SUFFOLK

A Powerful and Magnetic Approach

How Suffolk installed a 25-ton, 7T MRI at Brigham and Women's Hospital—after the building had been turned over

WHITEPAPER

Challenge

Brigham and Women's Hospital, one of the top healthcare institutions in the world, had secured a powerful 7T MRI for its new Hale Building for Transformative Medicine. Because of the leading-edge nature of the machine—about to be one of only two in the world approved for clinical use—BWH had not yet received regulatory clearance for use of the MRI when Suffolk was building the MRI room and adjoining spaces. Once the imaging equipment was delivered, Suffolk had to be ready to install this highly innovative, highly sensitive technology and still meet expectations for building turnover and occupancy.

The Team

SUFFOLK

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ARCHITECT

NBBJ

ENGINEERS

BR+A: MEP engineer
McNamara Salvia: structural engineer

TRADE PARTNERS

American Plumbing & Heating
Century Paint
Component Assembly: drywall
Gaven Industries: RF and magnetic shielding
JC Cannistraro: HVAC piping infrastructure
JC Higgins: HVAC piping fit out
Liberty Construction Services: general labor and carpentry
McCusker Gill: HVAC duct fit out
Millwork One
O.B. Hill Trucking & Rigging: 7T MRI rigger
Pavilion Floors
Siemens: equipment manufacturer and installer
Sullivan & McLaughlin: electrical

Background

Brigham and Women's Hospital had a vision for the Hale Building for Transformative Medicine: a building that could bring together leading clinicians and scientists to promote, collaborate and advance care for patients suffering from neurologic, orthopedic and rheumatologic conditions, such as Alzheimer's disease, Parkinson's disease and rheumatoid arthritis. The 680,000-square-foot facility at BWH, completed in 2016, includes three outpatient floors, eight research floors, and an administrative and imaging floor. It houses about 30 principal investigators, a 240-person research staff, and the Brigham Innovation Hub, a collaboration among leading experts to further enable partnerships within the Brigham and with industry.

To accurately research, diagnose, and treat these conditions, the building is home to some of the most powerful imaging capabilities and precise technologies in the world. Part of that new generation of ultra-high tech field instruments is a 7T MRI. MRIs are measured in Teslas, which account for the strength of the magnet. The higher the strength of the magnet, the higher the resolution of the images that they can produce. Typical MRIs are often 1.5T or 3T. The 7T MRI system's superior field strength and advanced electronics provide a stronger signal used to generate higher-resolution images that offer advanced clinical insights into neurologic diseases, including multiple sclerosis and epilepsy, and musculoskeletal conditions that involve the cartilage, muscle and fascia of the knee joint.

Because of the pioneering nature of the 7T MRI, BWH's machine would be only the second in country that would be approved for clinical use. Suffolk built the space for the MRI during the construction of the Hale Building in 2016. Once BWH received the MRI in May 2017, it was time to help the 7T MRI find its way home.

The 7T MRI

Solution

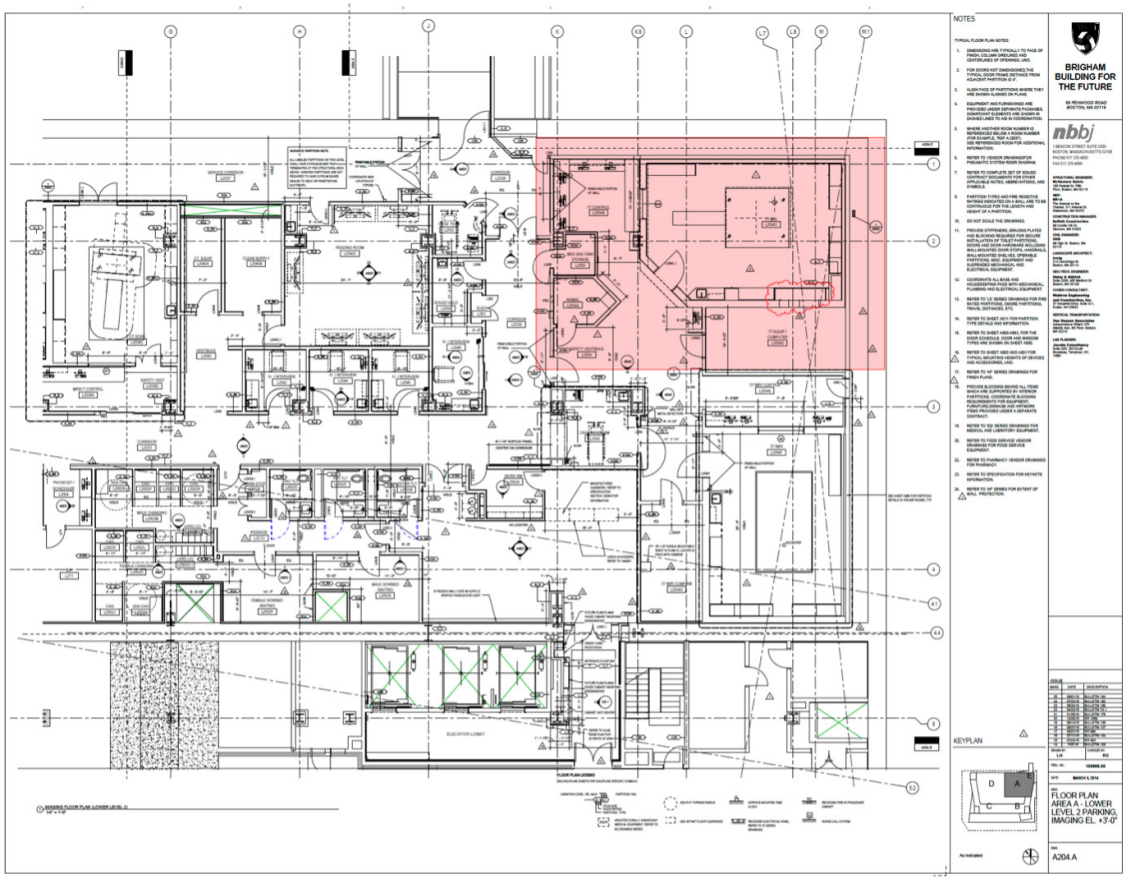
The Room

Thanks to close collaboration with BWH throughout construction of the Hale Building, Suffolk knew the plan for the 7T MRI early on and built the space accordingly. The team leveraged 3D modeling technology, such as BIM360 and Navisworks, to coordinate the various mechanical systems, shielding components, and other elements that would house the 25-ton machine.

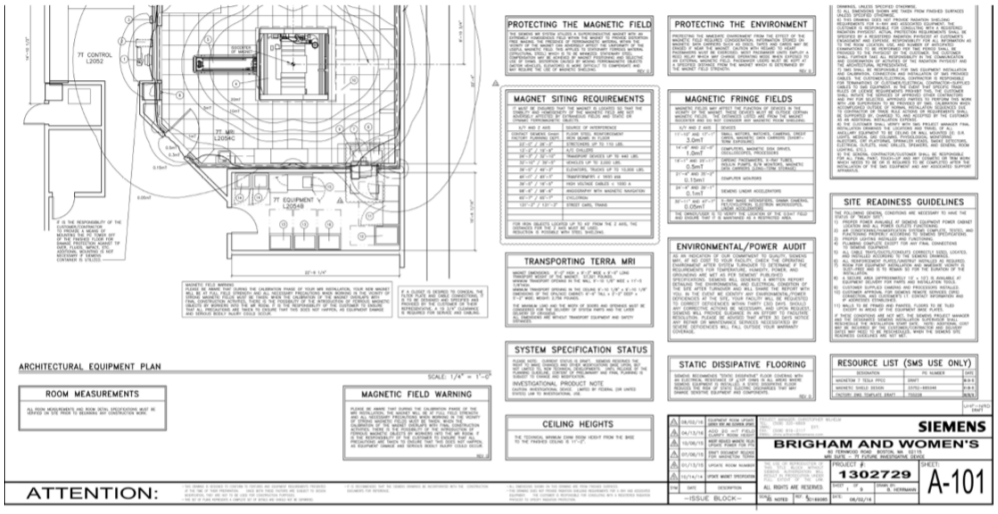
An MRI of that size left little room in the ceiling, the typical space for mechanical systems. To accommodate the 7T MRI, Suffolk built the room with a raised floor. That space is where Suffolk and Siemens, the MRI manufacturer and installer, ran the cables, wiring, and power hookups from the equipment and control room to the MRI room.

Suffolk's team also worked closely with Siemens to ensure the accuracy of the height of quench vent, which released helium if the MRI overheated. That height had to be accurate within 1/16 of an inch. Other components of the room that required pinpoint accuracy: the level of the plate on which the machine rested, the distance between the cables, electrical load capacities, and power and chilled water requirements. Suffolk coordinated between Siemens, the architect, and the project's HVAC, electrical, and pipefitting trade partners to ensure the room met all the standards for this new MRI.

An architectural drawing of the 7T MRI location

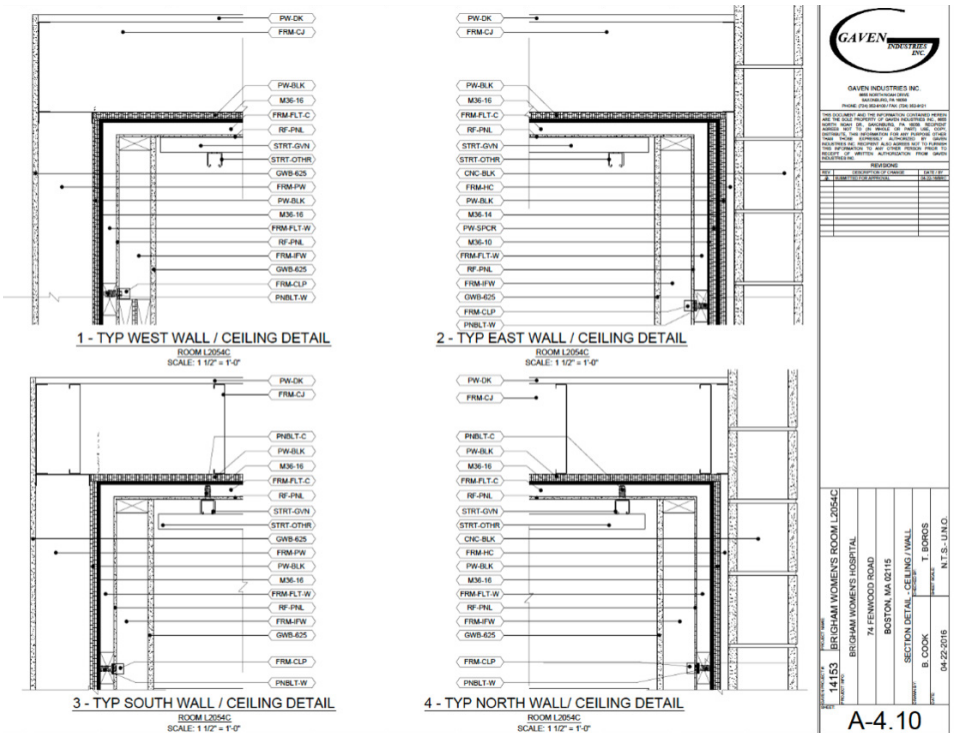


The Siemens architectural equipment plan for the 7T MRI



The team also paid special attention to the walls, making sure the room had the correct dimensions and accounted for the necessary copper and extra layers of silicon steel that the 7T MRI required. The silicon steel protects the spaces outside of the MRI suite from the force of the magnet, while the copper prevents outside radio frequency interruptions to the MRI when the machine is in use. The more powerful magnet in the 7T MRI demanded greater shielding: about 50 percent more than a standard MRI. Suffolk collaborated with Siemens and Gaven, a specialty installer for steel shielding and copper, to engineer and build parent walls and the shielding that attached to them. The parent walls were 6-inch metal frame studs to handle the weight of the shields, which added up to 16 sheets in some places.

Trade partner drawings for the copper and steel shielding required for the 7T MRI room



The Move

Building the room had its unique challenges; hoisting the 25-ton MRI and then moving it into the occupied hospital building held another set of hurdles. In this case, preplanning was key.

Because BWH located the 7T MRI on a dedicated imaging floor, the hospital had an existing opening with a precast cap at grade level. To replace MRIs, teams could remove the cap and lift the MRIs down through the opening. Suffolk used this route and coordinated with O.B. Hill Trucking & Rigging Company, the hospital, and the surrounding community to set up a crane on a private street and lower the 7T into the building.

Once the machine made its way through the precast opening, the team used a chain fall system to slide the MRI from the crane and onto the heavy-duty dollies that carried to the imaging suite. All work was accomplished with minimal disruption to ongoing clinical operations.

To make room for this enormous piece of equipment as it traveled to its destination, Suffolk's team removed doors, door frames, ceilings, and lights in a back-of-house corridor. Standing at about 10 feet, the machine was inches from the walls and ceilings. Completing the move in the occupied hospital space demanded extra planning and communication with BWH, Siemens, and the various trade partners handling the room's systems. Two months of planning had paid off, though: the install went smoothly and BWH was able to use the MRI for research and training before it became available for patient care in September 2018.

Trade partners hoisting the 7T MRI into the precast opening

Trade partners lowering the MRI and preparing for transport

Conclusion

The Suffolk team's experience in MRI installation made it possible for its members to effectively manage the many logistics of moving this machine into an occupied hospital. That experience extended beyond the mechanical and into the personal, as Suffolk had built strong relationships with project stakeholders while installing the other MRIs in the Hale Building. With a solid, collaborative foundation, the team was excited and ready to take on the challenge of installing the 7T MRI. Achieving this feat was the result of applying technical expertise, great planning, effective communication, and a "find a way" attitude.

After its initial research period, the 7T allowed BWH researchers to identify lesions in 38 percent of epilepsy patients that were not readily discernible on high-quality 3T MRI scans. The machine is now fully integrated into the MRI program at BWH, focusing on world-class research and providing patients with the most advanced care available.

BY THE NUMBERS

2
The number of 7T MRIs approved for clinical use in the world

25 tons
The weight of the 7T MRI

50 percent
The increased amount of shielding the 7T MRI required

1/16 of an inch
Accuracy required for the MRI's quench vent

Here's how you can connect with our healthcare experts:

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