

WHITE PAPER / **MODULAR MEDICAL UNITS**

# DEPLOYING THE NEXT EVOLUTION OF FLEXIBLE HEALTHCARE FACILITIES

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Beyond innovative medical treatments, the approach to delivering quality healthcare demands personal and comprehensive patient care. As outpatient facilities increasingly move into the communities they serve and as natural disasters and pandemics strain hospitals and healthcare systems, it has become clear that a flexible and robust facility solution is needed.



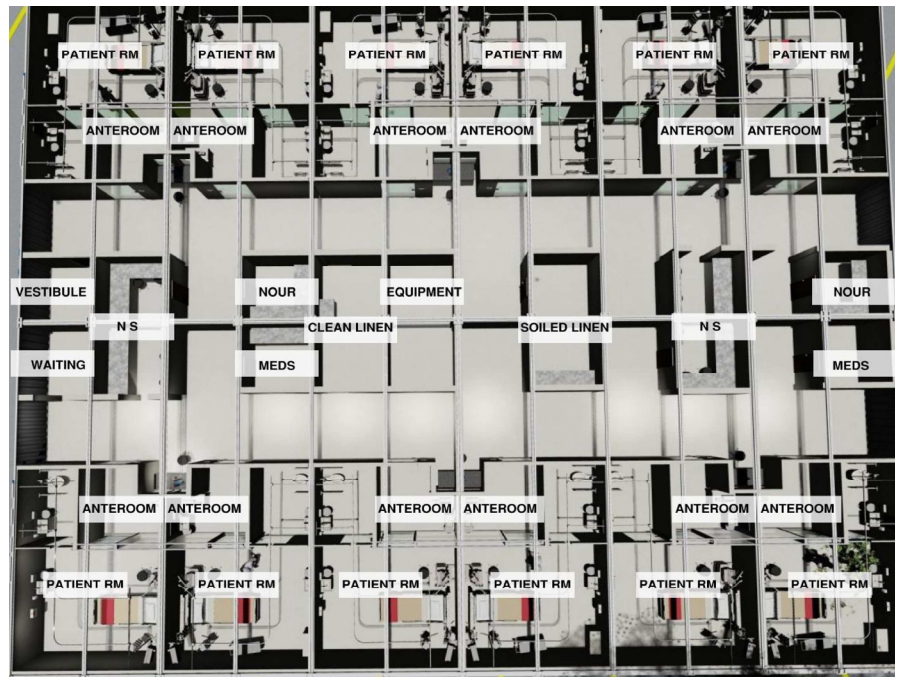
Research and innovation are essential for the healthcare industry. From penicillin and proton therapy to telehealth services and community-centered outpatient facilities, medicine and patient care are always advancing to meet new needs. With an innately creative and resilient mindset, the medical field consistently invents ways to provide comprehensive care within often constrained capital budgets.

That drive is on full display during times of stress, whether it's a natural disaster or a global pandemic. With COVID-19, as hospitals and healthcare systems across the U.S. and around the world saw capacity demand and testing needs surge, the next industry need became clear: a fast, flexible and robust healthcare facility deployment solution.

### THE MODULAR MEDICAL UNIT MODEL

Temporary medical facilities already exist, such as mobile testing trailers and the tent structures often used following a natural disaster. However, these facilities cannot accommodate the intricate medical requirements for isolation patient beds, operating rooms (ORs) or the myriad complex patient care functions. Modular medical units were designed with these complex spaces in mind.

The modular medical unit model uses International Organization for Standardization (ISO) shipping containers as the interlocking pieces to create flexible, free-standing healthcare settings. Unlike a standard testing trailer that can only extend lengthwise, ISO shipping containers can be stacked vertically and connected on all ends to provide the vertical clearances and square footage required of a wide variety of healthcare functions. For example, a surgery room requires a clear ceiling height of at least 10 feet. One module cannot accommodate that height, but the connective flexibility afforded by stacking one on top of another

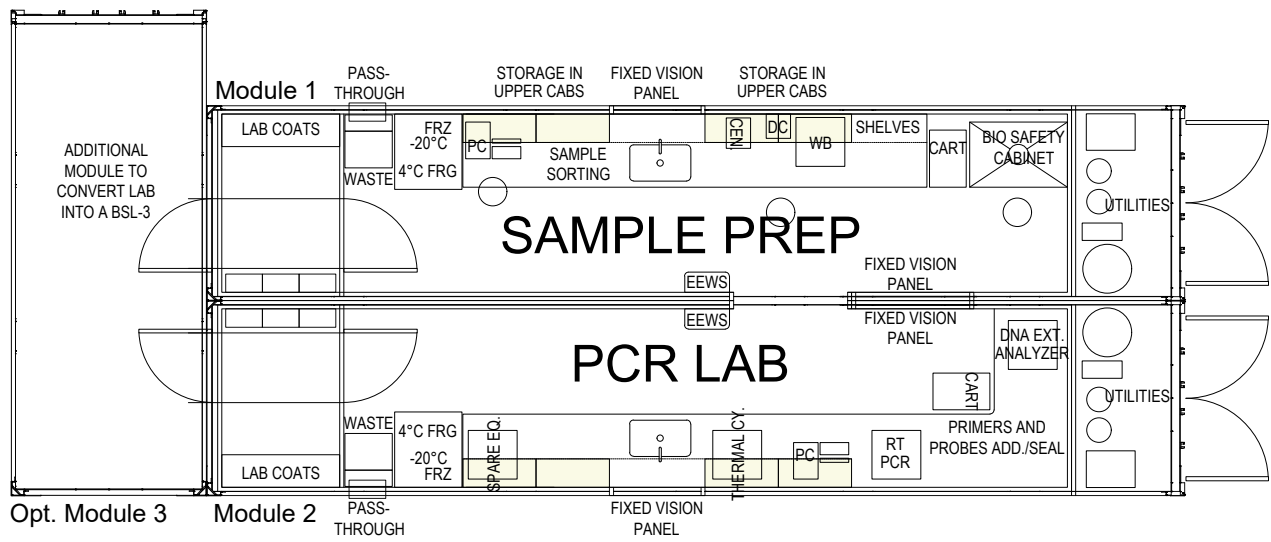


**FIGURE 1:** Example layout of a 12-bed patient room modular medical unit.

provides that clearance, which is needed for overhead OR lights, medical gas booms and more.

The broad flexible nature of these modules can therefore meet temporary and long-term expansion demands for healthcare systems and hospitals. From eight-bed isolation intensive care units (ICUs) and surgery suites to pharmacy accommodations, ORs and all required support spaces, the modular medical unit model can be customized and equipped based on the need — no matter how medically complex. And its connective properties allow the spaces to be fully combined and housed within the structure, avoiding separate modules for separate uses linked solely by outdoor walkway access.

This model can also be deployed on a grander scale. For example, if a hospital campus is compromised by a natural disaster, modular medical units can be combined to create every space needed within a temporary replacement hospital. With the ability to provide 30-plus patient beds, labor and delivery, surgery suites,



**FIGURE 2:** Example layout of a testing and laboratory modular medical unit.

pre- and post-accommodations, a pharmacy, a lab and more, it's possible to rapidly stand up a safe and effective healthcare space for the community.

### CONNECTING THE BENEFITS

While the flexible nature of modular medical units allows for a robust and comprehensive array of medical spaces and functions, the benefits do not stop there. No matter if the modules are deployed to assist after a natural disaster or to accommodate temporary overflow at a rural hospital, the customizable framework offers wide-ranging value.

### INCREASED SPEED TO MARKET

In contrast with the standard design and construction approach of a brick-and-mortar facility on a hospital or healthcare system campus, modular medical units work within the distinct structural base of an ISO shipping container. While the modules can be configured in unique and flexible ways, the definitive aspects of the base allow for shortened processes around deployment.

For one, the fixed framework, prefabrication and known square footage of the containers abbreviate design timelines from those starting with a blank slate. For example, a project for an eight-bed ICU would begin with an understanding that 20 to 25 modules would be needed to achieve the needed

square footage. From there, the hospital or healthcare system would be able to view a standard layout for its need within the structured framework and begin customizing to its specifications.

From there the design would be sent directly to a prefabrication shop to build the customized modules. Prefabrication itself is a truncated method for traditional construction, because so much of the work is completed off-site in a controlled environment. Prefabrication boasts an efficient process of precutting materials and assembling sections within streamlined workflows to reduce hours on an active healthcare campus. The off-site nature of prefabrication also eliminates pauses for weather events and potentially limited craft labor resources, helping to reduce delays.

Once all the modules are fabricated and precommissioned, they are transported and assembled on-site. This process would involve physically interlocking the many modules, establishing the environment for immediate use, and commissioning the final product based on strict healthcare standards. In stark contrast with a traditional brick-and-mortar facility, this assembly approach can turn months or even years of disruptive on-site construction into weeks.

## A QUALITY CONSTRUCTION SOLUTION

In addition to saving time, the tried-and-true method of prefabrication for modular medical units allows the essential elements and core requirements to be built in a controlled indoor environment. This provides not only safer work conditions — by eliminating the need to build pieces on-site, often at great heights or in potentially hazardous outdoor conditions — but also consistency in workforce.

Within prefabrication facilities, specialized workers can concentrate on a linear production process when creating components while adhering to frequent checks and balances. This repetitive, concentrated process from dedicated craft laborers results in high-quality module output.

Prefabrication also allows all construction — aside from site assembly — to be removed from crowded, fully operational healthcare campuses or potentially hazardous surroundings after a natural disaster. Therefore, the modules are fully completed, checked and approved, including all headwalls, medical gas outlets, exam lights and medical gas booms, before they are loaded for transport.

## REDUCED CAPITAL BUDGET STRAIN

With such flexibility in medical use case and configuration, modular medical units also provide flexibility to capital budget expenditures and resources. By accommodating temporary and permanent deployments, hospitals and healthcare systems can determine the right approach for both their short- and long-term goals.

For example, a hospital may not have laboratory capacity to handle the pandemic testing surge or isolation bed overflow. However, though meeting the immediate need is essential, a brand new brick-and-mortar facility may not be appropriate in the long term. Therefore, a temporary modular medical unit configured for a lab and 12-bed isolation patient rooms could allow the hospital to provide necessary care without dipping into the capital costs of hard construction.

On the other hand, an emergency room is a long-term asset that a rural hospital location may need to serve its communities. If capital isn't available for a brick-and-mortar addition, or if labor costs are too high in the area, a

free-standing modular configuration could provide that long-term service with a relatively short recovery of the investment.

## ASSEMBLING A SPECIALTY APPROACH

As is true for all flexible, multiuse solutions, upfront time and consideration are needed to see that the final product fits the need. Therefore, comprehensive project coordination and preplanning with the modular medical unit provider is essential, determining medical use type, duration preference, site placement and equipment needs.

It's also beneficial to work with a provider experienced in the healthcare industry as well as engineering. After all, creating a medically sound environment with all the key facility, equipment and layout needs requires extensive knowledge of industry regulations and codes. A team with expansive engineering background can also assist with siting recommendations and adaptations as necessary, so the modular configuration is located in a sound location with a solid foundation for the duration of its use.

## CONCLUSION

As medicines and treatments advance, so should facilities and approaches to patient care. Whether a cost-effective solution to provide long-term healthcare services to rural communities or a fast deployment to maintain medical care in times of surging need, the flexible and robust offerings of modular medical units could be the next evolution of customizable healthcare facilities.

## BIOGRAPHIES

**CHRIS POWERS, RA, NCARB**, is a regional healthcare practice leader and a project manager at Burns & McDonnell. With almost three decades of experience in the industry, Chris leads design and construction services for healthcare projects in the Southeast region. Prior to joining Burns & McDonnell, he served for more than a decade as director of design for a major international healthcare system. In this role, he spearheaded design services for some of that company's most pivotal projects, including facilities for cancer treatment, pediatric nursing, emergency medicine, neurosciences and orthopedics, surgical and interventional, and women's and children's healthcare.

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