HEALTHCARE DESIGN

THE NEW STANDARD FOR INTRAOPERATIVE IMAGING ENVIRONMENTS

IN CONJUNCTION WITH

VENDOME GROUP

THE CENTER FOR HEALTH DESIGN®


UC San Diego
Jacobs Medical Center

The new standard for intraoperative imaging environments

UCSD Jacobs Medical Center builds the first fully integrated multimodality intraoperative imaging suite

BY ANNIE LEHATTO, AIA, LEED AP, EDAC; CARLOS AMATO, AIA, ACHA, LEED AP, EDAC; BOB CARTER, MD, PHD; AND WILLIAM BRADLEY, MD, PHD, FACR

IMAGES COURTESY OF CANNON DESIGN

The surgical team at the University of California, San Diego's (UCSD) Thornton Hospital is doing inspiring things in medicine, such as awake brain surgery for maximal resection of brain tumors near functional areas of the brain, minimally invasive computer-guided surgery for ENT, neurosurgery, and spine surgery applications. A common theme in many of these procedures is the need for real-time imaging to confirm successful execution of a procedure. So when developing a design for the new 500,000-square-foot, 10-story, 245-bed Jacobs Medical Center, the team knew it wanted an intraoperative imaging surgical suite that would be equally inspiring and allow team members to do things even beyond their current capabilities. The clinical team, along with the owners and the design team, have developed the building with the project vision of "transforming people, process, and place" always in mind. The new Center for Advanced Surgery will transform all three with its 10 new state-of-the-art operating rooms and four-OR intraoperative imaging suite.

This suite will consist of an intraoperative 3.0T MRI that runs on a ceiling-mounted rail between two ORs, with a "garage" at the center that can be used for diagnostic imaging when the magnet is not in use for a surgery. Across a shared control room, two additional ORs are configured on either side of 64-slice ceiling-hung CT housed in another garage.

This suite will be the first of its kind in the world, co-locating both modalities in a comprehensive suite. Intraoperative MRIs and CTs have been built in a number of hospitals all over the country in smaller arrangements, but never before in a suite configuration housing four operating rooms. This will enable surgeons and radiologists at UCSD to collaborate as never before, creating better outcomes for patients and setting the stage for a new industry standard.

A persepctive view inside the operating room, showing the MRI entering the room and the "Wall of Knowledge" in the background.

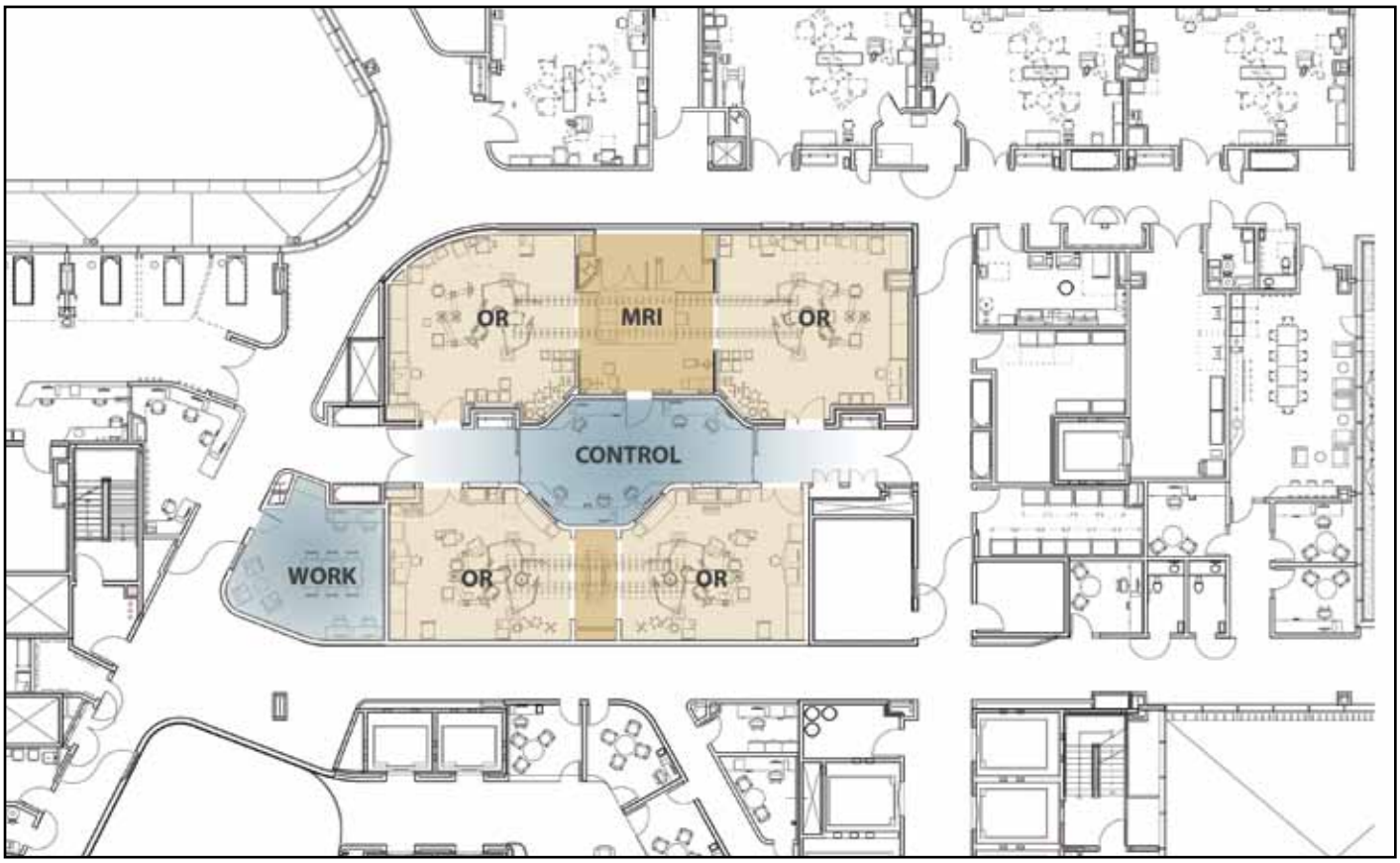
Both multidisciplinary teams were asked why they were excited about this new model and how they could use it to advance their practice. Dr. Bob Carter, chief of neurosurgery, notes that this suite is the "culmination of a dream of building an operating room environment where we can push the frontiers of surgical procedures in the central nervous system—not only performing better the surgeries of today but creating the next generation of neurosurgical procedures for tomorrow." Carter notes that new technologies such as real-time tracking of infusion of growth factors for Alzheimer's and other neurodegenerative diseases, incorporation of advanced functional imaging data to select the optimal site for brain tumor biopsy, rapid feedback on extent of resection of brain tumors, and safer placement of spinal instrumentation are just a few of the upcoming surgical advances that the suite will make possible.

A view showing the collaborative shared control room space.

On the radiology front, Dr. William Bradley, chair of the department of radiology, says, "We are very excited about working on this intraoperative MRI and CT suite with Dr. Carter and Carlos Amato, and their teams. Real-time, intraoperative MR imaging will allow us to correct for any brain shift following the craniotomy using conventional MRI as well as newer techniques, such as diffusion tensor imaging, perfusion imaging, and MR spectroscopy. This will lead to greater tumor resection while maintaining the safest intraoperative environment possible."

Dr. David Barba, chief of functional neurosurgery at UCSD, is equally enthusiastic. "Functional neurosurgery is designed to restore lost function. With the integration of the MRI or CT scanners in the new operating rooms, we will be able to more precisely guide our surgeries and advanced treatments, like gene therapy and deep brain stimulation for Parkinson's, Alzheimer's, and, eventually, depression. We will be able to see the internal brain structures that are our targets for these treatments while we are working, and adjust our treatment deep in the brain while observing its effect. Our surgeries will become less invasive and more accurate with these new systems. In addition, this new operating room environment will enable us to collaborate with neuroscientists, neuroradiologists, and our patients themselves, in real time and in a way that has not previously been possible," Barba says.

Locating the imaging devices within the suite will allow these physicians to do a number of things they could not previously do in a typical operating room. For instance, a neurosurgeon can perform a resection of a brain tumor and determine during the actual procedure whether the resection has been successful or needs additional work. This allows the surgeon to



Detailed floor plan of the imaging suite.

remove a conservative amount of tumor during each resection and then scan the patient while still in place to determine how much, if any, tumor still remains and continue the resection if necessary. Carter adds, "This is the best combination of safety and efficacy for our patients. We can push to accomplish the maximal safe resection while ensuring that we don't push too far and damage vital neural pathways … all made possible by advanced MRI imaging during our surgical procedure."

On the CT side, a surgeon will be able to place complex hardware in a patient's spine and then perform an intraoperative CT to determine that the screws have been placed correctly. All of this can be done in the safety and sterility of the surgical environment, decreasing the risk of infection or complication.

Having the ability to perform these scans while still in a surgical environment is invaluable to the patient's safety and comfort. In the past, a patient would be transported to get a scan following their procedure, and if any additional work was determined to be necessary, the team would be required to perform another procedure. Eliminating the need for additional surgeries decreases the patient's exposure to various risks, including the chance of complications and infection, as well as the risks associated with additional anesthesia.

In addition to the enhanced surgical techniques, the configuration of the suite is unique in that it is designed to improve collaboration between all members of the surgical/imaging teams. The new suite is located at the hub of the Advanced Surgery Center, directly adjacent to 26 PACU beds, 22 prep/recovery beds, and 10 additional ORs. Just down the hall will be the newly renovated special procedures suite, new locker facilities, staff and physician lounges, and conference space. The main patient, staff, and materials elevators are located just to the south, along the suite's west corridor.

As an academic medical center, collaboration and learning are keys to the philosophy of the team at UCSD. With that in mind, a dedicated surgery "red carpet" lounge/workroom has been incorporated adjacent to the ORs, which the physicians believe will become a center of activity. This will be a place where surgeons can collaborate, chart, discuss, and watch cases on monitors and share their activities and teaching with the rest of the world. It also will allow the care team a place of respite, to reflect and meditate before and after cases, while still being close to the ORs themselves. This multidisciplinary group of caregivers, including surgeons, radiologists, nurses, and technicians, will have a place to gather between procedures, creating the perfect opportunity for spontaneous interaction and collaboration.

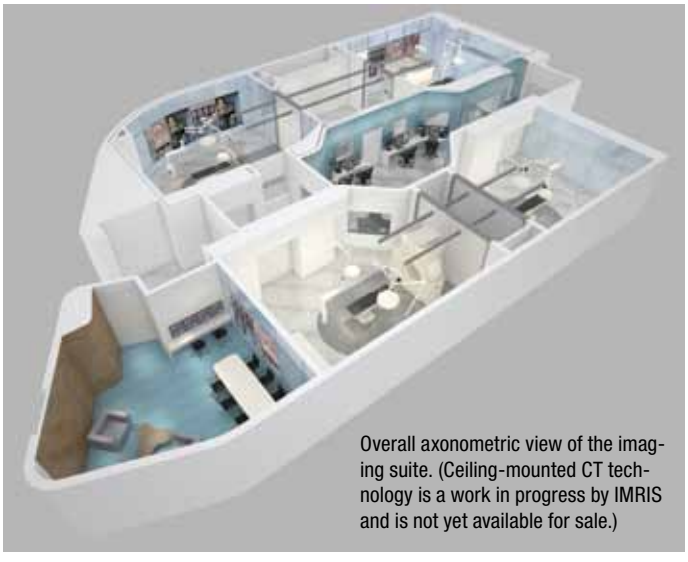
Another space envisioned as a hub of activity and teamwork is the shared control room in the center of the suite. From this room, one will be able to see directly into all four ORs and the MRI garage. This will be a room not only for technologists to work but also for surgeons, nurses, radiologists, and others to partner and work as a team to provide the best possible outcomes for the patients. The team will gather in this space as the images are being produced and be able to evaluate and assess them in real time to determine the next steps in the care of that patient, while the procedure is still in progress. "Just as we interpret the preoperative MRI scans, it is important for neuroradiologists to be present during the operation to finetune the intraoperative MRI exam to maximally detect residual tumor as well as eloquent parts of the brain adjacent to the tumor,

An exterior view of UCSD Jacobs Medical Center.

which the neurosurgeon will want to avoid. A team effort is much more effective in the setting of intraoperative MRI," Bradley says.

Another advancement making this suite the most innovative in the country will be the incorporation of the world's first ceiling-hung intraoperative CT. Locating the scanner in this manner will eliminate the floor rails formerly used in intraoperative CT configurations, which will enhance not only infection control but also safety. Any break in the normally continuous floor material of a surgical suite creates a problem for infection control and can present a hazard to anything rolling or walking across the rails. This will be avoided by hanging the CT from the ceiling on a track similar to the one used for the iMRI.

The team has been working closely with both BrainLAB and IMRIS to develop the most technologically advanced suite possible. Each OR is planned to have a "wall of knowledge," where one entire wall of the room is made of large video screens in which images can be viewed and manipulated during the surgical process. This allows unrestricted access and streaming to data, such as medical records, previous scans of the patient, and vital signs. Voice activation will be utilized so the surgical team can manipulate and use the data without compromising sterility. The team is also working to incorporate dedicated integration software into the hospital's main electronic medical records, teleconferencing capabilities, and other software to create a seamless connection, enabling further interaction, collaboration, and teaching opportunities.



Overall axonometric view of the imaging suite. (Ceiling-mounted CT technology is a work in progress by IMRIS and is not yet available for sale.)

We asked Jim Cleaton, AIA, project director for UCSD, why he supported Carter's team vision. "The intraoperative suite and its numerous innovations is one of many examples within this project of UCSD's goal to be on the leading edge of healthcare delivery. As a major academic medical center, it is part of our core mission to be developing new practices and advancing both the science and delivery of medicine. By building the Jacobs Medical Center on the main UCSD campus, immediately adjacent to all of the university's research labs, next to the only NIH-designated cancer center in San Diego, and across the street from the new Clinical Translational Research Institute, the dream of 'bench to bedside' will finally be able to be realized," he says.

The UCSD team knows that in building such an advanced clinical space, flexibility is key to success. For this reason, the MRI garage is fully functional as a diagnostic MRI space, and the operating rooms can function as typical surgical spaces when not being used for neurological or spinal cases. Thus, all of the planned rooms can be used for a number of purposes and are set up for future changes or advances in technology.

The intraoperative imaging suite at UCSD is one of the many exciting features of the new Jacobs Medical Center at UCSD. The entire team is excited about this project because, in the spirit of the project vision, this suite will enhance and transform the patient experience. **HCD**

Annie Lehatto, AIA, LEED AP, EDAC, is a healthcare planner and associate with Cannon Design. Carlos Amato, AIA, ACHA, LEED AP, EDAC, is Principal and Western Region Healthcare Market Leader with Cannon Design. Dr. Bob Carter, MD, PhD, is the Chief of Neurosurgery at UCSD Medical Center. Dr. William Bradley, MD, PhD, FACR is the Chair of the Department of Radiology at UCSD Medical Center. For more information on UCSD Jacobs Medical Center, please visit health.ucsd.edu/Jacobs/.