Biosafety Cabinetry.

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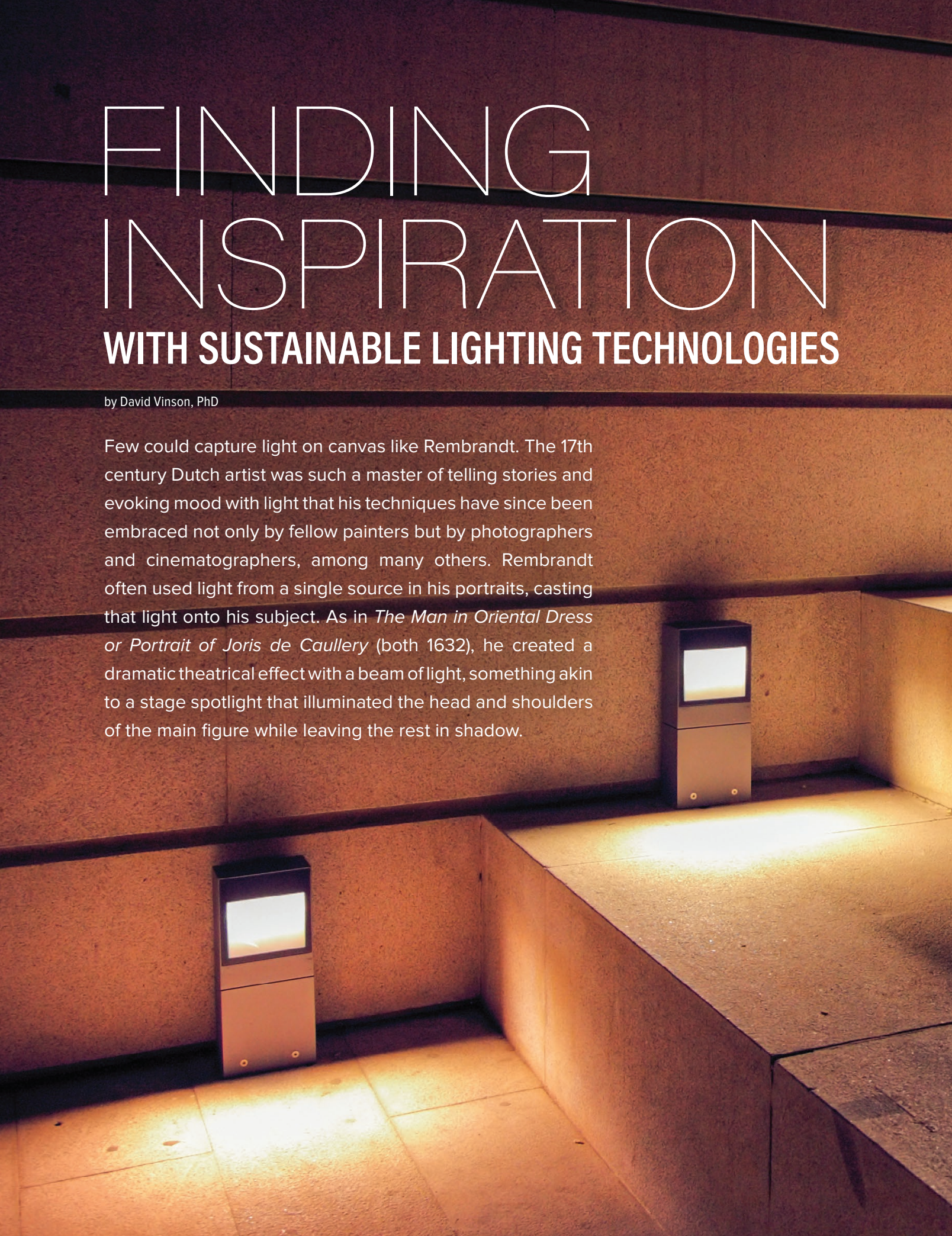
FINDING INSPIRATION

WITH SUSTAINABLE LIGHTING TECHNOLOGIES

by David Vinson, PhD

Few could capture light on canvas like Rembrandt. The 17th century Dutch artist was such a master of telling stories and evoking mood with light that his techniques have since been embraced not only by fellow painters but by photographers and cinematographers, among many others. Rembrandt often used light from a single source in his portraits, casting that light onto his subject. As in *The Man in Oriental Dress or Portrait of Joris de Caullery* (both 1632), he created a dramatic theatrical effect with a beam of light, something akin to a stage spotlight that illuminated the head and shoulders of the main figure while leaving the rest in shadow.



He even inspired "Rembrandt lighting," a technique of capturing light still used today in the visual arts. What one sees is a triangle of light falling beneath the subject's eye and on the shaded side of the face. The effect is stark and dramatic, in which a distillation of light and shadow enhances the subject's relationship to the physical world while also calling attention to the subject's interiority. This use of light and shadow suggests something elemental about what it means to be human.

Rembrandt would have been a fine photographer, and devoted cinephiles can spot his influence on Murnau's *Nosferatu* or in the works of Bergman, Antonioni, Hitchcock, and so on. He would have made a wonderful architect, too. After all, he was adept at conveying the relationship between light—natural or man-made; usually light from a candlestick—and the physical spaces that contained his subjects. He was drawn to light and to the full range of feelings that light could evoke, and one can only marvel at how he managed to convey all of this nuance on a two-dimensional canvas. Even if by intuition only, we each grasp the essential role of light. In the realm of higher education, we are aware of the ways in which lighting technologies can transform indoor and outdoor spaces on campus. Light makes our campuses safer and more functional, and the way we use lighting technologies can magnify the beauty of our architectural spaces and campus grounds. On-campus lighting also works as a powerful recruitment tool for prospective students, faculty, and staff. Rembrandt's mastery of creating light to inspire a range of feelings teaches a lesson about the role light plays in altering our perceptions of the material world. We can internalize this lesson and apply it as we endeavor to unlock the full potential of what our campuses offer.

When Lighting Goes Wrong

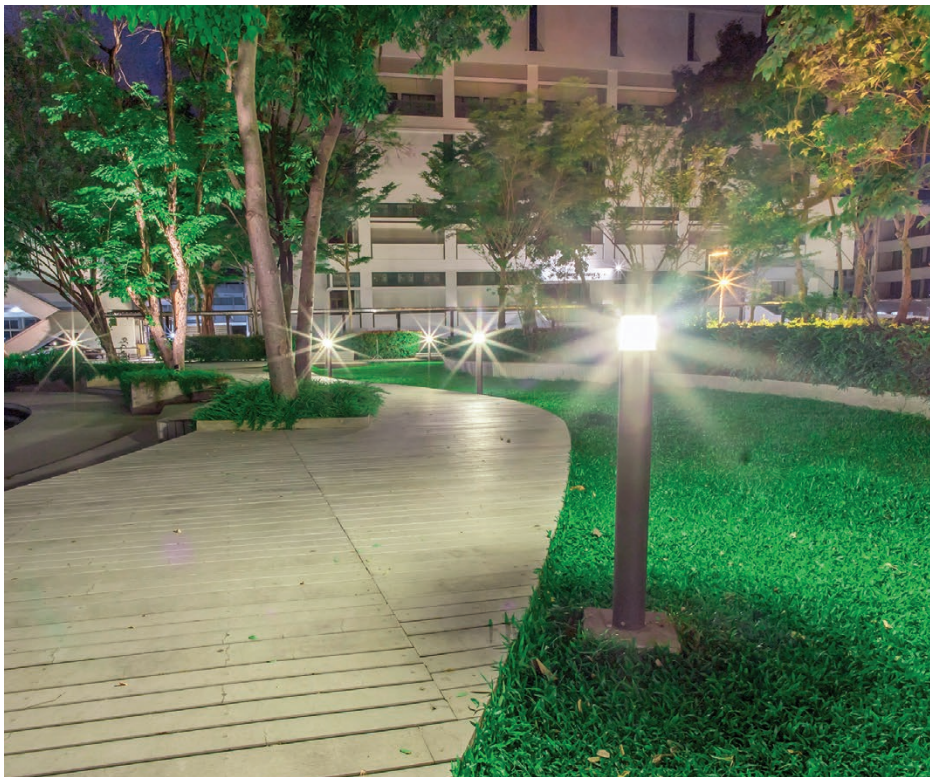
At various points in our daily lives, we are often spoiled by good lighting. This situation is ideal, an indication that a balance has been struck between aesthetics and functionality. Such moments may happen as we sip coffee and read at the library, or as we work on our computers in the office, classroom, or wherever we spend the majority of our time on campus. When lighting works, we tend not to notice it. But we certainly do take notice when lighting is insufficient—if we cannot see as we should, or when light is harsh, uninviting, or distracting in its artificiality. Such problems may reflect a larger concern, in which the architectural space has been conceived as an object to be viewed from a detached position rather than as a habitat to be experienced. When lighting goes wrong, it may be due to the lighting technologies already in place or to a lack of natural light, or both.

Occupants are uncomfortable in poor lighting, and it is not uncommon for spaces either to have too little or too much light. Moreover, harsh or dim spaces can hinder people's progress in working and learning. When lighting goes wrong, it can make people sluggish, impact their moods, or even cause anxiety.

Interior Lighting Options: Beauty, Functionality, and Sustainability

Occupants of any space, indoor and outdoor exterior alike, need lighting that provides adequate visibility. This point, while obvious, is too often overlooked at the design stage. To design with lighting in mind allows for quality lighting conditions. Product teams can provide not only functional and comfortable spaces, but those that are sustainable, efficient, and cost effective.

A wide variety of sustainability issues intersect with architectural lighting. When developing an integrated approach to sustainable lighting, various challenges should be anticipated, most notably light pollution, the life-cycle impact of lighting products, and chemicals of concern. Light pollution includes over-lighting, light trespass, in addition to the impact of lighting on plant and animal life in the surrounding ecosystem. A related concern is the impact of light pollution on nearby buildings and communities. Regarding the life-cycle impact of lighting products, designers should work with manufacturers over time to reduce the embodied



energy and carbon cost of fixtures, luminaires, and lamps. To help extend the life of a building and further reduce its impact on the environment, lighting can be designed so that it can be retrofitted and adapted to align with future advances in technology. Designers should likewise work with manufacturers to reduce the level of toxic materials in lighting products. For instance, compact fluorescent lights contain highly toxic mercury; these can often be replaced with LEDs, which are mercury-free.

The proliferation of affordable LED and CFL bulbs has revolutionized how we illuminate indoor spaces on campus. As garish as some preliminary models were, today's offerings are just as attractive as their incandescent predecessors. The market for sustainable lighting has also seen novel work emerge from lighting designers who have reconsidered the way we use materials to create lamps. For instance, there are lamps now available that harness the power of bioethanol to create an LED lantern, one with enough additional power to charge an iPhone. We have

access to rechargeable lamps, LED bulbs that boast a lifespan of twenty-three years, and fixtures that use corrugated cardboard made of FSC-certified paper sourced from forests that replant more trees than are harvested. The installation of task lighting is yet another sustainable and cost-effective option. Planners should consider individual reading lights inside study spaces and dorm rooms, those which replace overhead ambient lighting but use a fraction of the energy. Similarly, floor lamps prevent excessive overhead lighting while adding to the ambiance of an interior space. Dimming technology is another option for sustainable lighting because it uses less wattage and extends the life of a lightbulb.

Outdoor Lighting: Challenges and Solutions

While outdoor lights at night provide clear benefits in terms of safety and navigation, the artificial brightening of the night sky can disrupt human sleep patterns, disorient migratory birds, hinder astronomical research and, of course, waste electricity. To this latter point, data from the International Dark Sky Association (IDA) indicates that a third of all outdoor lighting in the U.S. is wasted, and largely by unshielded fixtures that allow light to spill where light is not needed. This waste alone costs facility owners some $3.3 billion each year. Further, the IDA contends that wasted illumination is responsible for twenty-one million tons of carbon emissions annually, making light pollution a factor in dialogues concerning climate change.

The good news is that innovative lighting technologies are readily available, and these aid in keeping our campuses safe, beautiful, and easy to navigate. Better yet, they cut down on nighttime light pollution. As with indoor lighting, LED bulbs can be used outdoors and are energy efficient. One can even purchase outdoor LED lights than run on solar power. Motion-sensor lights can be installed along walkways; candles and torches are green solutions that provide a softer illumination than solar powered lights; using light fixtures that shield light from the top and sides reduces unnecessary glare and brightness; and lights positioned closer to the ground enhance the beauty of campus grounds while reducing energy costs and shielding the night sky from harsh, glaring light.

With sustainable lighting technologies, leaders in higher education have an opportunity to enhance the beauty of their campus grounds, to create a greener path for the planet, and to save money in the long-term. Let us not forget Rembrandt and the lesson he imparts: light has transformative power.

ABOUT THE AUTHOR: Dr. David Vinson has a PhD in English with specializations in transatlantic literature and cultural studies. He is a committed scholar, teacher, and dad. If you ever meet David, avoid the subject of soccer. His fandom borders on the truly obnoxious.

Safeguarding Next-Generation Technology

Students at Milwaukee School of Engineering (MSOE) are abuzz. Rooms are filled with students learning on the leading edge of technological revolution, thanks to the university's latest project. MSOE's newest building is helping to make the university an educational leader in artificial intelligence (AI), cyber security, deep learning, cloud computing, and other next-generation technologies.

The $34 million Dwight and Dian Diercks Computational Science Hall is a 65,000-square-foot facility that provides modern classrooms, innovative laboratories, an auditorium, and spaces to support companies who collaborate with MSOE. A major feature of the facility is a data center, which houses a NVIDIA GPU-powered AI supercomputer. The supercomputer offers undergraduate students the ability to apply their learning in a hands-on environment; they prepare for their careers by computing and solving real-world problems in their course work.

"A supercomputer has no limits," says Rick Thomas, information technology director at MSOE. "It is very high speed and allows you to do massive amounts of computations all simultaneously, where a normal computer is bound by a processor." Thomas says for the students at MSOE, this supercomputer provides a unique experience that will help them in their future careers. "We were very fortunate to be able to grow a new program with a supercomputer at the core," he says. "They are learning how to program to use a supercomputer; it's learning how to get the results they are looking for and how to not waste time … and all at a higher level that most other schools don't have access to."

The supercomputer, "Rosie," is housed in a state-of-the-art data center on the second floor of Diercks Hall. Rosie's name was inspired by the women who programmed one of the earliest computers—the Electronic Numerical Integrator and Computer (ENIAC) and captured in the documentary "Top Secret Rosies—The Female Computers of WWII." More than one hundred of the most advanced NVIDIA GPUs power Rosie. Thomas says one of the most critical pieces to operating a supercomputer is power. "Supercomputer queries often run hours into days," he says. "Power is absolutely critical for us because if we lose power in the middle, we will have lost that whole bed of work and it all has to be re-set up, re-established, and re-started—and nobody wants that."

Not only would the data be lost; a loss of power would be catastrophic to the equipment itself, says Dr. Blake Wentz, professor and MSOE's owner's representative for the Diercks Hall construction. "If the computer lost power, it would probably overheat and melt," he says. "The real problem is not the computer shutting off; it's the air conditioning system shutting off to it. There is roughly $1.5 million worth of equipment in that room. It is very important to make sure the power stays on." The planners for the facility decided to employ a redundant power solution which uses multiple natural gas units to provide reliability and flexibility while ensuring peace of mind. "We wanted to get the absolute top of the line items we could get, across the board."

To protect the new investment, MSOE designers determined that a backup generator was needed. In deciding on a specific

generator, they considered many aspects of the power needs, including total electrical demand load; this load was estimated at 1550 kilovolt-amperes (kVA), with the total load being placed on the generator at 600 kVA. The major applications that needed to be backed up included the supercomputer standby loads, facility emergency loads, and a 20% growth factor for the facility loads. Another key factor was spacing. The campus is located in a compact metropolitan area, and outdoor space for the generators was limited Keeping all considerations in mind, the MSOE turned to Wolter Power Systems for help. In the end, the system that was recommended included two natural gas standby generators. "Due to the compact nature of the project, a rooftop application was necessary," says Jason Lelewicz of Wolter Power Systems. "We first needed to make sure we had small, light units for weight distribution on the roof. The area was so compact, traditional cranes could not be used to transport the units to the roof. A specific crane had to be built onsite to handle the installation." For protection against the elements, the generators have a weatherproof, acoustic enclosure.

Wolter Power specified a Modular Power System (MPS) for redundancy and scalability. Generac's MPS makes generator paralleling easier by removing the need for traditional switchgear. With integrated paralleling, MSOE can start with a smaller unit to meet their initial

PHOTO COURTESY OF GENERAC

power needs and can add on units as their power needs grow. "We have planned for the future of what five or ten years from now would look like," says Wentz. "There is a pad ready for a third generator that we can add later because if we expand out the supercomputer, the load just keeps getting bigger. But the redundancy to make sure that no matter what happens, the computer was safeguarded; that was important."

The corresponding electrical distribution is located in a dedicated emergency electrical room in the garage, which is also where the automatic transfer switches are housed. The paralleling electrical distribution feeds four automatic transfer switches serving the fire pump, life safety loads, optional standby facility loads, and optional standby supercomputer loads, respectively. The major life safety systems include the fire alarm systems, door security systems, life safety lighting, and exit signs. The major standby loads include IT rooms on each level, supercomputer loads, and the associated mechanical equipment.

Wentz points out that providing backup power to the supercomputer was important, but not as important as life safety systems. "It is an academic facility," he says. "There are a lot of students running around, and we really want to make sure that they are safe. In case something were to happen, we want to guarantee that they can get out of the building quickly and safely without any issues." The backup system is able to guarantee that at least one of the two generators would be serving life safety loads within ten seconds.

MSOE and Generac have had a long-standing relationship, and MSOE representatives say that the relationship is a natural fit. "Our students have a really strong work ethic," says Jeff Snow, vice president of development at MSOE. "The values that we have as an institution and the values our students graduate with align very well with those of our corporate partners." Wentz says that this choice was an easy one to make. "The big driving factor for us was simply with this supercomputer and with this building, we were not going to spare any expense," he says. "We wanted to get the absolute top of the line items we could get across the board for everything."

Wolter Power is extremely proud to be a part of this project and is pleased to be able to help support the future leaders of our economy. "This was a special project to be a part of," says Lelewicz. "With the help from Wolter Power, young engineers will have the opportunity to understand and develop new ways to improve data center up time."

ABOUT THE AUTHOR: Case study supplied by Generac. Generac is a leading energy technology company that provides advanced power grid software solutions, backup and prime power systems for home and industrial applications, solar and battery storage solutions, virtual power plant platforms, and engine- and battery-powered tools and equipment. www.generac.com.

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LAPTOP CHECKOUTS

AUTOMATED DISPENSING KIOSK SYSTEMS TRANSFORM HIGHER-ED COMPUTING

by Jonathan Ruttenberg

Making sure all students have access to the technologies they need for learning is a critical requirement for private colleges and universities, but using a desktop computer in a lab setting isn't always a convenient option for students. For this reason, many institutions have created innovative programs to let students check out laptops for temporary use.

Mobile device loaner programs can be a hassle to operate, however. Checking devices in and out—and making sure they are fully charged and in good working condition between usage—can consume many hours for IT or library staff if these processes are handled manually. Universities can address this challenge with an innovative, secure, and 100% automated solution. With a mobile device dispensing kiosk, private institutions throughout the United States can allow students to borrow nearly any type of laptop device without the overhead required by a manual checkout desk.

Barry University Slashes Wait Time for Computers

At Barry University, a private Catholic institution serving nearly 8,000 students in a suburb of Miami, laptop dispensing kiosks have dramatically reduced the amount of time that students have to wait for a computer, without taking up much additional space. In 2011, campus officials noticed that use of the university's computer lab had dropped, with only about half of its seventy-two desktop computers being used at any given time. "Because we are always challenged for space, we looked at re-purposing that lab space and moving our computer lab to another location," says John Baldwin, director of technology delivery.

Because so many students gather in the library to study, campus officials decided to move the computer lab there, with fewer machines. But space in the library was at a premium as well, so the new computer lab held only twenty-four computers. "As we monitored its use, we saw that it was very full—and students were often waiting to use a computer," Baldwin notes. That situation prompted campus leaders to look at distributing mobile devices to students to satisfy the demand for computing time. "We wanted a solution that was easy to use and manage, with strong security," he says. "We didn't want someone physically checking out devices, because we didn't want to incur staff time."

Baldwin and his colleagues found just the right solution in automated kiosks. They installed the university's first kiosk in the library in 2012. It held twenty-four laptops, loaded with the same software as the university's desktop computers—effectively doubling the number of computers available to students. Students can check out a laptop for up to 24 hours, and they can take it anywhere they need to on campus.

"Soon after we installed the first kiosk, we started getting requests from students who asked: Why can't we have this feature in other locations as well?" Baldwin says.

To satisfy these requests, the university placed two more 12-bay kiosks in student-centric locations on other parts of the campus in 2015. A few years later, as part of a laptop refresh, Barry University replaced its 24-bay kiosk in the library with a 12-bay kiosk and added another 12-bay kiosk at a fourth location. In 2021, in response to the COVID-19 pandemic, Barry University ordered three additional laptop kiosk systems. Together, these kiosks have handled tens of thousands of automated checkouts since the program's inception. "It has been a great success," Baldwin says of the program.

Impact on Staff Time is Minimal

The kiosks can be programmed to accommodate whatever local policies that campus administrators desire. At Barry University, there is no fee for late returns; instead, students get emails reminding them to return their device. If they don't heed these reminders, the dean of students is notified. "Administration on the back end is very minimal," Baldwin observes. The magic comes from automating the device checkout and return process. When a laptop is pushed back into an empty bay in the locked position, it is docked to a power source so it can recharge automatically. What's more, colleges and universities can opt to license Deep Freeze or a similar program for restoring the laptop to its initial/pre-set state.

Once returned, the laptops communicate their presence through an RFID card reader built into every bay, and they also communicate their battery life to the company's central server. A laptop will only be checked out when it exceeds the minimum battery life established by an administrator. Automatic notifications help administrators manage the loaner program as needed. For instance, an administrator can receive notification for late returns, bays that fail, or devices identified by end users as requiring service. Administrators also can visit the LaptopsAnytime website to view reports and entire logs of every event that has occurred at a kiosk. All transactions are recorded by a camera that is built into each kiosk, so administrators can identify users by face if there are any problems. Another unique feature is that the kiosks will distribute laptops to students on a rotating basis, so all units receive similar usage. This feature helps prevent some devices from receiving more wear and tear than others.

A Customized Solution for Every Institution

Automated dispensing kiosk systems can accommodate enterprise laptops from vendors such as Acer, Apple, Dell, HP, and Lenovo, as well as Chromebooks and iPads upon special request. Colleges and universities are responsible for purchasing the devices, and the company will deliver customized kiosks that can handle whatever devices an institution deploys.

Because the form factor for each device type and manufacturer is different (and tends to evolve fairly rapidly), institutions might need to have their kiosk bays retooled if they upgrade or refresh devices. Depending on what kind of service plan they choose, this service may be timed as a 3-year, 4-year or 5-year refresh included in the annual hardware agreement. For instance, Barry University is on a plan which includes a free SmartBay upgrade once every three years to account for its device refresh cycles. "We have gone through four different retoolings of our kiosks," Baldwin says. "The service that LaptopsAnytime provides is excellent—we highly recommend it."

Barry University has students authenticate checkout using their campus ID cards in conjunction with a password. The software driving the kiosks integrates with the university's Active Directory database to identify students. To make sure students return the laptops to the correct kiosk, Barry University has taken advantage of the ability to brand each kiosk with customized

PHOTO COURTESY OF LAPTOPS ANYTIME

graphics. The skins on the kiosks match those on the laptops they dispense, making it easy for students to remember which kiosk they borrowed their laptop from. Another innovation that Barry University is embracing is a ChargersAnytime Kiosk that dispenses Portable 110V Power Chargers that BYOD (Bring-Your-Own-Device) students can access anywhere on the University campus to power up their own devices at any time around the clock.

A Win-Win Scenario

Having access to the latest tools for learning is essential, and a student's finances should not stand in the way of obtaining an education. With automated kiosks, Barry University is making sure that all students have access to the technology they need for success. Dispensing mobile devices through an automated kiosk gives students access to technology in a format that is convenient for them. This arrangement also saves space for institutions and doesn't create a drain on staff time. The result is a win-win scenario for colleges and universities. Barry University represents one forward-thinking, innovative customer that shows how private institutions can transform their computing environments with an understanding of what is possible through implementing new and innovative technology systems.

ABOUT THE AUTHOR: Jonathan Ruttenberg is the Vice President and Co-Founder LaptopsAnytime. Jonathan's expertise at LaptopsAnytime is in the manufacturing of physical products, brand building, product marketing and establishing partnerships. LaptopsAnytime has established a foothold in the Education marketplace with 4+ Million Automated Checkouts per year. Jonathan can be contacted at jonathan@laptopsanytime.com

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Haverford College Selected as Truth, Racial Healing, & Transformation Campus Center

Chosen by the Association of American Colleges and Universities, these Centers are part of the W.K. Kellogg Foundation's movement to heal our communities.

Haverford College has been selected by the Association of American Colleges and Universities to be one of the 2021 Truth, Racial Healing, & Transformation (TRHT) Campus Centers. These centers, launched in 2017 by the W.K. Kellogg Foundation as part of its TRHT program to address the historic and contemporary sources of racism and bring about transformational and sustainable change, are designed to prepare the next generation of strategic leaders and critical thinkers to address inequities and dismantle the belief in the hierarchy of human value.

"We applied to become a Truth, Racial Healing and Transformation campus because it seemed to be the best complementary program to help us develop long-term goals and programming for the kind of activities that we hope will transform our campus as we move toward antiracism," said Interim Dean of the College Joyce Bylander, who spearheaded the effort.

Haverford's first step to becoming a TRHT Campus Center will be to attend the 2021 Virtual Institute on TRHT Campus Centers in June. The team attending the Institute includes Bylander, incoming Dean of the College John McKnight, Professor of Psychology Ben Le, Professor Emeritus of History and Visiting Professor in the Writing Program Emma Lapsansky-Werner, and Jasmine Reed '22.

"It is not required that you have students but they welcome student members, [and] I believe that it is essential to have student representation on our team to help us move our campus forward," said Bylander. "Last year, students were instrumental in challenging Haverford to reconsider some of our assumptions about ourselves as a community. We want to make sure we continue to have a student voice as we embark on this important work."

At the Institute, campus teams will participate in and design Rx Racial Healing Circles, the centerpiece of TRHT's framework, which brings together a diverse group of people in a safe, respectful space to share stories. Additionally, teams will participate in workshops and climate assessments, and will collaborate with experienced mentors to develop a transformative campus action plan, which will include strategic goals and intended outcomes. This work is in addition to Haverford's own antiracism action plan, though it will also contribute to the College's antiracism plans.

"We will begin the work of truth, racial healing, and transformation in the fall," said Bylander. "Once we attend the Summer Institute, we'll have a better idea of how to move this work forward."

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