

How Nabholz Construction Threw Away the Tape Measure In Delivering \$23 Million ICU Months Ahead Of Schedule



The ICU's round design presented challenges for the construction team.

I. Introduction

How do you start a construction project so innovative that it bears a striking resemblance to the Starship Enterprise? If you're Danny Tuttle, you throw away the tape measure.

This is an examination of a construction project that crossed the finish line four months ahead of schedule in spite of immensely challenging requirements. You'll learn how Danny Tuttle, M.A., Senior Project Manager at Nabholz Construction, an \$800 million Midwestern general contractor, and his team defied the odds by faultlessly delivering a \$23 million, 18-room intensive care designed unlike any other.

Or, as it became known, the Starship Enterprise of ICUs.

II. Situation

The Hutchinson Regional Medical Center (HRMC) is a not-for-profit, 199-licensed bed acute care hospital located in Hutchinson, Kansas. The hospital serves the healthcare needs of more than 65,000 Reno County residents, located in south-central Kansas.

The current HRMC facility opened its doors in 1975. Portions of the structure have been updated in the years since, such as the emergency room in a 2015 \$6 million renovation.

Two areas that have not been renovated are the electrical system and the intensive care unit (ICU). The 43-year-old ICU doesn't fit well with how healthcare has changed over the decades. "Our traditional inpatient census is declining and will continue to decline," explains Ken Johnson, President and CEO of the Hutchinson Regional Healthcare System, of which HRMC is a principal part. "Our inpatient census today tends to be the sickest patients. We currently don't have the best means to treat the sickest patients." The future of hospital care in Hutchinson and elsewhere across the U.S. is trending to more intensive care. To keep pace, the HRMC board authorized a new \$23 million ICU.

What should the new ICU look like? How should it be different, especially in anticipation of future needs? The hospital turned to their internal experts. HRMC gathered a multi-disciplinary team that included senior ICU nursing staff to present their ideas on a

dream facility. The team presented an innovative vision based on best practice, according to JoAnn Rivera, RN, Director of Patient Care Services. "We recommended a round unit," says Rivera.

A round design enables the nursing staff to visually monitor patients more easily, an observation confirmed by researching and touring other ICU facilities. The committee's recommendations also included other design requirements, including:

- Centralized booms over the patient beds for cables and suction, minimizing clutter and patients being tethered to the wall
- Beds situated in the middle of the room for easier patient access
- Decentralized ICU nursing station
- Nursing stations between every two rooms
- Each room plumbed for dialysis treatment
- Ample space for extended family visits

HRMC leadership supported the concept. "The new ICU puts the patient at the center of the equation,"



To accurately capture the extreme congestion of the mechanical room, J Brown pushed the FARO Laser Scanner up through layers of pipe.

says Wes Hoyt, HRMC Chief Operating Officer. "We'll be in good shape to provide critical care for the next 20 to 30 years."

III. Challenge

Configuring 18 ICU rooms in a round format looks like the iconic starship when viewed from above. For a general contractor commissioned to build to the specification, it looks like, well, an exceedingly difficult task. First, there is the challenge of the in-the-round model itself, then doing it all without shutting down the hospital for any extended length of time.

"About halfway through the design phase is when the project hit my desk," recalls Tuttle. He determined a design with virtually no parallel lines required an exceptional plan. "We created a leadership team with laser scanners, mechanical designers, electricians, my people, and hospital officials. I knew this building had to be built virtually before a single tool was picked up."

The ambitious pre-planning allowed the team to sequence an intricate array of building materials and processes. Fortunately, HRMC leadership understood the need for a quiet period devoted to means and methods. "Part of the project involved us working with the Nabholz team to go in and really 3D-map our infrastructure so we would know exactly what the building looked like. Where are the pipes located? Where could we de-conflict on the computer and save time in construction? How could we best use technology to pre-build," explains COO Hoyt, wholly supportive of the extended

planning phase. "Nabholz was up front and very transparent with how they were going to invest a lot of time at the beginning, which would pay dividends on the backend."

IV. Solution

Enter Structural Modeling & Analysis (SMA), a Kansas City-based engineering firm with special expertise with laser scanning as-built conditions. The SMA lead on the HRMC project, J Brown, P.E., S.E. and Principal Structural Engineer, says, "We look at [a structure] like a design professional looks at it. We know what they need to see."

Using a FARO® Focus^{3D} X 330 HDR, Brown was able to supply the Nabholz team with a super-accurate understanding of existing conditions, particularly MEP assemblies. For example, the hospital's mechanical room "had the nastiest congestion I've seen," according to Brown. "Danny arranged to bring some scaffolding in so I could lay on my back pushing the X 330 through five layers of pipe." But that was just the beginning.

"Danny found ways to utilize the scanning in several different applications. The integrity checks, documenting the existing conditions before construction, documenting locations, even documenting below-grade piping. We tried to document everything," says Brown.

"I've been on hundreds of construction sites. Occasionally you see one new piece of technology or process at work. Every time we visited this project, there was some brand new technology

in play. The fact that Danny was able to bring all the technology together to support the project is unheard of," Brown adds.

Comprehensive imaging counts for little if it doesn't help advance the project in a timely manner. As trade after trade soon discovered, the technology was a difference-maker.

Take the reaction of Jared Bechard, BIM and VDC Manager for the Kruse Corporation, the contractor responsible for the project's mechanical and plumbing work. "This is the first time I used raw laser scan data. We were able to find many, many as-built discrepancies we wouldn't have known about otherwise. There was no need for the usual back and forth field verification. For example, we reconfigured the mechanical room to account for conflicts the construction documents didn't anticipate," Bechard said.

The millwork team, who depend on extreme precision in the fabrication of cabinets, wall paneling, and especially exotic glass finishing on radiuses, nurse stations, window seals, and countertops, were skeptical a tape measure-free construction zone was the answer. Cole Blakely, Senior Project Manager at the millwork company, Fadco, recalls his initial thoughts and reaction:

"I was worried how this would play out. Fabrication can't begin until we have verified wall links, verified wall thicknesses, and verified plumbing centers. I hate to use the word perfect, but the scanned laser data was perfect. There were no issues whatsoever,

which is unheard of in this field. We're talking about radius glass walls that are probably worth about four years of my salary. This isn't something you can shape in the field. It has to be accurate. We didn't make one adjustment. This level of pre-construction accuracy is an industry changer."

Tuttle's team kept the software side basic to help speed delivery to the field. Brown says "Our primary registration software was SCENE Software from FARO. We used AutoDesk® RecCap™ to integrate with everybody else on the project through BIM 360." In Tuttle's view, the software choice worked out "extremely well. It was seamless." The only data-handling issue were the massive file sizes. The team routinely used portable hard drives to speed data transfer.

V. Results

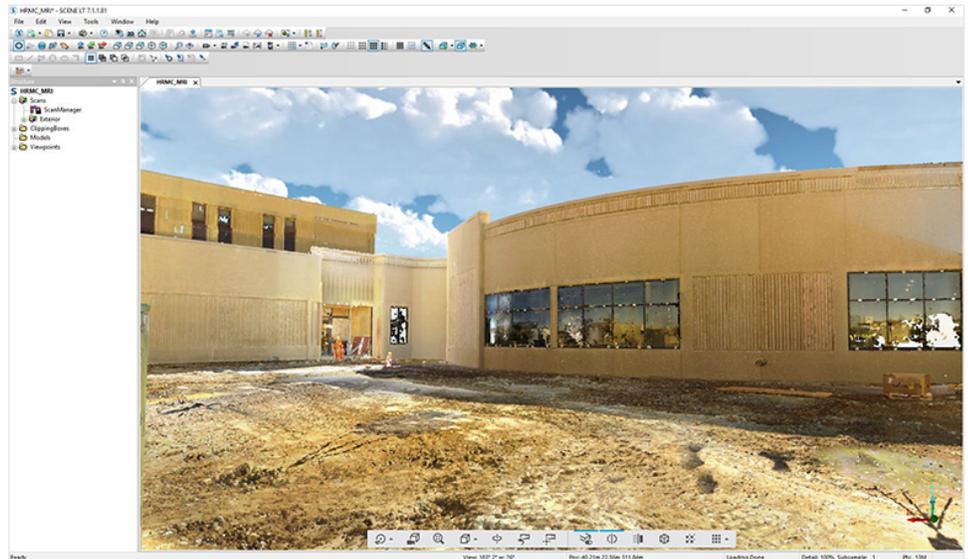
Hoyt and the senior leadership of HRMC were wowed by the consequences of comprehensive planning and the enabling technology. "We're talking highly precise rounded glass panels that were constructed offsite and fit perfectly. That's so hard to imagine. Normally, I expect to see shaving and trimming. We haven't had to do that because of the precision technology delivered to the project," Hoyt says.

Project Manager Tuttle had hoped a "tape measure-less" construction process would yield unexpected benefits. He wasn't disappointed:

"We delivered four months ahead of schedule. On a project like this, that's probably seven-digit savings. For instance, all of the mechanical systems were prefab-based on our model. The milled components were fabricated many weeks in advance of what's considered standard practice.

"The entire structure is built to plus or minus an eighth of an inch tolerance. The building snapped together like a giant Lego set. No rework. No jackhammering concrete. That's unheard of. We provided the dimensions for a \$140,000 round piece of glass before framing even started, before the concrete was even placed. Because of laser scanned data, we knew exactly where the building existed, where it lived."

The HRMC was recently named the eighth safest hospital out of 128 Kansas hospitals. All expectations are the new ICU will help them achieve even better outcomes for area residents. For Hoyt, the amazing thing is "... we're doing this with an infrastructure that's 45 years old. We'll continue to evolve. When health care experts ask, 'What does the future of rural healthcare look like?' Go to Hutchinson Kansas. See it for yourself."



For registration of scan data, SMA primarily used SCENE Software from FARO.



Senior leadership of HRMC, shown here at the ribbon cutting of the new ICU, were impressed by the results of planning and technology.

For More Information

Website: www.FARO.com | Toll Free: 800.736.0234 | Direct Dial: 407.333.9911