# THE INTERDEPENDENCIES OF DESIGN AND MEDICAL TECHNOLOGY

Integrated Planning from a
Single Room and Project-wide Perspectives

# LEARNING OBJECTIVES

- Develop the best practice design process on Hybrid OR solutions
- Identify the various design challenges related to Hybrid OR environment
- Assess the impact of medical technology on health facility design
- Understand the Integrated Technology Planning - the best practice for the design and delivery process

# SINGLE ROOM PERSPECTIVE

## LEARNING OBJECTIVES

## WHAT IS A HYBRID OR?

BROAD DEFINITION:

A hybrid operating room is a surgical theatre that is equipped with advanced medical imaging devices such as fixed C-Arms, CT scanners or MRI scanners

NARROW DEFINITION:

Cath Lab meets Surgery

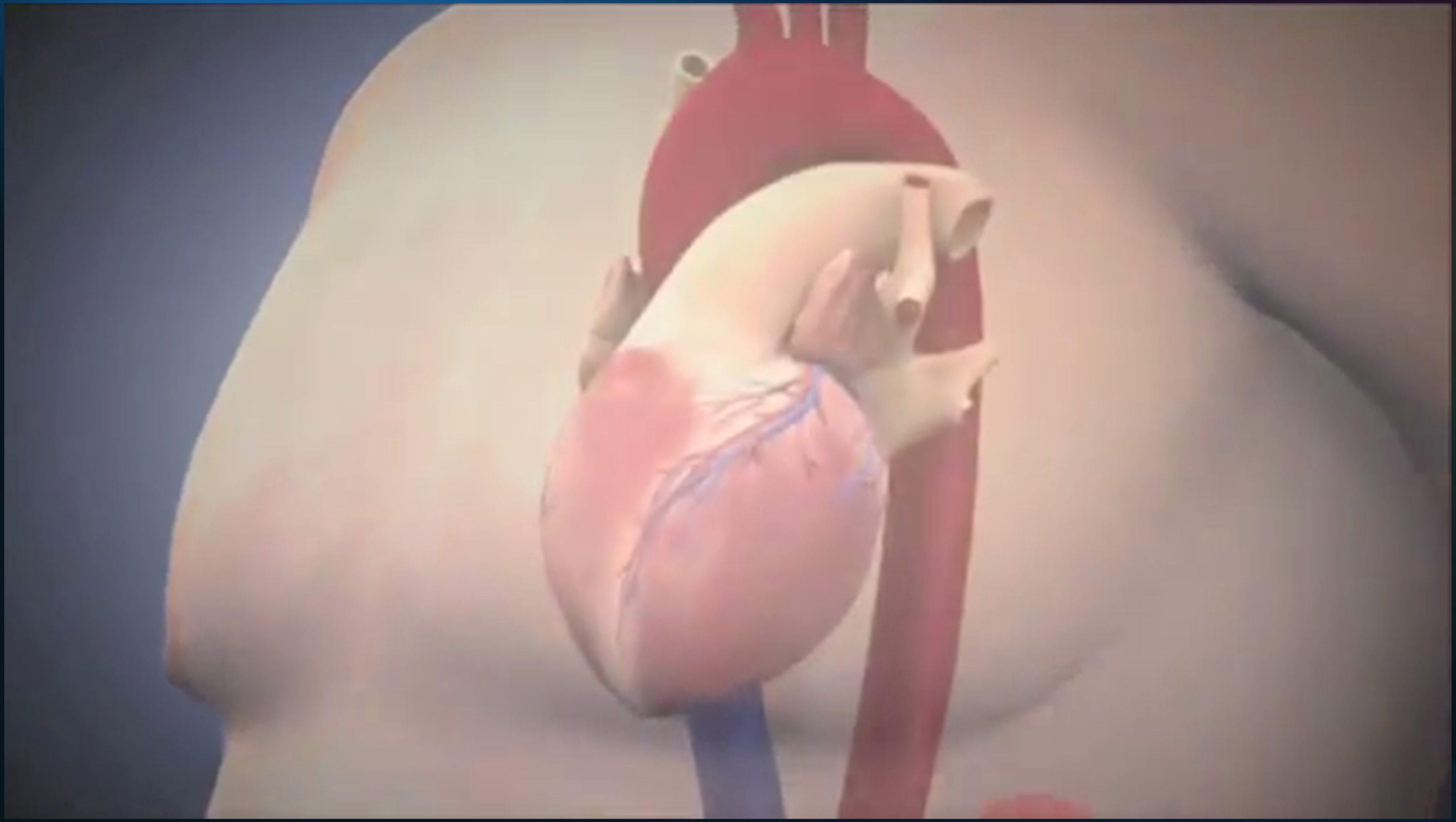
# DEFINITION

Cath Lab Suite

Operating Theater

Hybrid OR

# TRANSCATHETER AORTIC VALVE REPLACEMENT - TAVR



# DRIVERS OF HYBRID OR - *BENEFITS*

***SURGEONS:***

- Improved patient care: Crisis management, improved communications, integrated technologies
- Room Flexibility: Interventional use to MIS to open procedures all in one room
- Improved workflow collaboratively designed for improved safety and productivity

***NURSING:***

- Improved staff productivity through improved ergonomics and workflow
- Improved patient care
- Improved room utilization, reducing scheduling challenges

***ADMINISTRATION:***

- Optimize capital monies
- Optimize room utilization – full range of procedures allowing 24/7 use
- Surgeon retention and recruitment

# TYPES OF PROCEDURES

| | Vascular Surgeon | Cardiac Surgeon | Interventional Cardiologist (Adult) | Interventional Cardiologist (Peds) | Neurosurgeon |
|---|---|---|---|---|---|
| Common Procedures | • Abdominal aortic aneurysm (AAA)<br>• Thoracic aortic aneurysm (TAA)<br>• Carotid stenting<br>• Peripheral PTA<br>• Peripheral stenting<br>• Peripheral artery bypass | • Coronary artery bypass graft (CABG)<br>• Aortic valve replacement<br>• Mitral valve repair/replacement<br>• Ventricular assist device implantation<br>• Heart transplant | • Diagnostic caths<br>• Coronary stenting<br>• PTCA<br>• Peripheral PTA<br>• Peripheral stenting<br>• Atherectomy | • Hypoplastic left heart syndrome<br>• Heart biopsy<br>• Diagnostic cath<br>• ASD<br>• VSD<br>• PFO<br>• PDA | • Aneurysm coiling<br>• Intracranial stenting<br>• Carotid stenting<br>• Intra-arterial TPA |
| Procedure well suited for Hybrid Room | • AAA<br>• TAA<br>• Peripheral stenting | • MIDCAB/stent<br>• Valve/stent<br>• Percutaneous valves | • Peripheral stenting<br>• Sent/MIDCAB<br>• Stent/valve<br>• Percutaneous valves | • Structural heart<br>• Hybrid Stage I | • Aneurysm coiling |

Source: *Hospital of the Future*, The Advisory Board Company

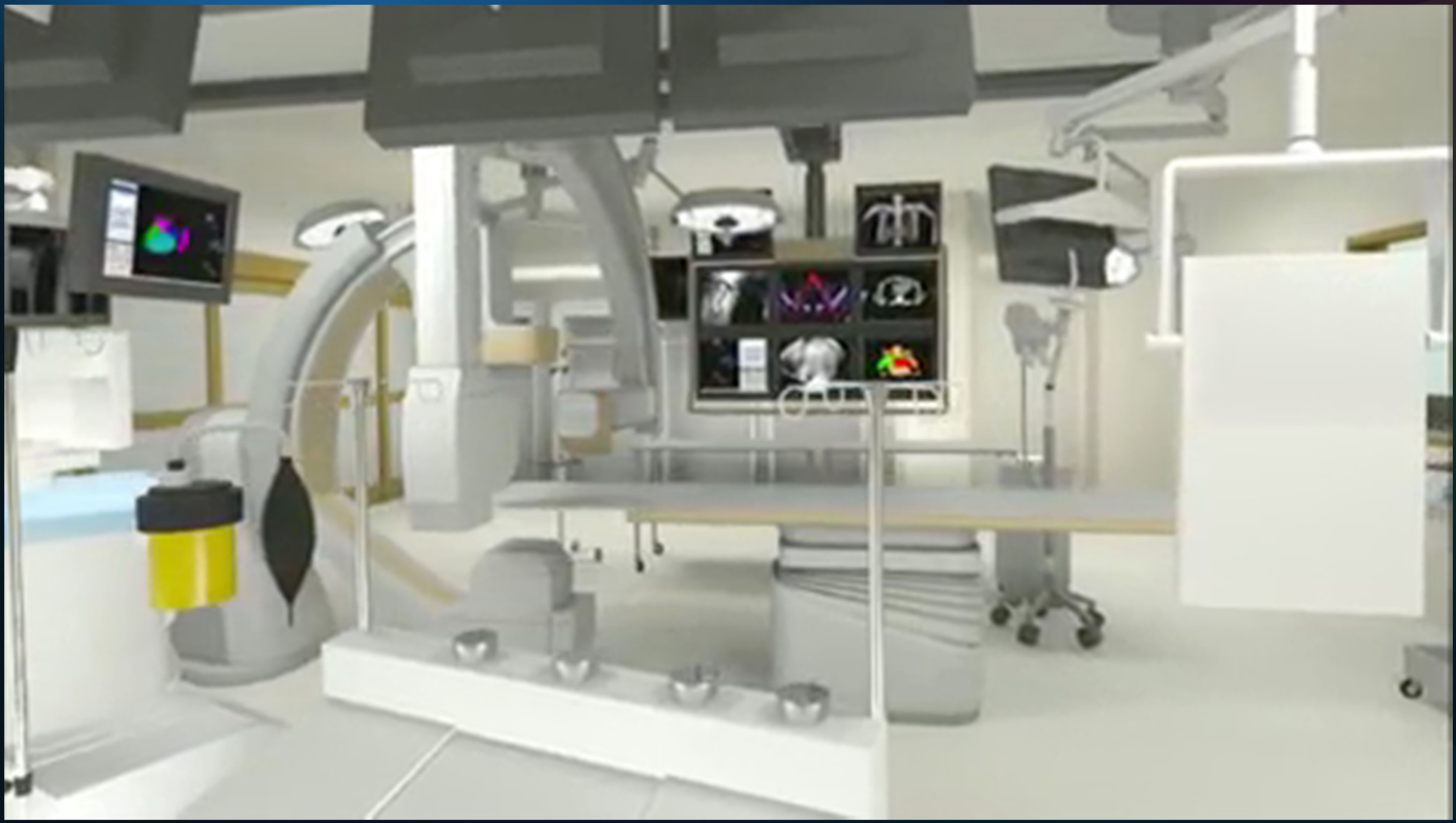
# TECHNOLOGY OPTIONS

CONVENTIONAL

ROBOTICS

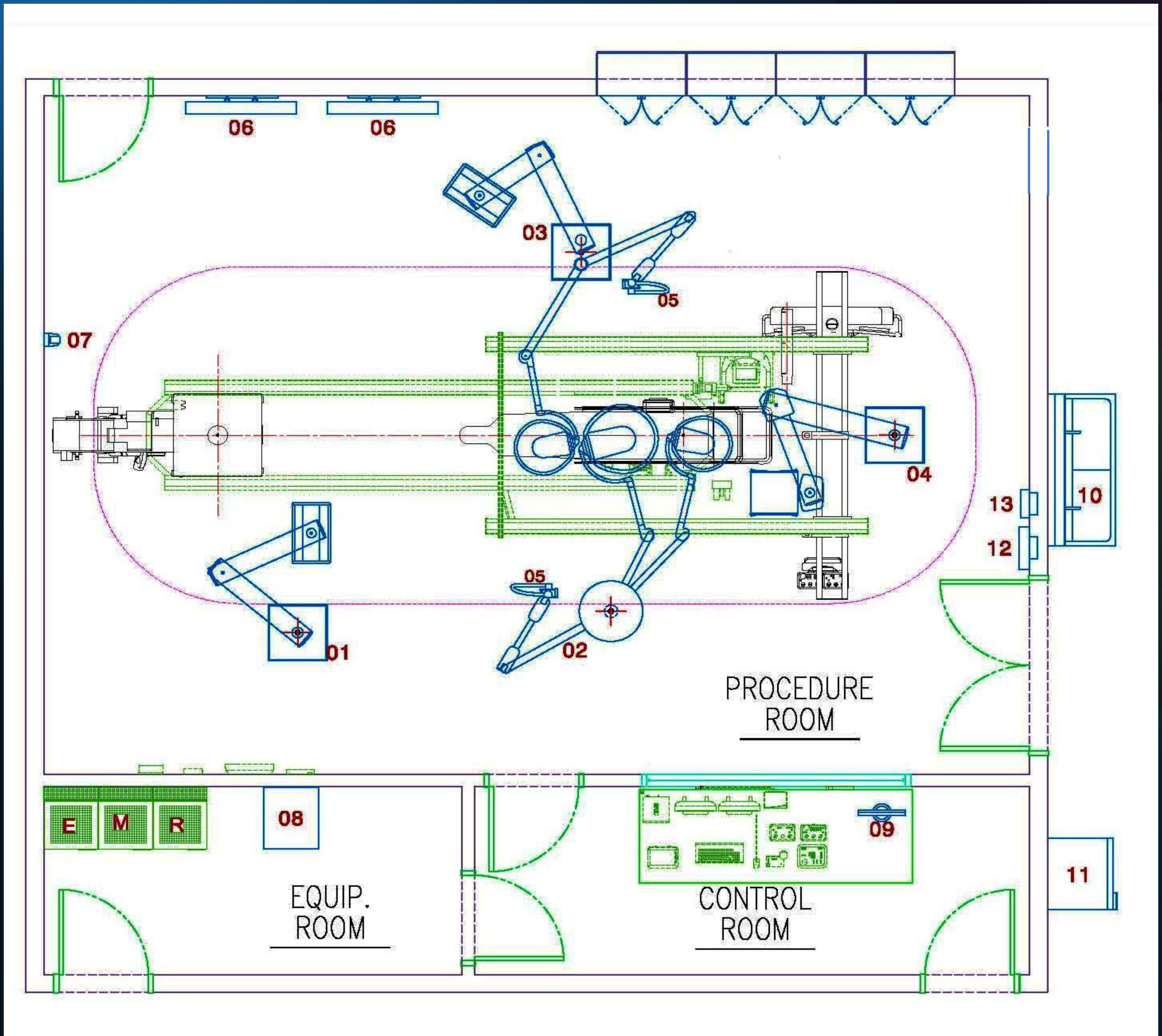
FLEXIBLE

# TECHNOLOGY OPTIONS - *CONVENTIONAL*



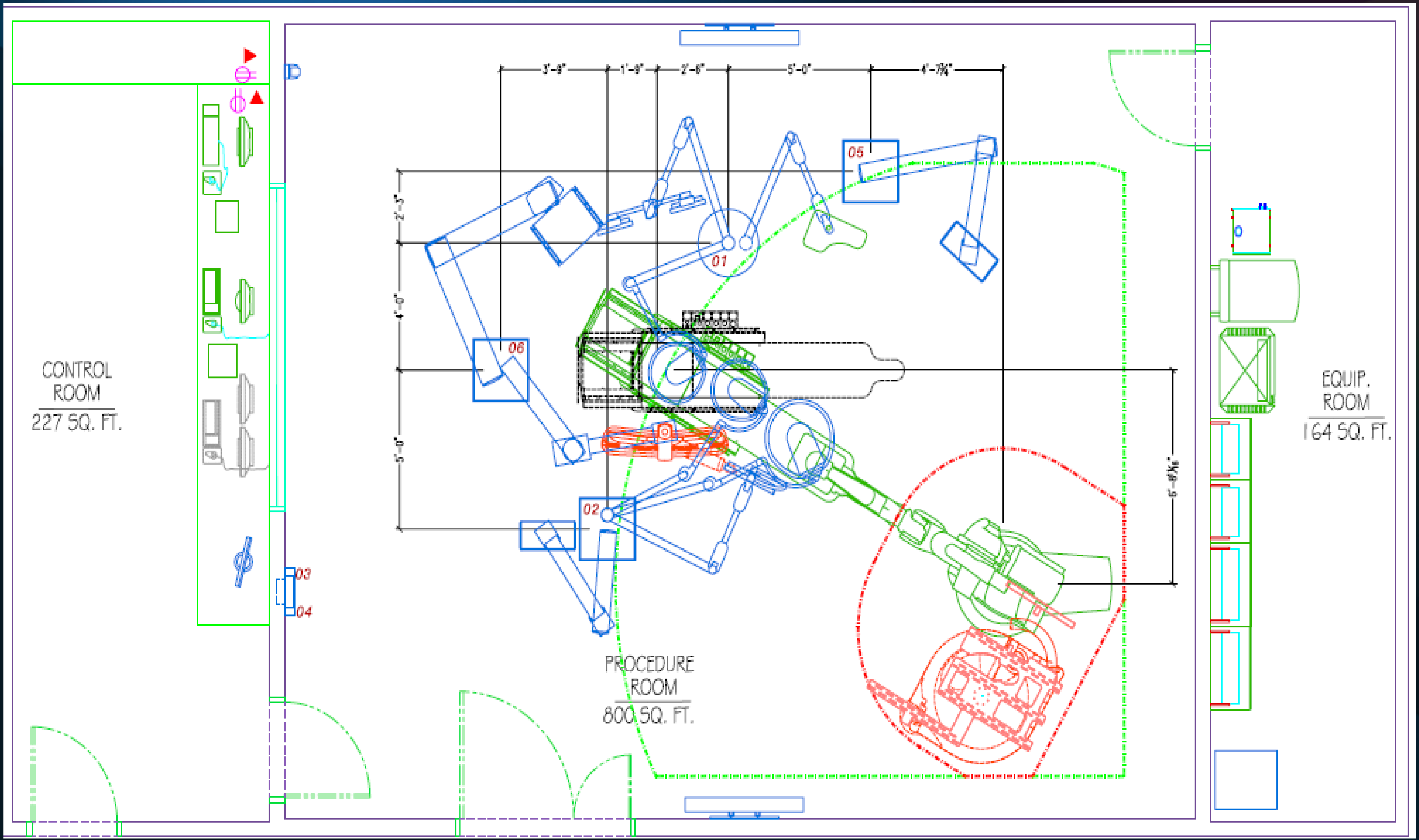
Source: *HKS Architects*

# SAMPLE ROOM LAYOUT - *CONVENTIONAL*

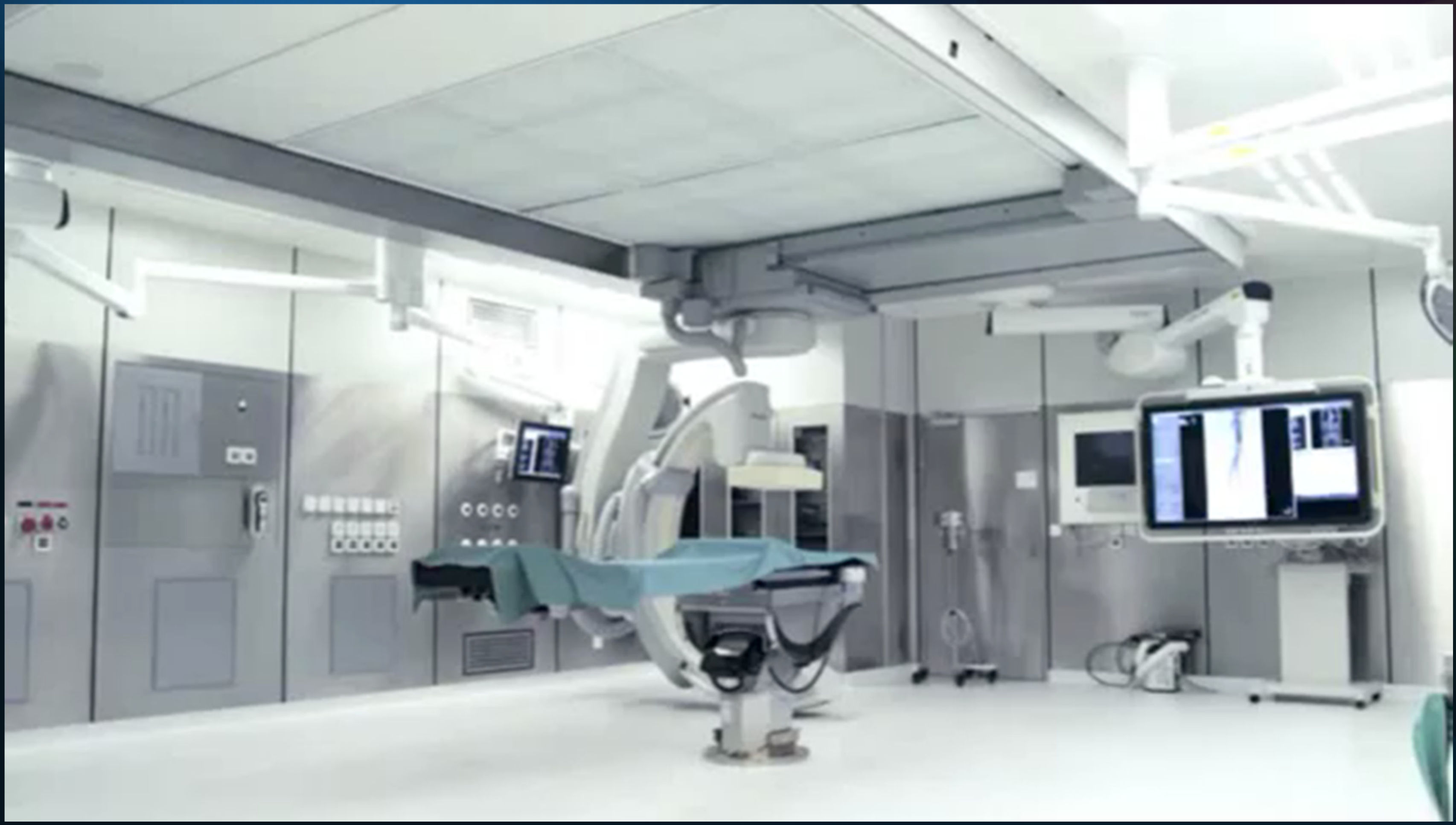


# TECHNOLOGY OPTIONS - *ROBOTICS*

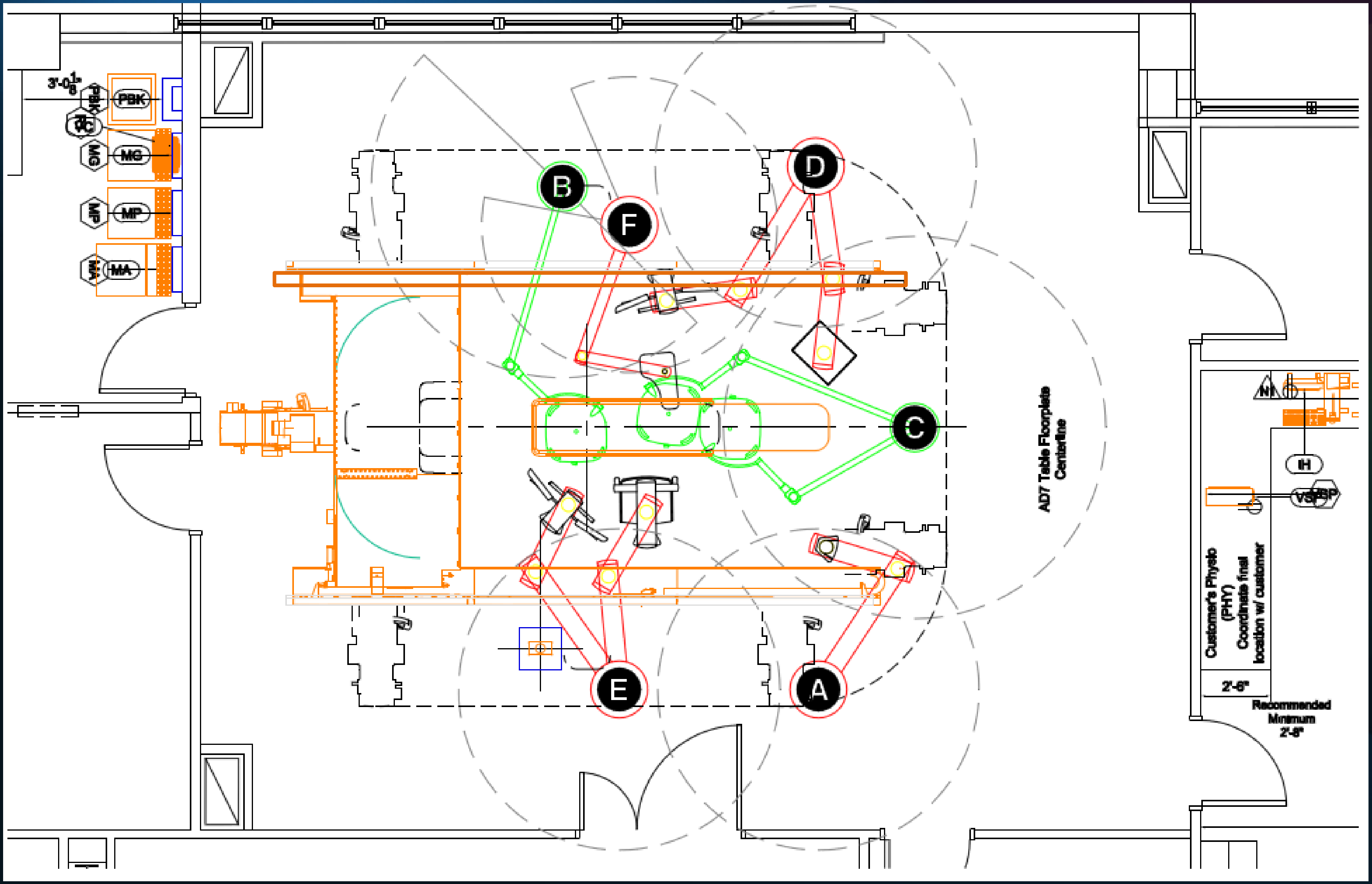
# SAMPLE ROOM LAYOUT- *ROBOTICS*



# TECHNOLOGY OPTIONS - *FLEXIBLE*



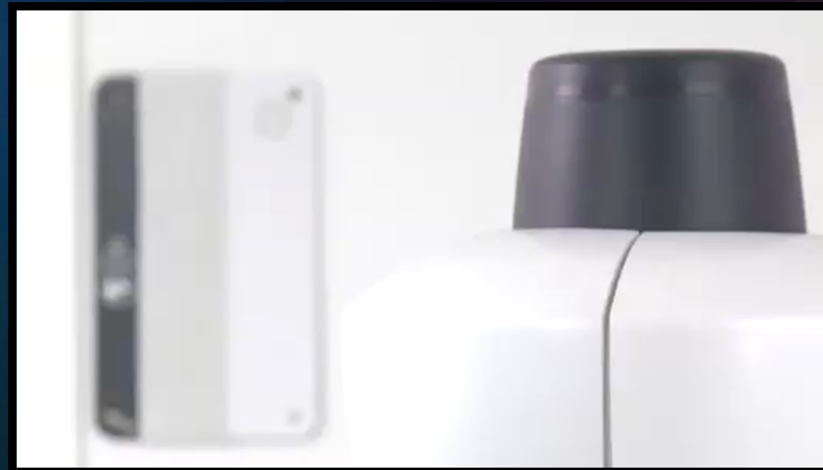
# TECHNOLOGY OPTIONS - *FLEXIBLE*



# TECHNOLOGY OPTIONS – *FIRST LASER GUIDED C-ARM*

## LASER-GUIDED MOVEMENT

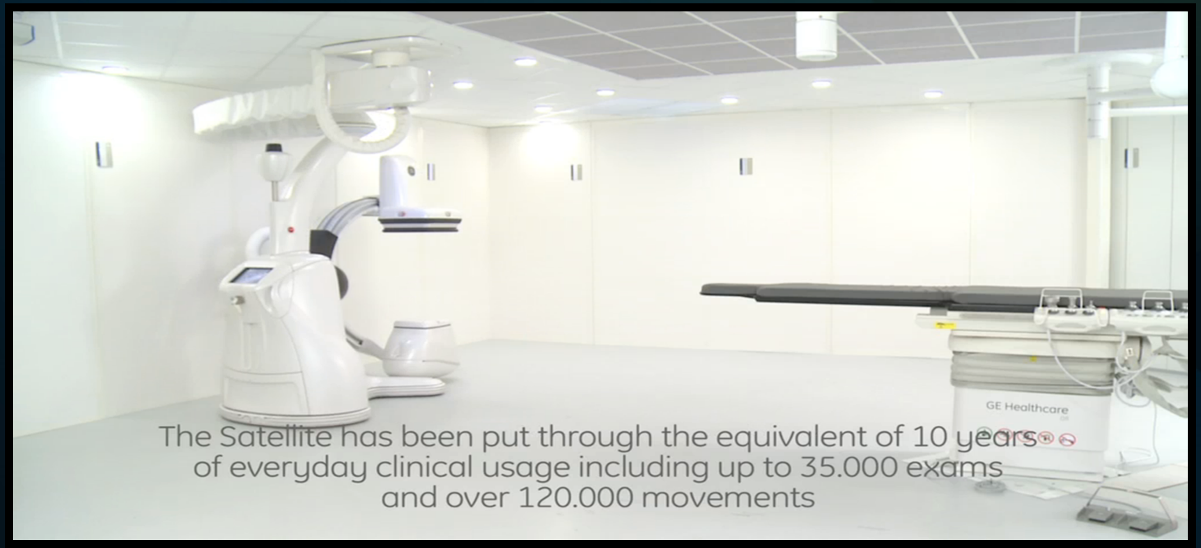
- The AGV rotating laser continuously scans its environment
- Position calculated based on the signal sent back by reflectors



## VEHICLE-MOUNTED GANTRY

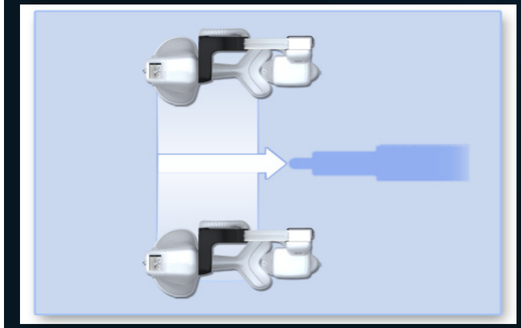
The C-arm is mounted on a motorized laser-guided L-arm, the Advanced Guided Vehicle (AGV)

# TECHNOLOGY OPTIONS – *FIRST LASER GUIDED C-ARM*

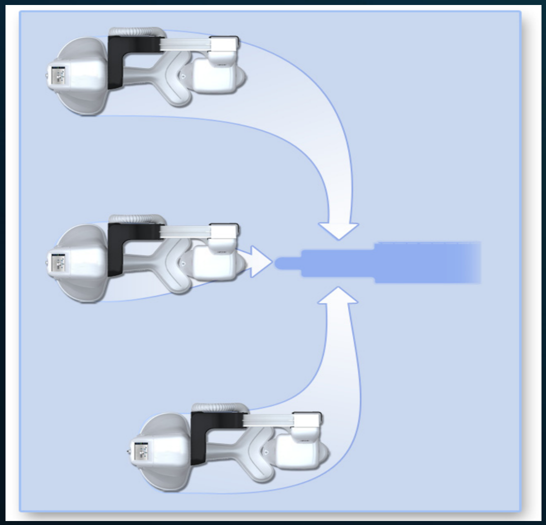



# TECHNOLOGY OPTIONS – *FIRST LASER GUIDED C-ARM*

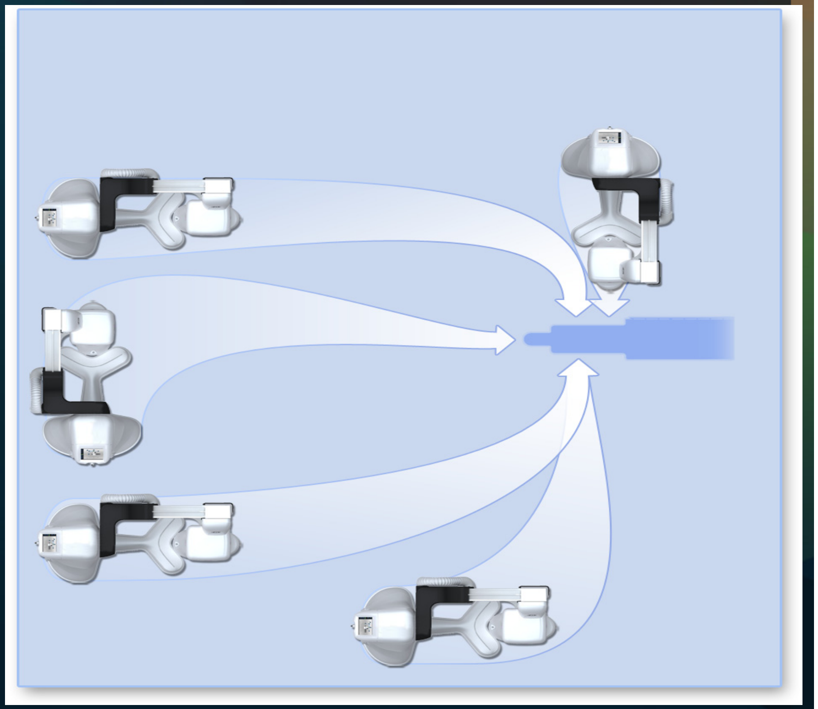
## Parking positions that adapt to your room



35 $m^2$
(377 $ft^2$)



45 $m^2$
(484 $ft^2$)



100 $m^2$
(1076 $ft^2$)

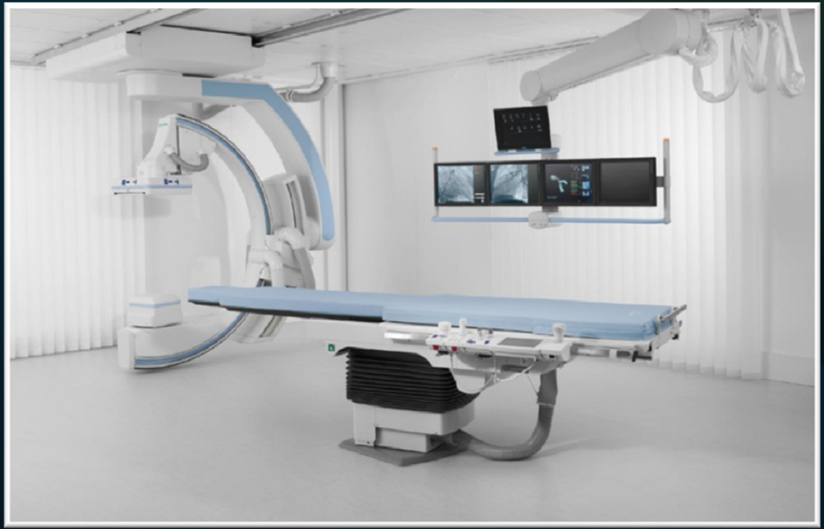
# TECHNOLOGY OPTIONS – *PROS & CONS*

| Technology | Pros | Cons |
|---|---|---|
| Conventional | • Lower equipment cost | • Less flexibility to park the C-arm when not in use |
| Robotics | • Flexibility in parking positions<br>• Less ceiling support required | • Higher equipment cost<br>• Require floor structural reinforcement |
| Flexible | • Complete flexibility in room coverage | • Higher equipment cost |

# DESIGN APPROACH

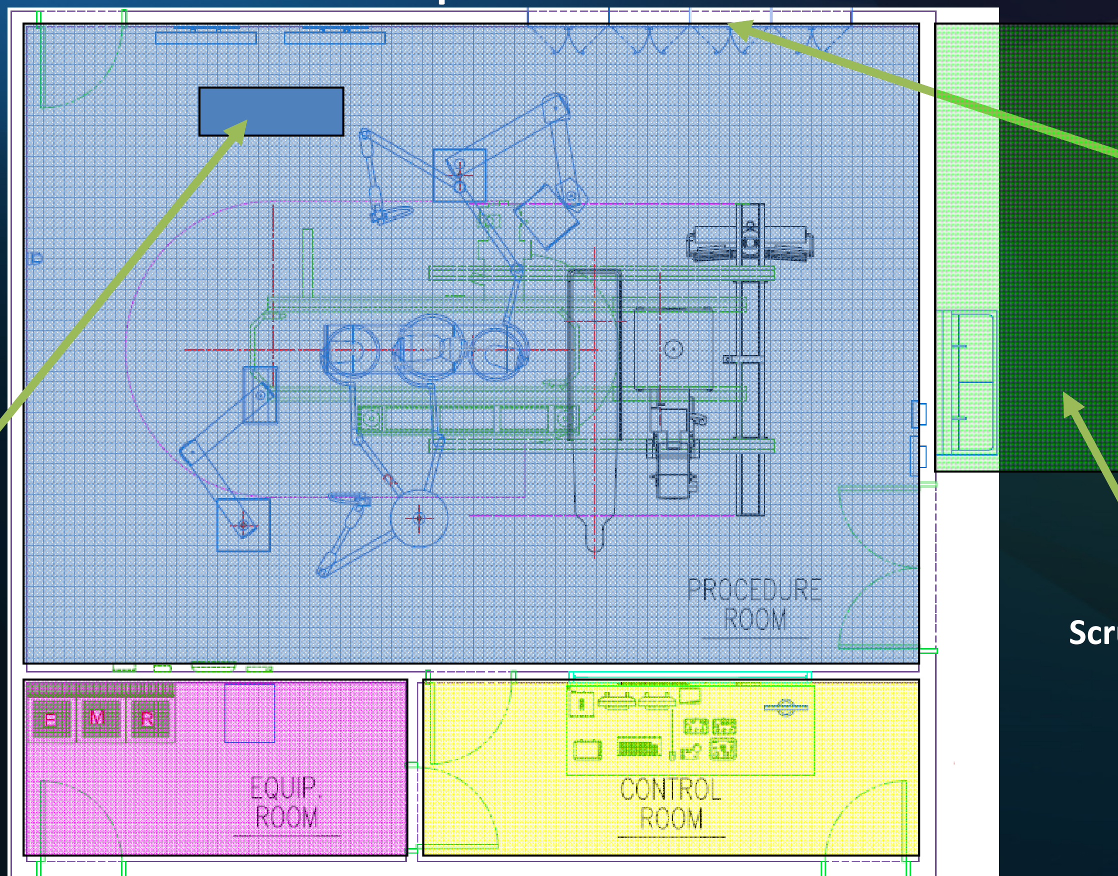
| Critical Tasks | Key Personnel | Deliverable |
| --- | --- | --- |
| 1. Identify technology platform(s) | • Hospital Administration<br>• Surgeons<br>• Nursing<br>• MEQ Planner | A business plan with specific technologies & procedures targeted |
| 2. Determine room sizing & orientation | • Architect<br>• MEQ Planner<br>• Surgeons & Nursing<br>• Imaging Vendor/OEM | Schematic departmental and room Layouts |
| 3. Layout X-Ray equipment | • Architect<br>• MEQ Planner<br>• Imaging Vendor/OEM | Preliminary site specific drawing for X-Ray system |
| 4. Develop ceiling mounted equipment configuration | • Architect<br>• MEQ Planner<br>• Surgeons & Nursing<br>• Lights & Booms Vendor | Preliminary site specific drawing incorporating X-Ray equipment, lights & booms |
| 5. Incorporate OR integration technology | • Architect<br>• MEQ Planner<br>• Surgeons & Nursing<br>• OR Integration Vendor | Conduit schedule based on the site specific equipment configuration |

# DESIGN APPROACH – *TECHNOLOGY PLATFORM*



# DESIGN APPROACH – *ROOM SIZING*

**Operating Room (Exam Room)**
**800 – 900 sq. ft. Recommended**




**OR Workstation**

**OR Storage**

**Scrub/Stretcher Alcove**
**140 sq. ft.**
**Recommended**

**Equipment Room**
**144 sq. ft. Recommended**

**Control Room**
**120 sq. ft. Recommended**

# CASE STUDY– *DEPARTMENTAL LAYOUT*

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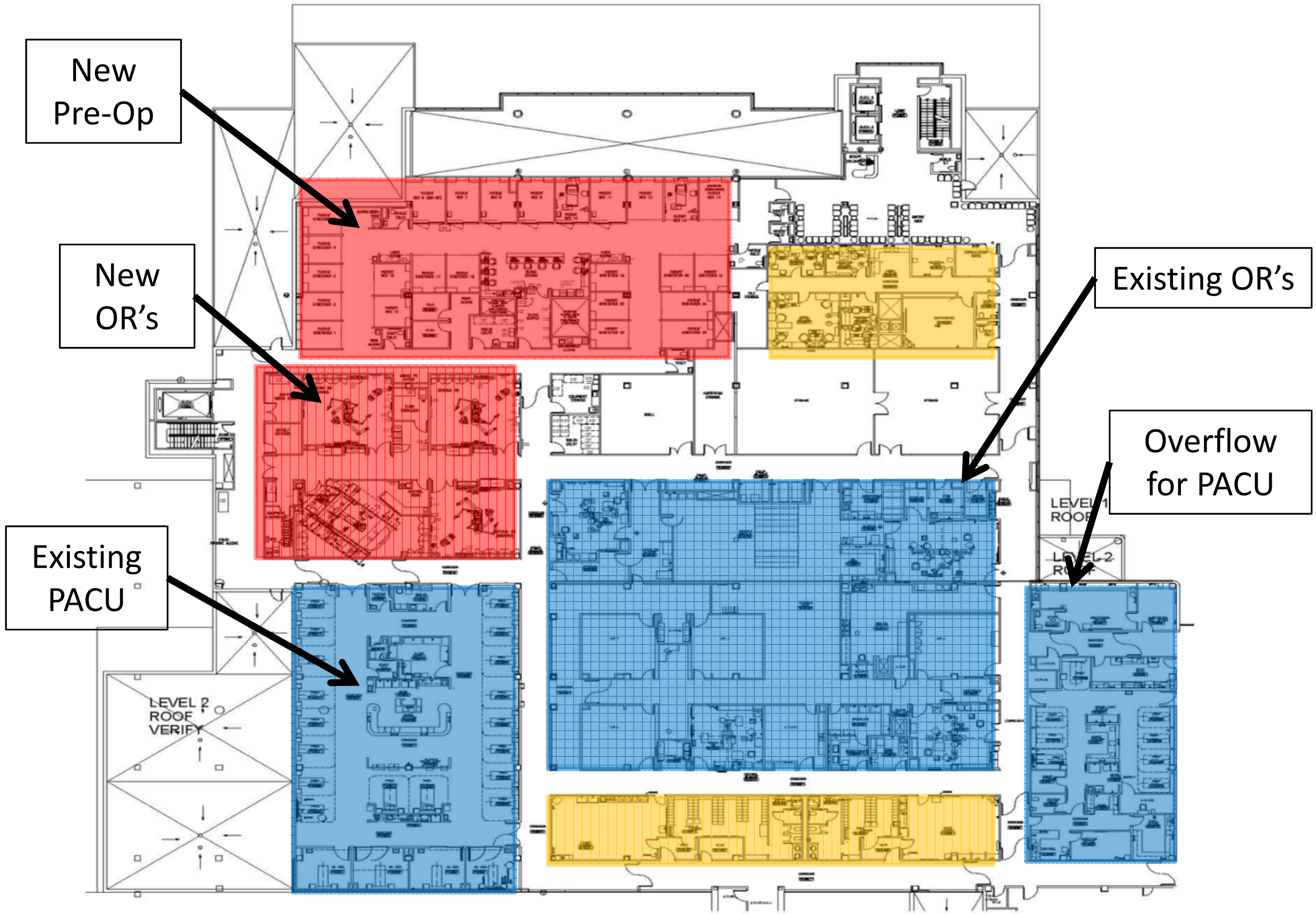
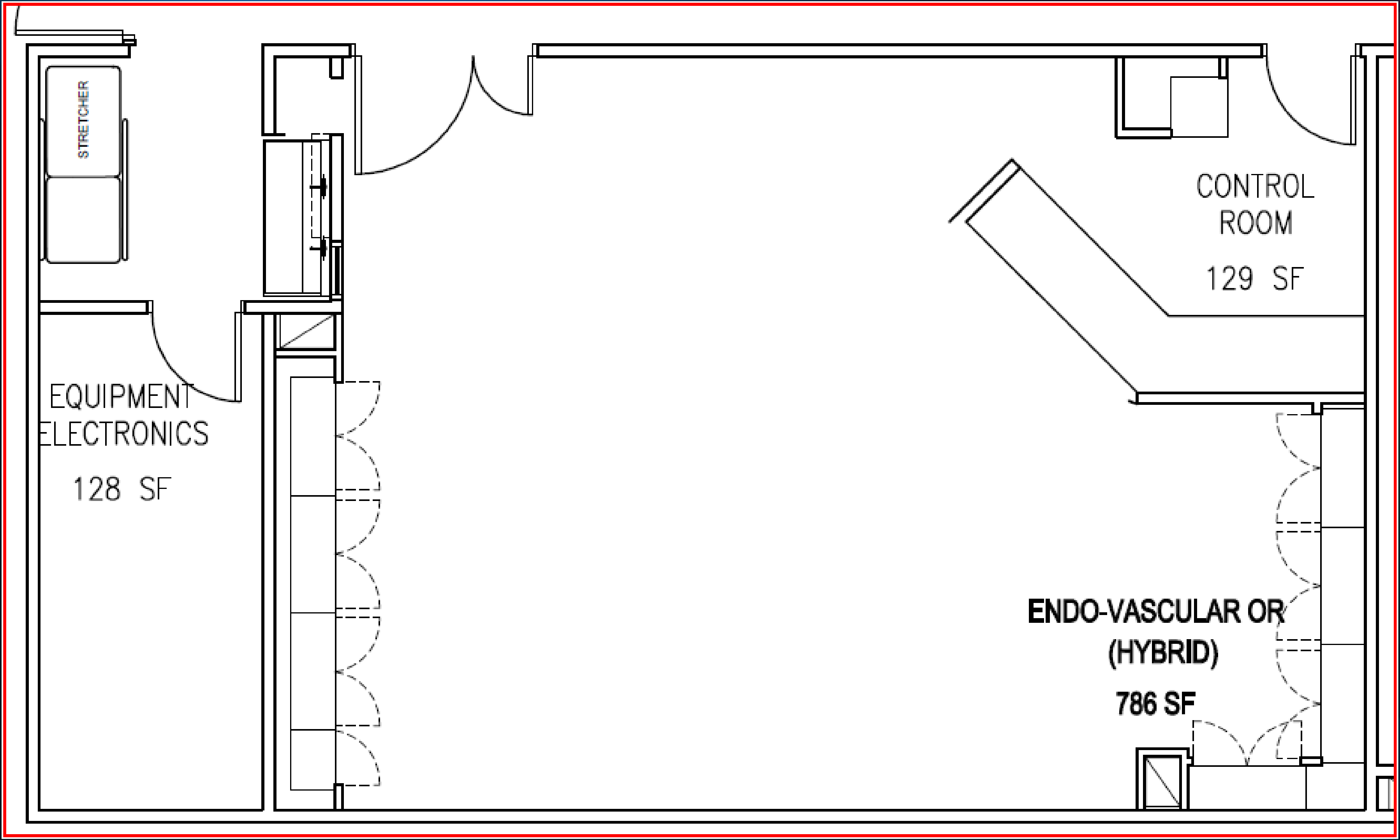
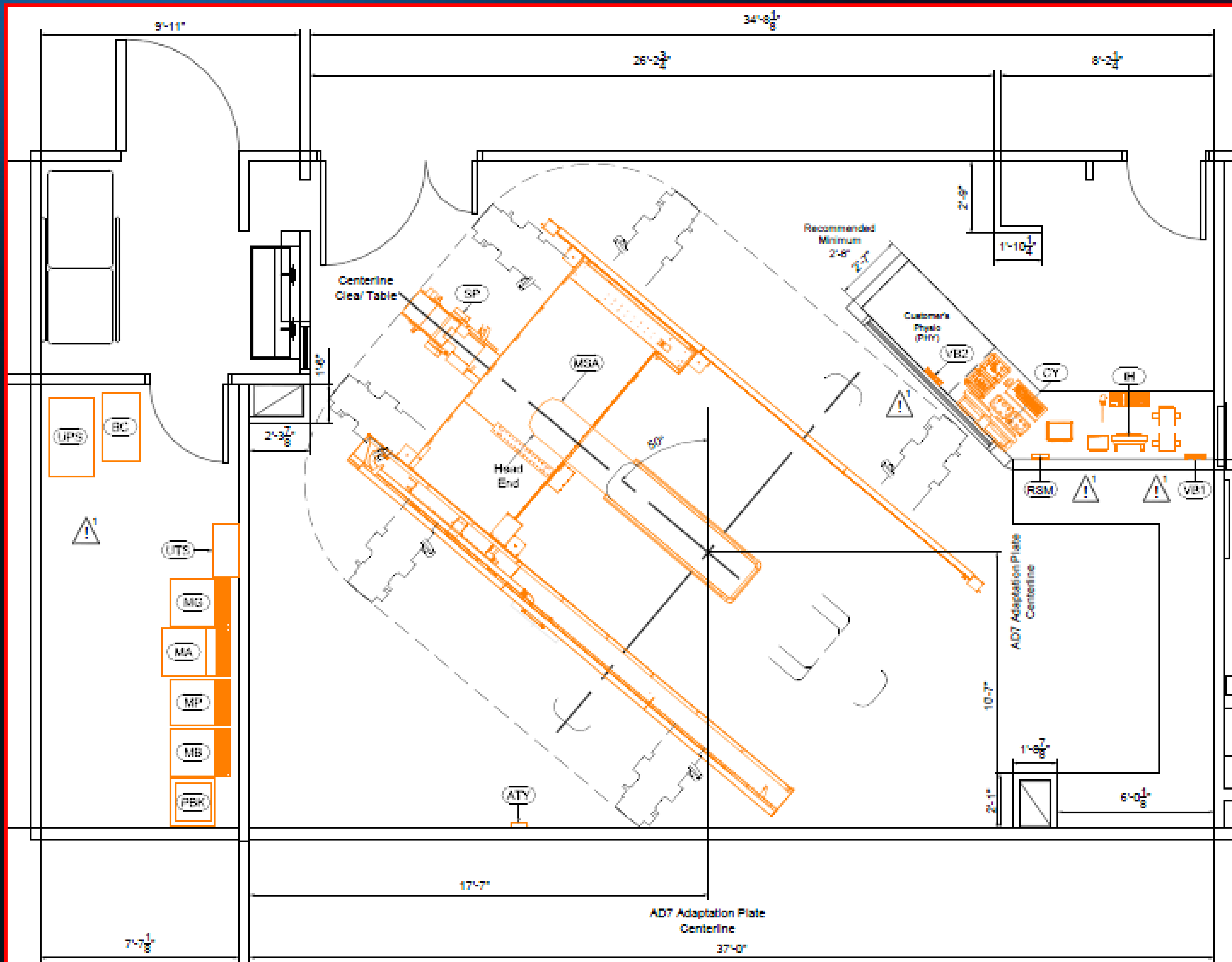


# CASE STUDY– *DEPARTMENTAL LAYOUT*

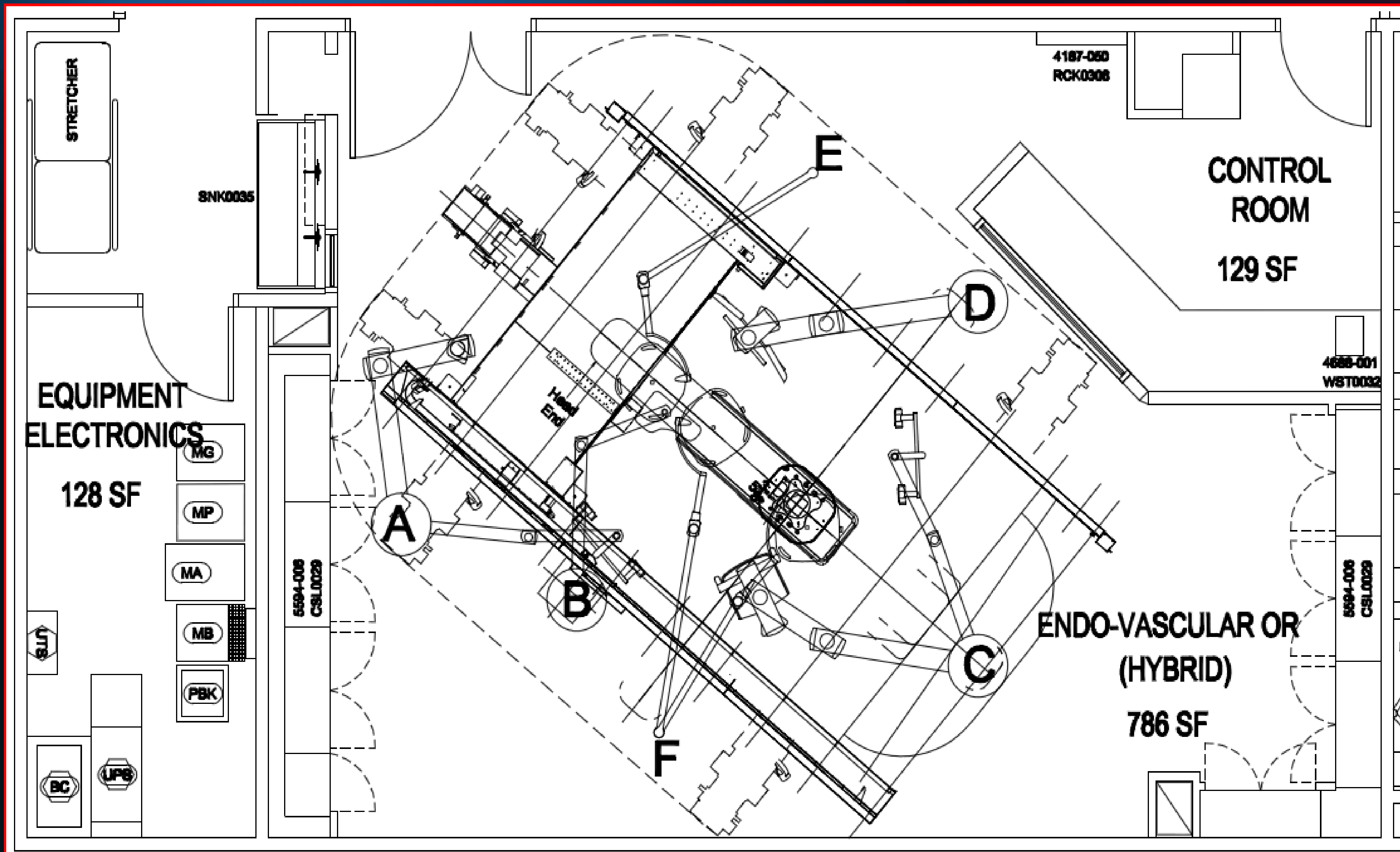
# CASE STUDY– *ROOM SIZING*



# CASE STUDY– *X-RAY POSITIONING*



# CASE STUDY – *CEILING MOUNTED EQUIPMENT POSITIONING*



# CASE STUDY – *CEILING MOUNTED EQUIPMENT POSITIONING*

# CASE STUDY – *VIDEO INTEGRATION*

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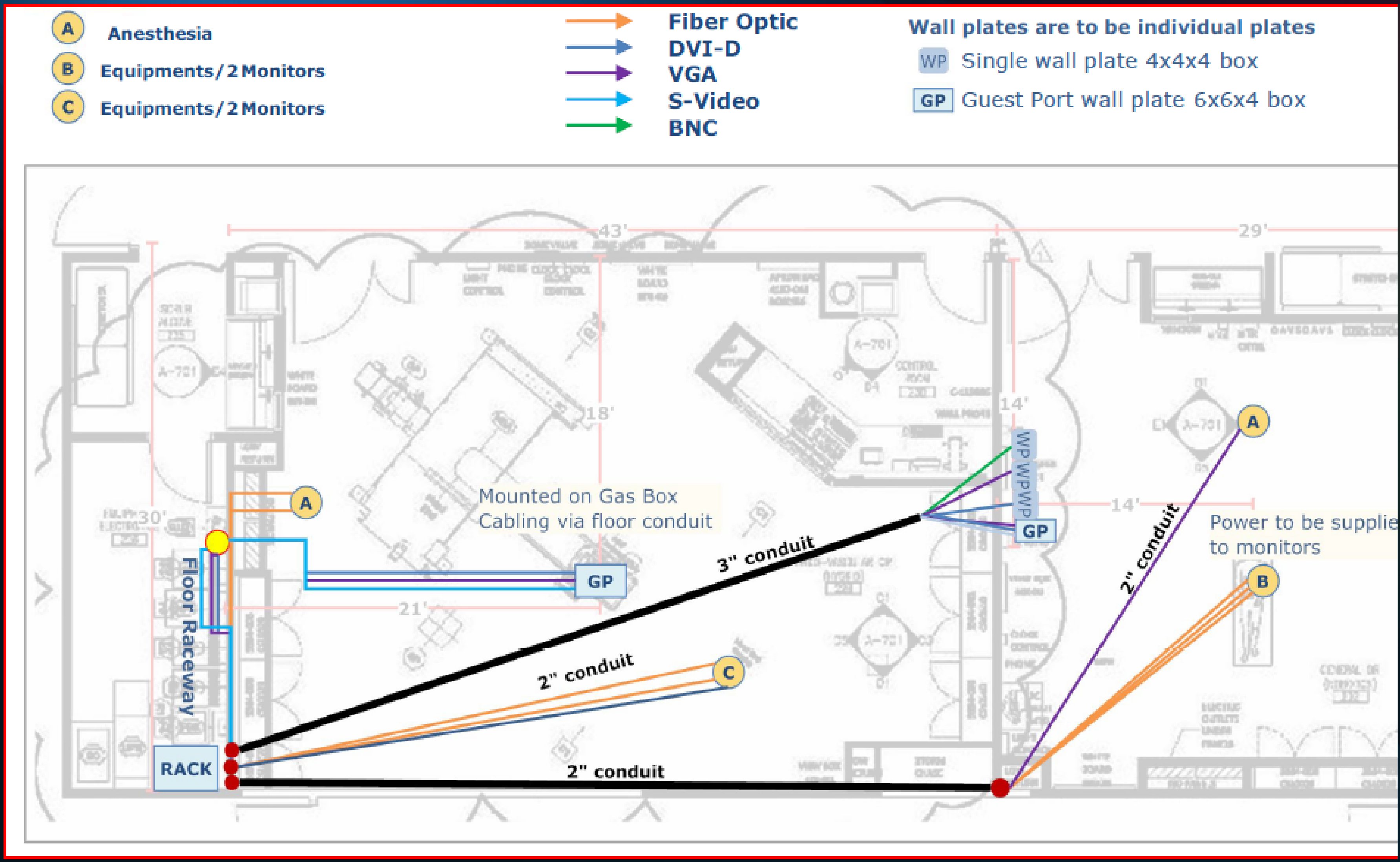


# PREPARED TO DESIGN YOUR HYBRID SUITE?

## Process & Approach

- ✓ Define your Hybrid Suite (Procedures & Technologies).
- ✓ Assemble a design team.
- ✓ Don't be afraid to engage vendors/OEMs.
- ✓ Implement the best practice approach.
- ✓ Hire a medical equipment planner!

# PROJECT-WIDE PERSPECTIVE

## MEDICAL TECHNOLOGY PLANNING

The alignment of Medical Technology with Architectural and Engineering Design is critical to the construction process; creating best-of-class facilities; and ultimately improved patient outcomes.

# IMPACT OF MEDICAL TECHNOLOGY

CONSIDERATION OF **MEQ** AS A KEY ELEMENT OF PLANNING IS CENTERED AROUND 6 MAJOR CLIENT DRIVEN DIMENSIONS:

- MEQ **capital represents over 25% of total project costs**
- MEQ **has a direct impact on facility design and operational work flows**
- MEQ **is a major critical path in a construction and delivery program**
- MEQ **coordination represents a high risk to all project stakeholders**
- MEQ **directly supports improved patient safety and clinical outcomes**
- MEQ **impacts an organization's bottom line**

# IMPACT OF MEDICAL TECHNOLOGY - *COST*

## TODAY'S HEALTHCARE PROJECTS ARE INCREASINGLY EXPENSIVE

Medical Technology Costs

- Are Second only to Construction
- Can Equal 30% of total Construction Costs
- Have Additional Cost Impacts:
    - *Patient Care*
    - *Ongoing Maintenance*
    - *Ongoing Operations and Staffing*
    - *Reimbursement*

***These are 'Forever Costs'***

# IMPACT OF MEDICAL TECHNOLOGY – *COMPLEXITY*

## TODAY'S HEALTHCARE PROJECTS ARE INCREASINGLY COMPLEX

- Universal Operating Rooms
- Robotics
- Point of Use / Mobile Devices
- Hybrid Surgical / Interventional Rooms
- Acuity Adaptable Patient Rooms
- Campus-centric Telemedicine
- e-ICU Rooms
- Facility-wide Monitoring & RFID
- Flexible Imaging Suites
- Central UPS Systems
- OR Integration
- Sterilization Automation
- Lab & Pharmacy Automation
- Bariatric Care



# IMPACT OF MEDICAL TECHNOLOGY – *IT AND EMR CAPACITY*

## THE EVER-EXPANDING LIST OF DEVICES

Examples of current Integration Points and Technologies:

- Imaging Systems
- Cardiac output monitors
- Defibrillators
- Fetal monitors
- Electrocardiographs
- Infant incubators
- Infusion pumps
- Intelligent medical device hubs
- Interactive infusion pumps
- Physiologic monitors
- Ventilators
- Vital signs monitors

Examples of future Integration Points and Technologies:

- Active RFID
- Patient Health Cards
- Biometric devices (palm vein readers)
- Thermometers
- Patient Scales
- Kiosks
- Alerts to communications systems
- Smart beds
- Lighting and environmental controls
- Vital Sign devices to EMR
- Nurse call systems
- Patient phone systems
- TV/entertainment system
- Refrigerators

# IMPACT OF MEDICAL TECHNOLOGY – *SYSTEMS & WORKFLOWS*

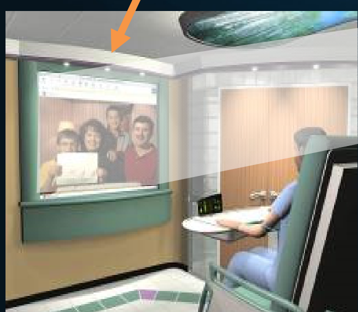
## THE EVER-EXPANDING LIST OF ROOMS AND SYSTEMS

### INTELLIGENT PATIENT ROOMS

2-way video conferencing
- Family
- Physician

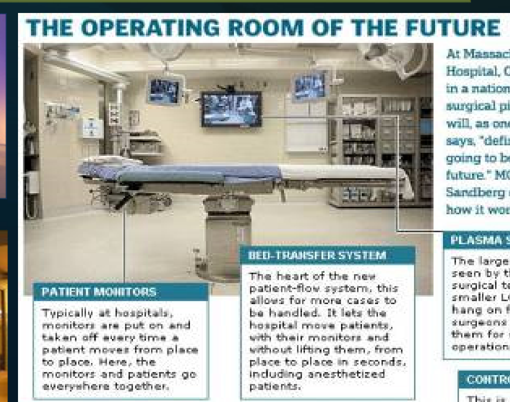
Tracking Systems

EMR
PAC's
Lab Results

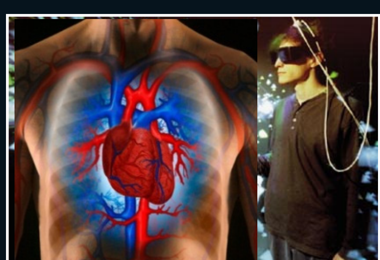


### TELEPRESENCE

### CONTEXT AWARE SURGICAL SUITES




### VIRTUAL ENVIRONMENTS



- Virtual Surgery
- 3D Electronic Medical Record
- Molecular Based Surgery
- Patient Therapy

# IMPACT OF MEDICAL TECHNOLOGY – *FACILITY FLEXIBILITY*

## NEED FOR FLEXIBLE FACILITY SOLUTIONS

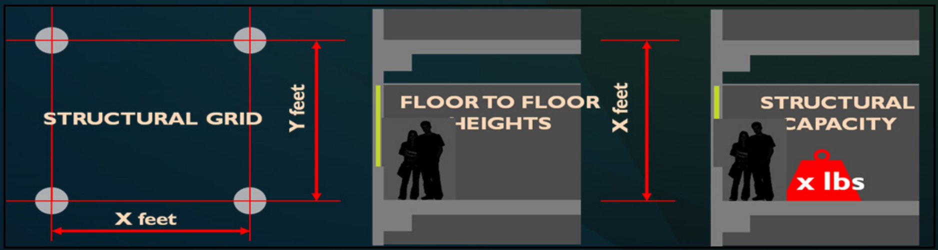
*Preventing facility obsolescence: building a hospital with a future*

*Technology Trends Impact:*

- Flexibility and Adaptability
- Physical Expansion
- Building System Infrastructure
- Information Technology Scalability

*MEP & Facility Capacity*


*Structural Capacity*




*Data Center & IT Capacity*

## RESULTS OF EARLY MEDICAL EQUIPMENT INTEGRATION WITH DESIGN

- ALIGNMENT OF TECHNOLOGY WITH TRUE CLINICAL REQUIREMENTS
- ALIGNMENT OF TECHNOLOGY WITH DESIGN CONCEPTS
- SUPPORT OF FLEXIBLE FACILITY DESIGN
- ELIMINATION OF WRONG TECHNOLOGY SELECTIONS
- TRUE BUDGET ESTIMATES EARLIER IN PLANNING
- REDUCTION OF DESIGN REWORK
- MINIMIZATION OF CONSTRUCTION CHANGE ORDERS
- IMPROVED SCHEDULE COMPLIANCE
- OPTIMAL PROCUREMENT AND TECHNOLOGY ADOPTION STRATEGIES
- DEVELOPMENT OF BEST VALUE TECHNOLOGY PACKAGE

# BREAKDOWN OF A TYPICAL MEDICAL EQUIPMENT PACKAGE

| Equipment Category | % of Equipment Budget | % of Equipment Items | Arch. Significant | IT Connectivity |
|---|---|---|---|---|
| Group 1 | 45% | 13% | 100% | 90% |
| Group 2 | 37% | 35% | 20% | 40% |
| Group 3 | 18% | 52% | 20% | < 2% |

*Group 1 = Major Fixed (Imaging, Sterilization, Lights & Booms)*

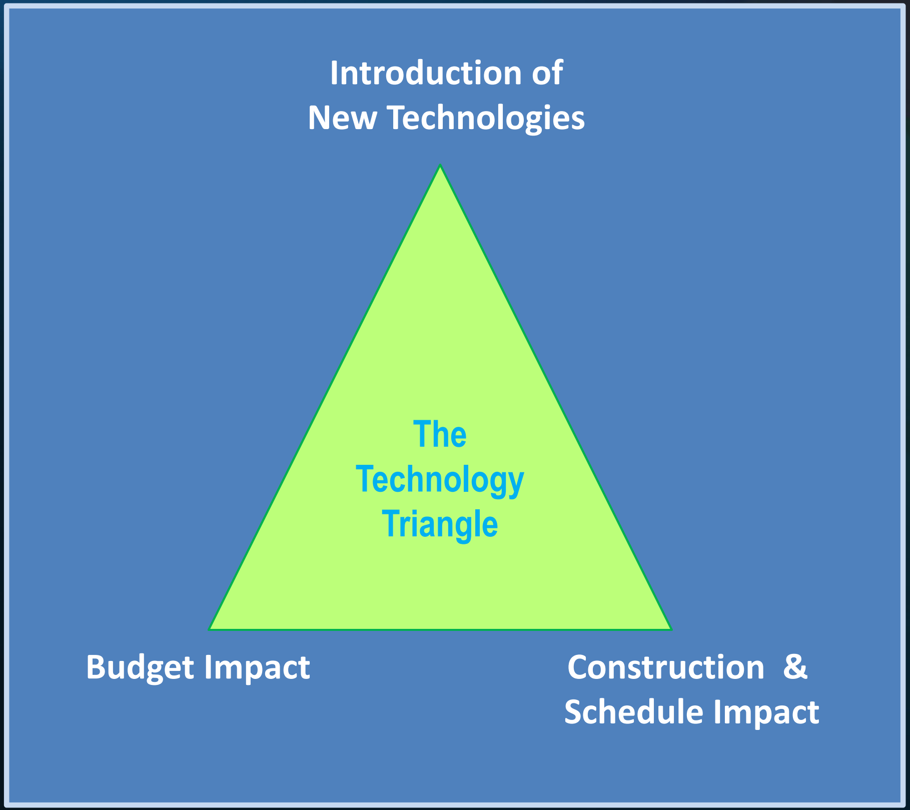
*Group 2 = Major Movable (Monitoring, Beds, Defibs)*

*Group 3 = Minor Moveable (Shelving, Carts, Waste Recpt.)*

*Note – Group 1 has lowest % of Qty, and highest impact on Design and IT*

# IMPACT OF MEDICAL TECHNOLOGY

## MANAGING THE IMPACT *(TECHNOLOGY TRIANGLE)*



# IMPACT OF MEDICAL TECHNOLOGY

## MANAGING THE IMPACT *(TECHNOLOGY TRIANGLE)*

- Involve Medical Technology Planning Early in the Design Process
- Develop and Manage 'Strike Lists' of High Impact Technologies
- Utilize a MEQ Design Matrix for all Major Equipment
  - *Allows the completion of CD prior to actual technology selection*
- Establish a Comprehensive Change Management Process
  - *Evaluation and Approval of Technology Changes*
- Establish a Strategic Technology Advisory Committee (for the duration of the project)
  - *Monitor Clinical Requests and Technology Trends*
- Early Engagement of Major Technology Vendors (During the Design Phase)
  - *Imaging Systems, Sterilization, etc.*
- Early Confirmation of Installation and Commissioning Schedules
- Early Confirmation of Training Requirements and Schedules