The Quality Colloquium on the Campus of Harvard University

Annenberg Hall in Memorial Hall 45 Quincy Street, Cambridge, MA August 19-22, 2007

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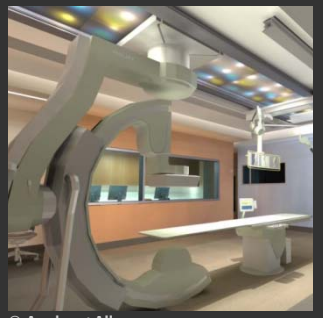

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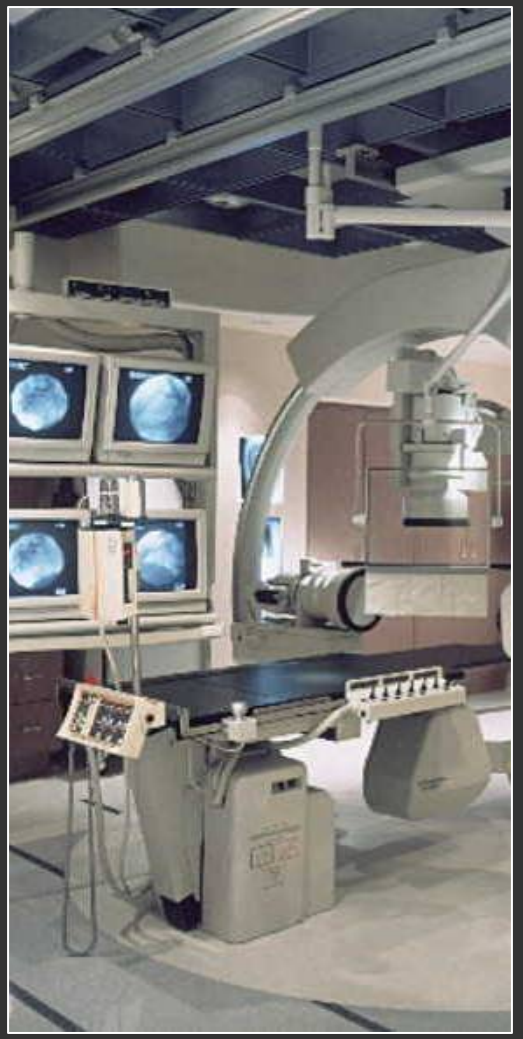
Designing the Hospital of the Future

Improving the Quality of Care through facility design

Bill Rostenberg, FAIA, FACHA, Principal and Director of Research Anshen+Allen Architects

Presentation Outline

1. ……. The Hospital of the Future
2. ..... Nursing Unit Design
3. ..... Diagnostic and Treatment Area Design



The Hospital of the Future

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Family-centered Supportive Environments

- Privacy, dignity, respect
- Clear intuitive way-finding
- “On-stage / off-stage”

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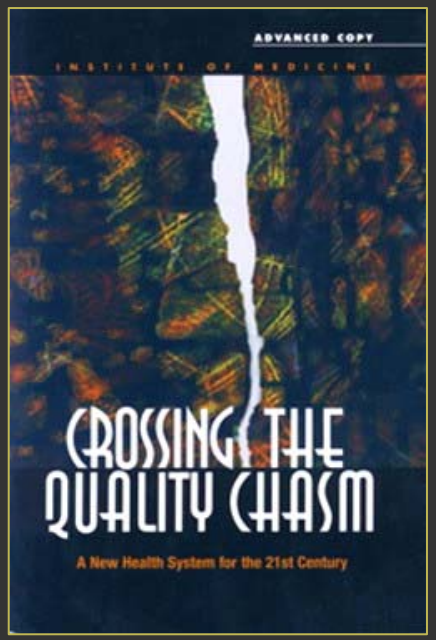
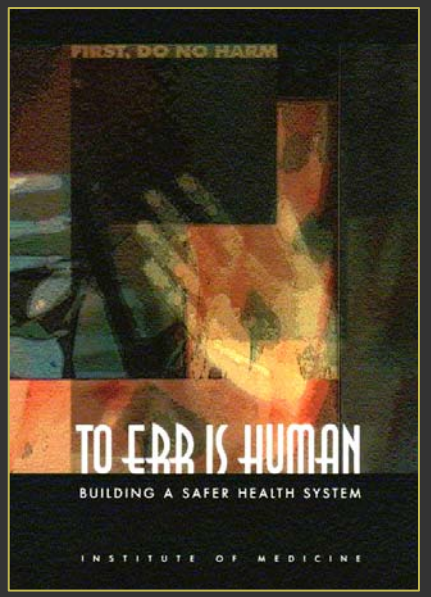
Improve Quality & Safety

- Standardization
- Advanced communications systems
- Improved lighting
- Better acoustic control
- Improved visibility



2001



2000

Leverage Scarce Resources

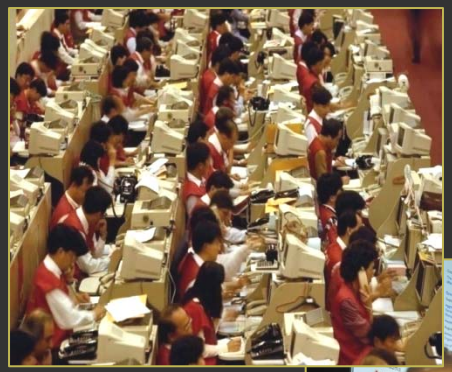
The Staffing Crisis will continue at many levels:

- radiology nurses
- radiology technologists
- radiologists
- “PACS” specialists

New types of personnel are evolving in the procedural environment:

- “Image-guidance” radiologists
- Surgical Imaging Technologists
- Surgical IT Managers
- Non-surgical Interventionalists

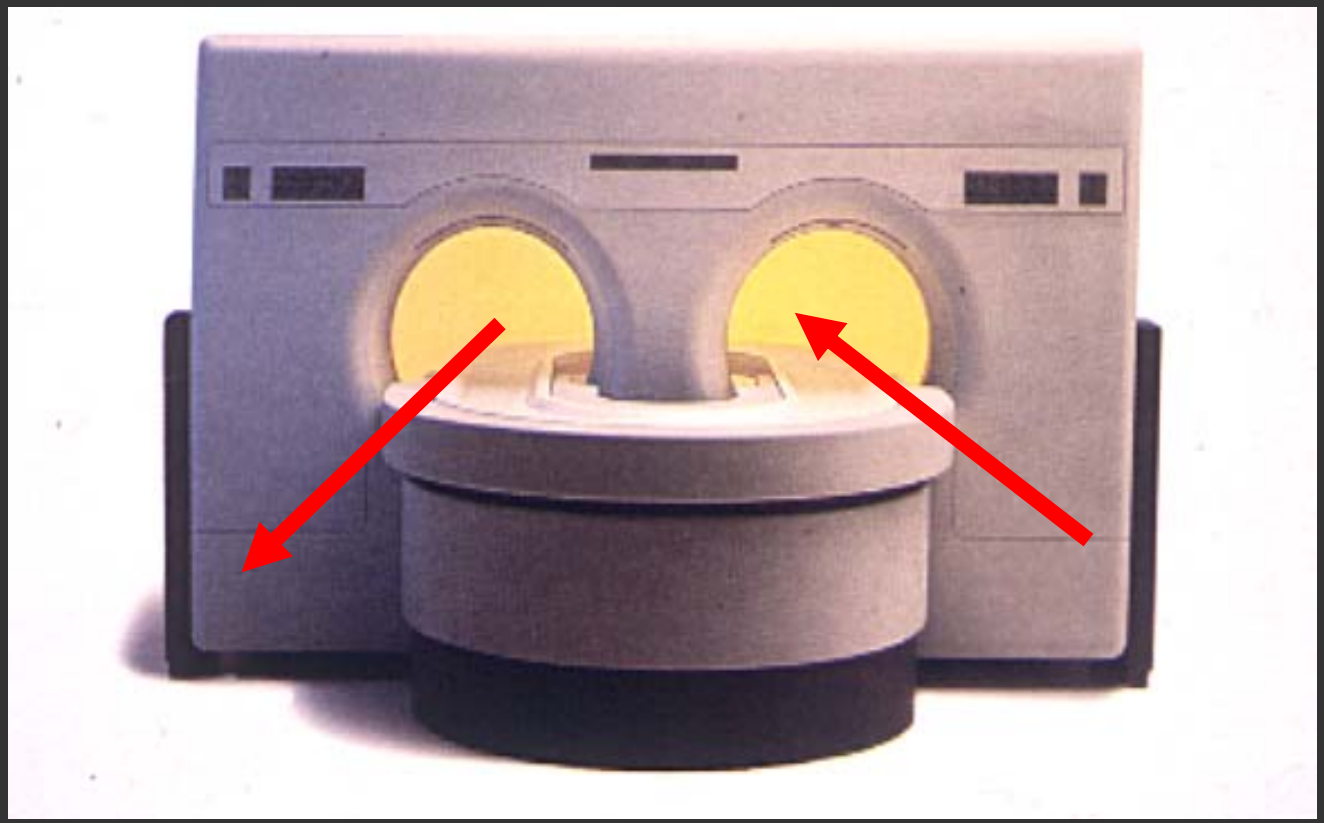
Leverage Remote Specialists



- Tele-radiology
- “e-ICU”®
- Call Centers
- Remote Outreach Facilities

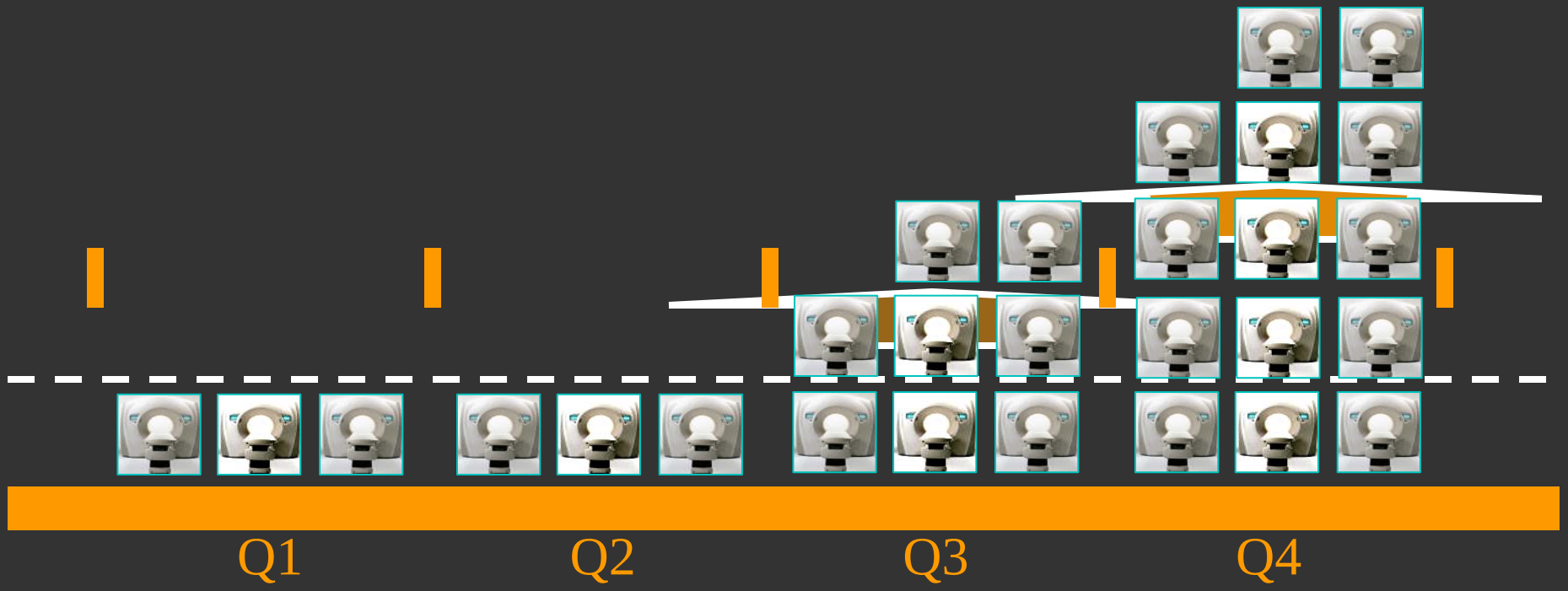
Photo courtesy of Sutter Health

Increase Productivity



Predict Future Changes

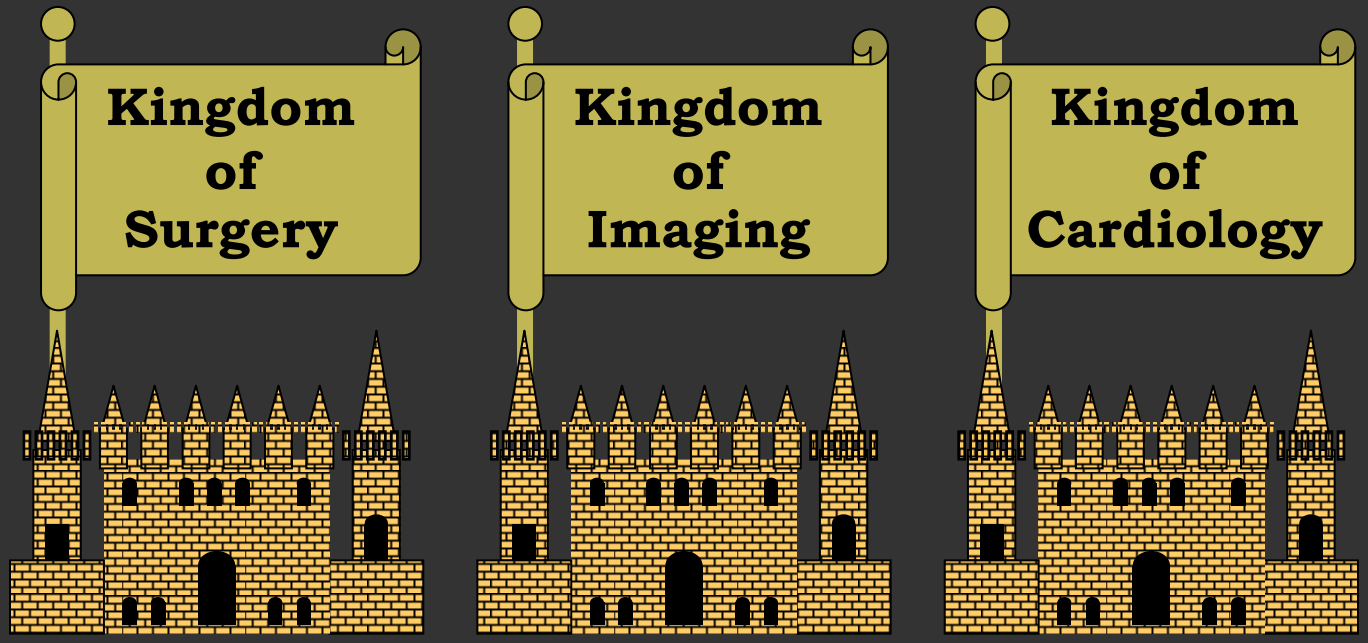
(reimbursement, regulatory, technological, procedural, etc)



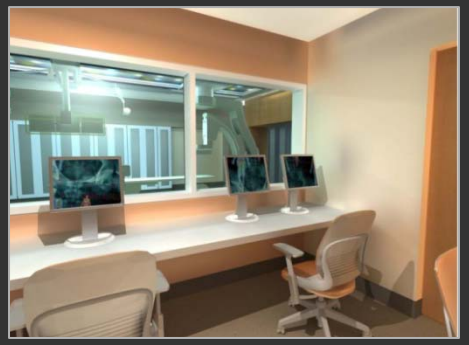
During the 6 months following CMS's 2001 PET reimbursement approval for certain oncology use, PET utilization grew by over 50% .... and continues ….

Convert Competition into Collaboration

- Competition among surgeons, interventional radiologists and cardiologists continues….
- Visionary leaders are beginning to mandate multi-specialty collaboration
- Many specialists are willing to collaborate rather than compete



Enhance Brand Identity



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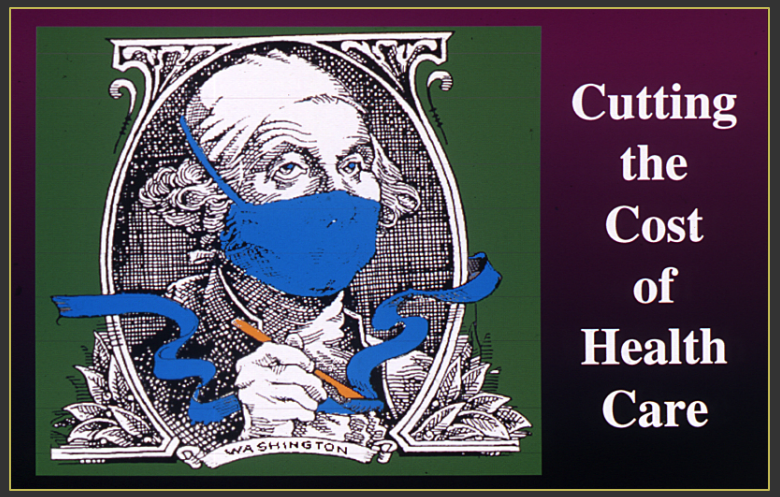
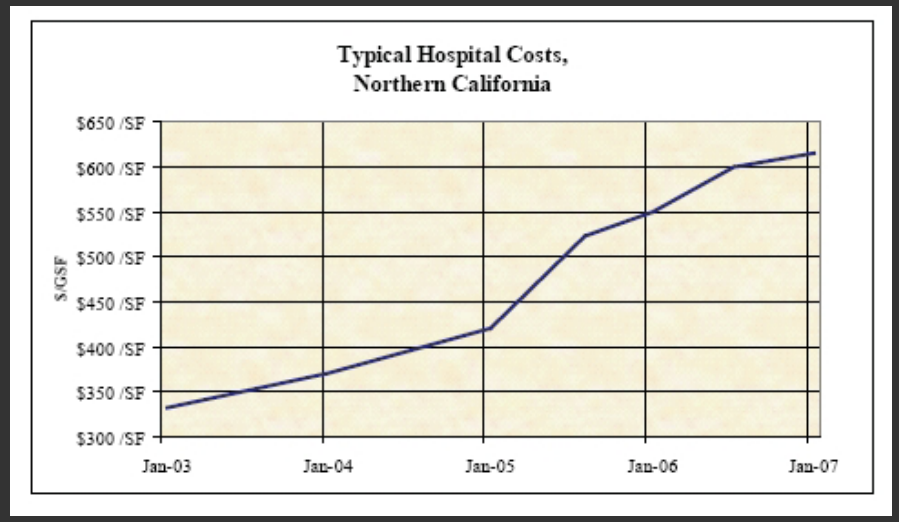
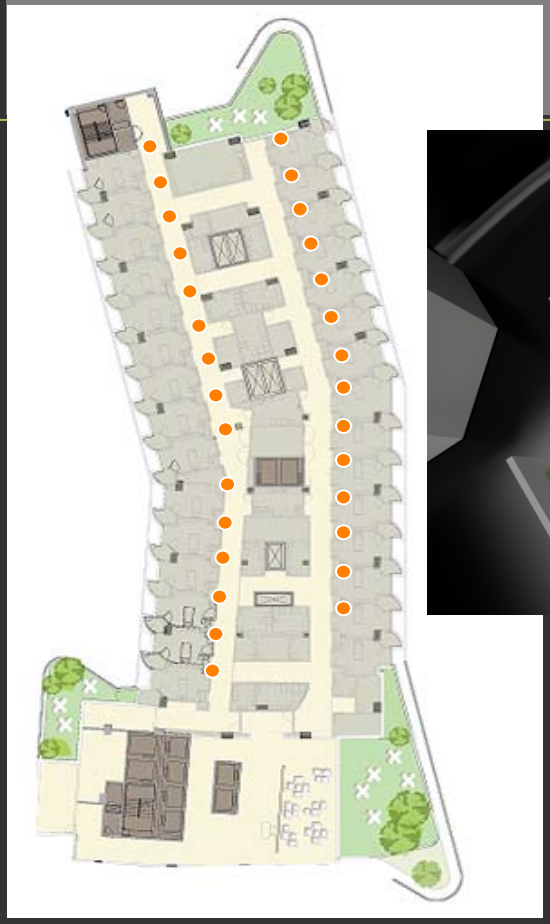
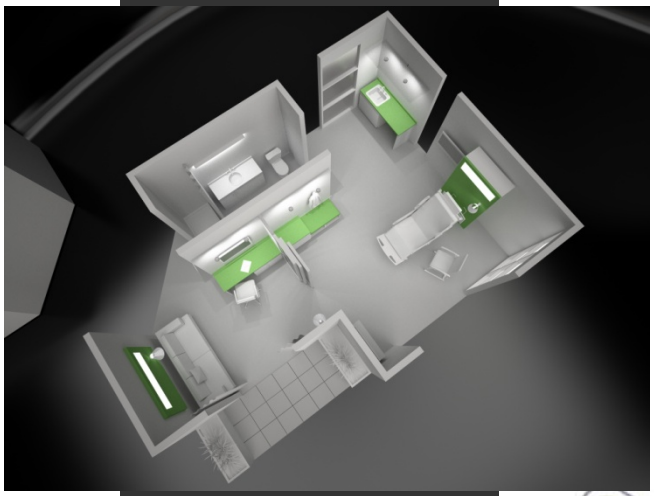
Balance First Costs and Life-cycle Costs

- Escalation remains as the most significant cost factor
- Lifecycle costs out-weigh initial construction costs
- Space programs that are too lean will limit future flexibility
- Infrastructures that don't have "robust" excess capacities will limit future flexibility (and cost more if upgraded later)
- MEP systems represent 40 – 60% of construction costs









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Nursing Unit Design

Patient Lifts

Video courtersy of Ann Hendrich

Patient Lifts

Projected costs of patient handling injuries based on cost per injury prior to ceiling lifts (PeaceHealth – Springfield, OR).

Unit	Direct Cost *	# Injuries	Avg direct cost per injury	Avg indirect cost (2x) **	Total Cost one injury	Avg # injuries per year	Total Annual Cost
Neuro	$222,646.	15 (3 yrs)	$14,843.	$29,686	$44,529	5	$222,645
ICU	$ 95,003	10 (2 yrs)	$9,500.	$19,000	$28,500	5	$142,500
subtotal							$365,145

*Direct costs of just patient handling injuries

** Indirect costs include light duty salaries, replacement salaries, and training costs

Patient Lifts

Actual preliminary savings after ceiling lifts are installed and used
(PeaceHealth – Springfield, OR).

Unit	Direct Cost	# Injuries	Avg direct cost per injury	Avg indirect cost (2x)	Total Cost one injury	Avg # injuries per year	Total Annual Cost
Neuro	$ 331.	1 (1 yrs)	$ 331	$ 662	$ 993	1	$ 993
ICU	$ 0	0 (2 yrs)	$ 0.	$ 0	$ 0	0	$ 0
subtotal	$ 331	1	$ 331	$ 662	$ 993	1	$ 993

*Direct costs of just patient handling injuries
** Indirect costs include light duty salaries, replacement salaries, and training costs

Patient Lifts

RETURN ON INVESTMENT:

$2, 149,914
cost of lifts installed

÷

$874,839
preliminary annual savings

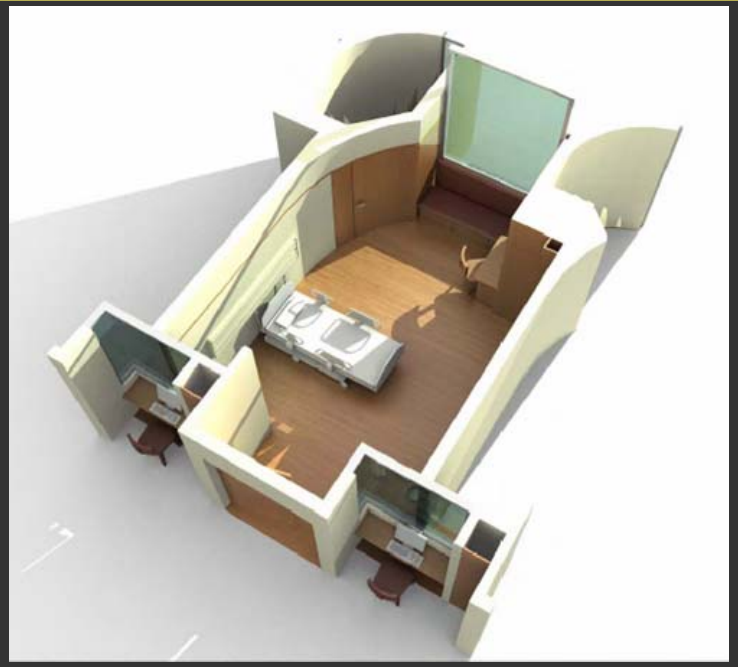
=

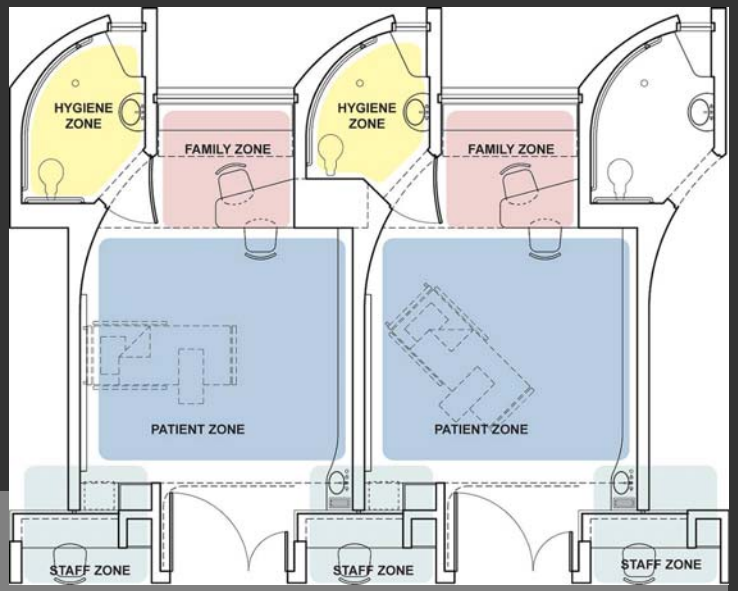
Payback within
2.46 years

© Anshen+Allen

Acuity-adaptable Patient Rooms

- Rooms that can “swing” from Acute Care to Critical Care
- Reduces need to transfer patients.
- This where most patient falls occur.
- ↓ patient falls, ↓ staff injuries, ↓ cost
- Most units “swing” best between Acute/TCU or TCU/ICU due to “cultural issues”
- Requires larger patient room





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Acuity-adaptable Patient Rooms

Patient Room – Patient Area

Patient Room – Footwall & Family Area

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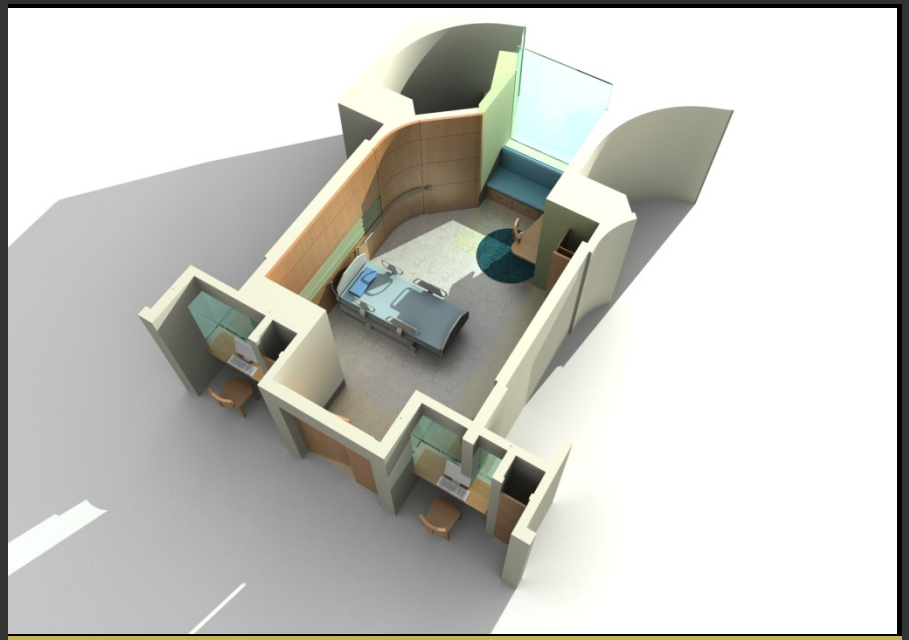
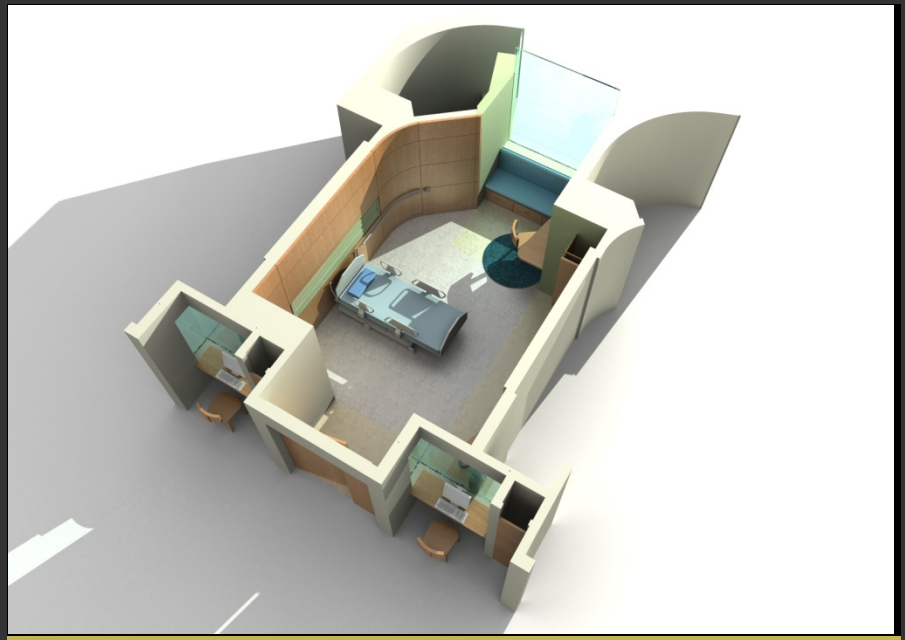
Acuity-adaptable Patient Rooms

Patient Room – Area Comparison



ACUTE CARE DESIGN

240 SF	Patient Room
40 SF	Toilet Room
280 SF	TOTAL



ACUITY ADAPTABLE DESIGN

280 SF	Room
40 SF	Toilet Room
320 SF	TOTAL

Premium: $384 / SF x 40 SF = $ 15,360 / room

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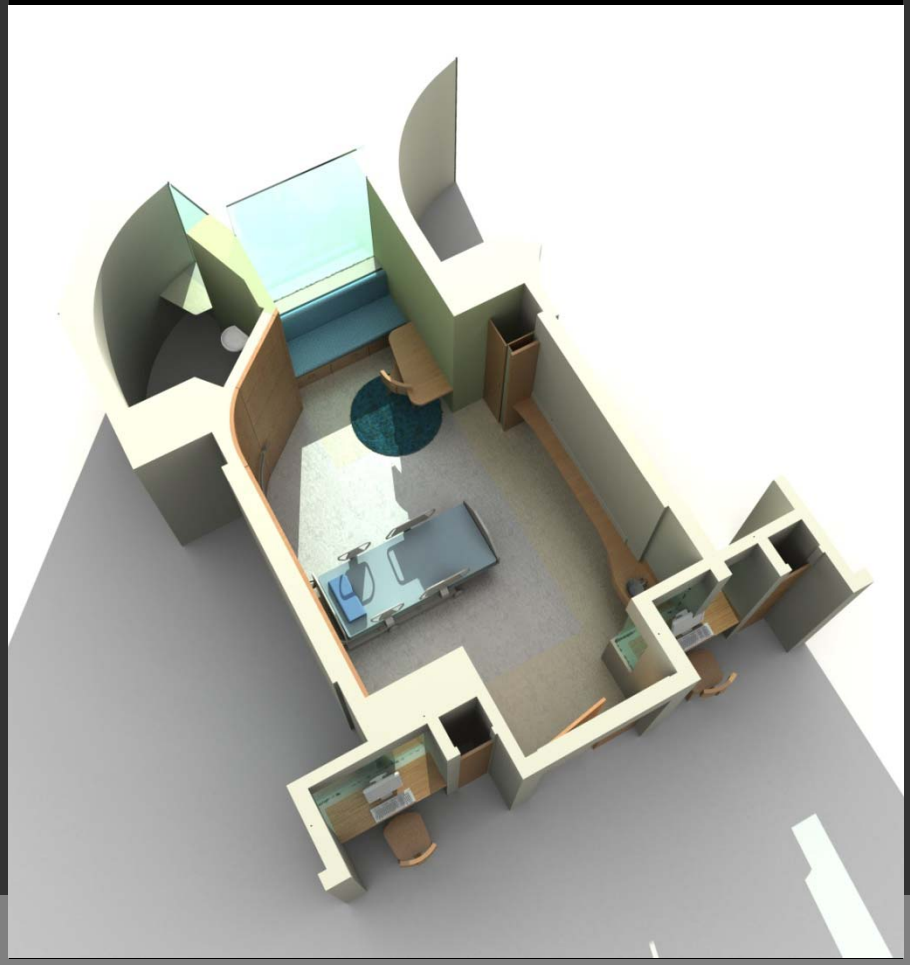
Acuity-adaptable Patient Rooms

Patient Room – Electrical Comparison



ACUTE CARE DESIGN

- Dimmers not required
- 2 duplex
- Emergency power not required

ACUITY ADAPTABLE DESIGN

- Dimmers required
- 6 duplex
- Emergency circuit required

Premium: $1,794 / room

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Acuity-adaptable Patient Rooms

Patient Room – Medical Gas Comparison

ACUTE CARE DESIGN	
2	O
2	V
2	A
6	Gas Outlets

ACUITY ADAPTABLE DESIGN	
4	O
6	V
2	A
12	Gas Outlets

Premium of 6 Gas Outlets = $ 6,000 / room
Premium for flow meters = $3,300 / room

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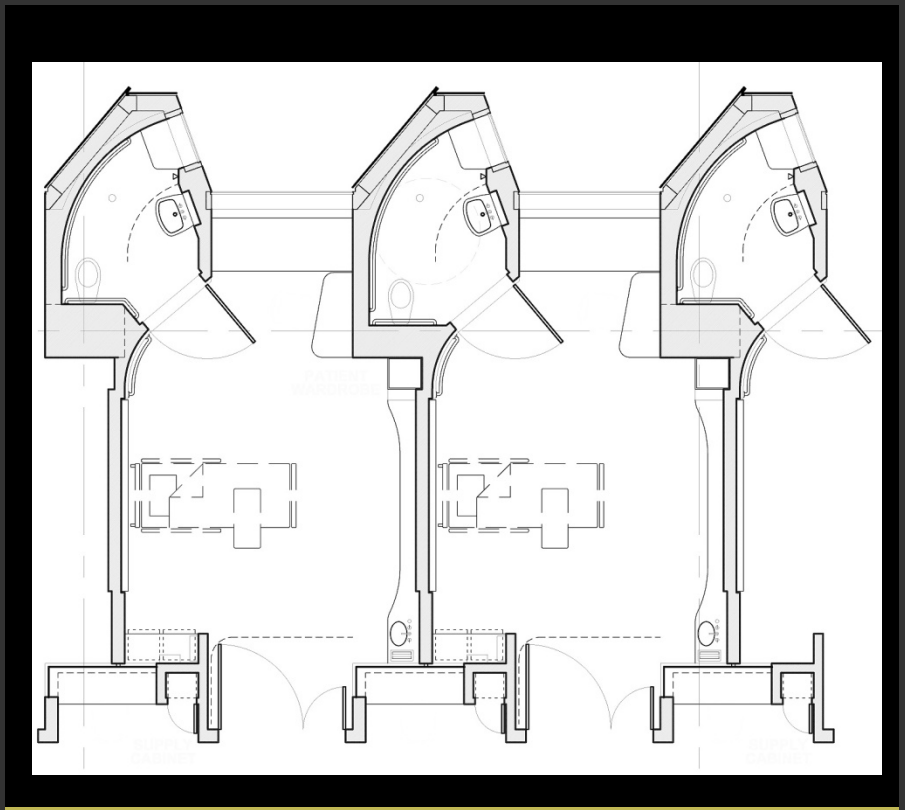
“Same-handed” Patient Rooms



“SAME HANDED” PATIENT ROOM

Definition:

A design that provides consistent orientation of the room elements (door, bed, headwall/footwall, toilet/ shower, etc.) to all patient rooms.

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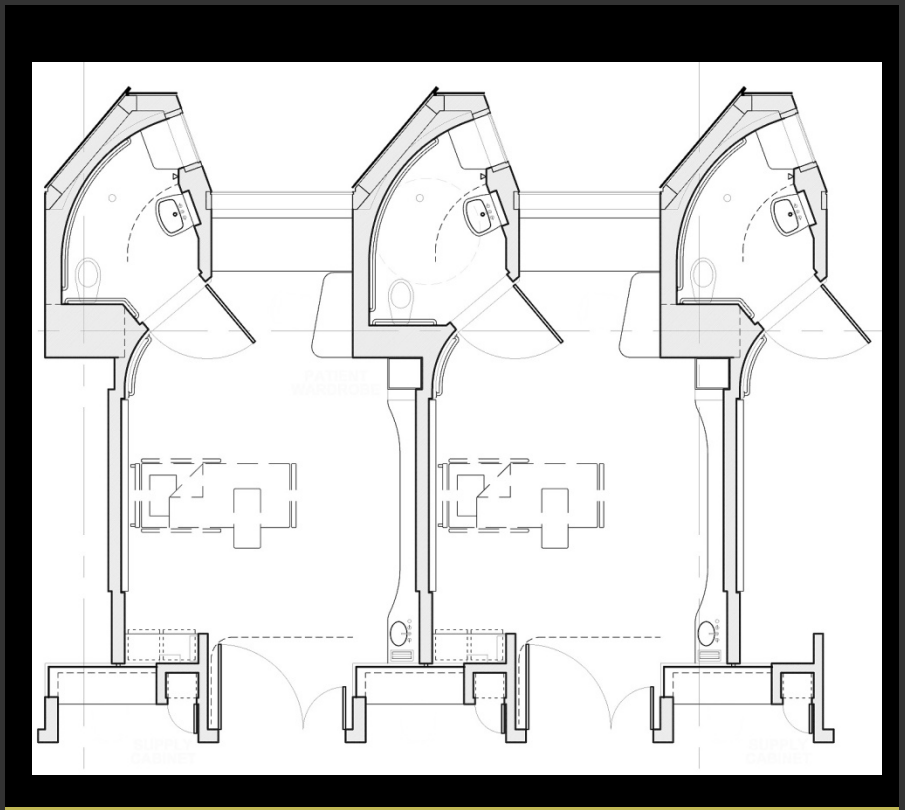
“Same-handed” Patient Rooms



“SAME HANDED” PATIENT ROOM

Potential Benefits:

- **Consistent approach and care practice**
- **Possible reduction in staff error**
- **Most beneficial for high stress areas (ICU)**

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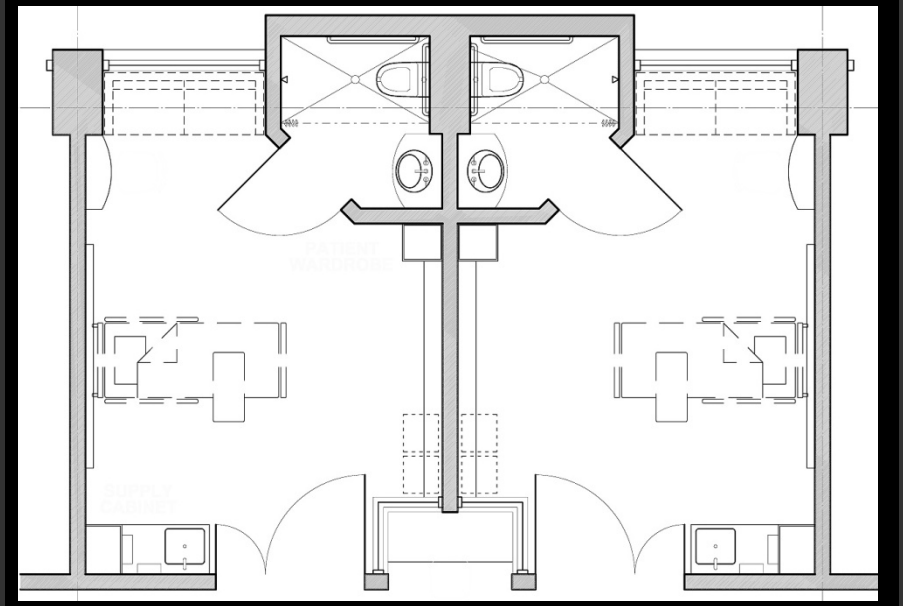
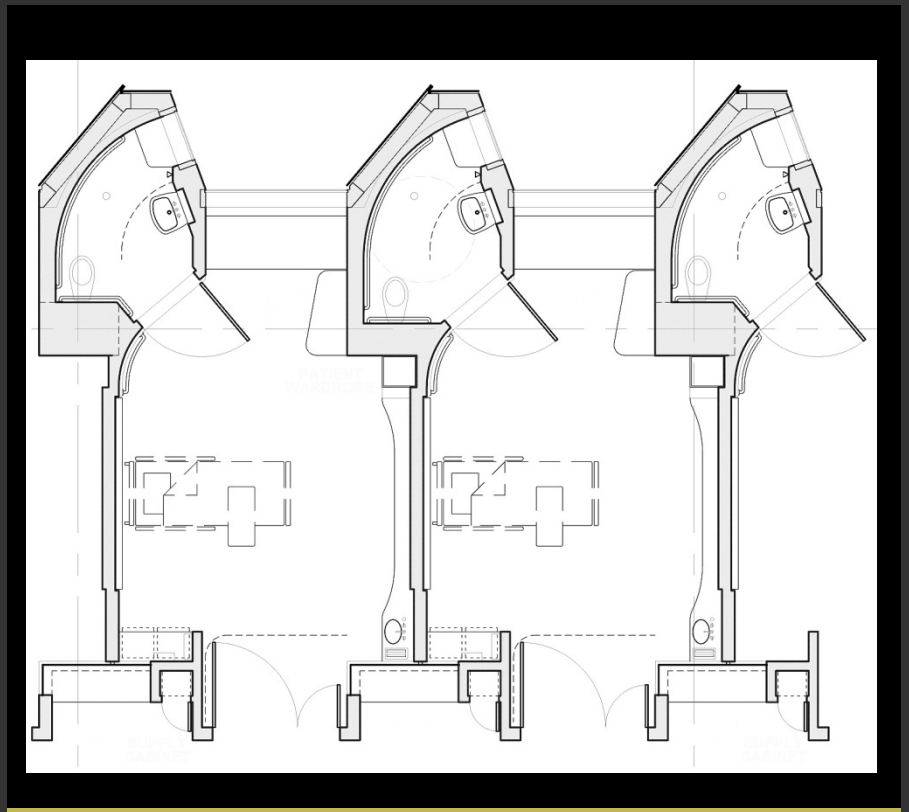
“Same-handed” Patient Rooms



TRADITIONAL “MIRRORED” ORIENTATION



“SAME HANDED” PATIENT ROOM

Non-shared plumbing wall premium = $987 / room

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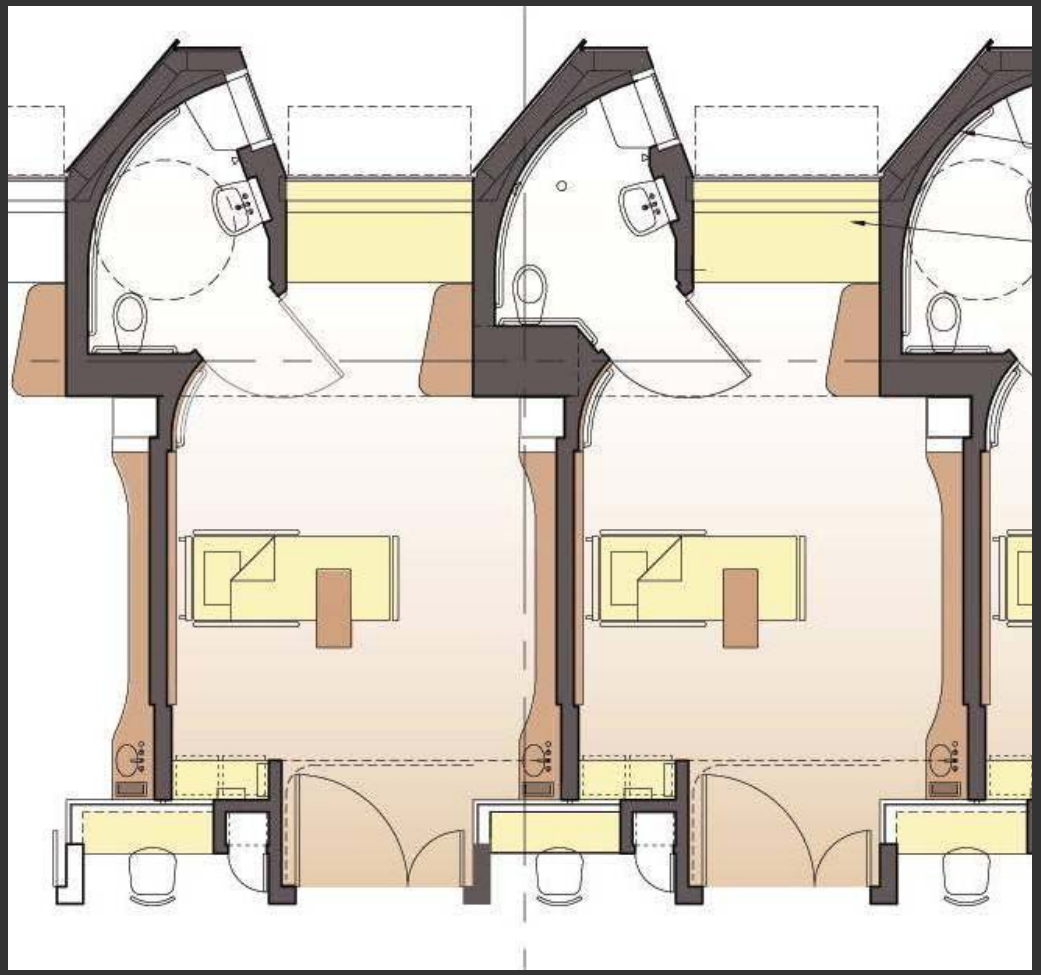
“Same-handed” Patient Rooms

- Designed for safety because everything is in the same place
- Do providers get disoriented (which patient)?
- Need to provide distinguishing visible landmarks
- Where is the evidence?



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Design of Diagnostic and Treatment Areas

Softening Technology

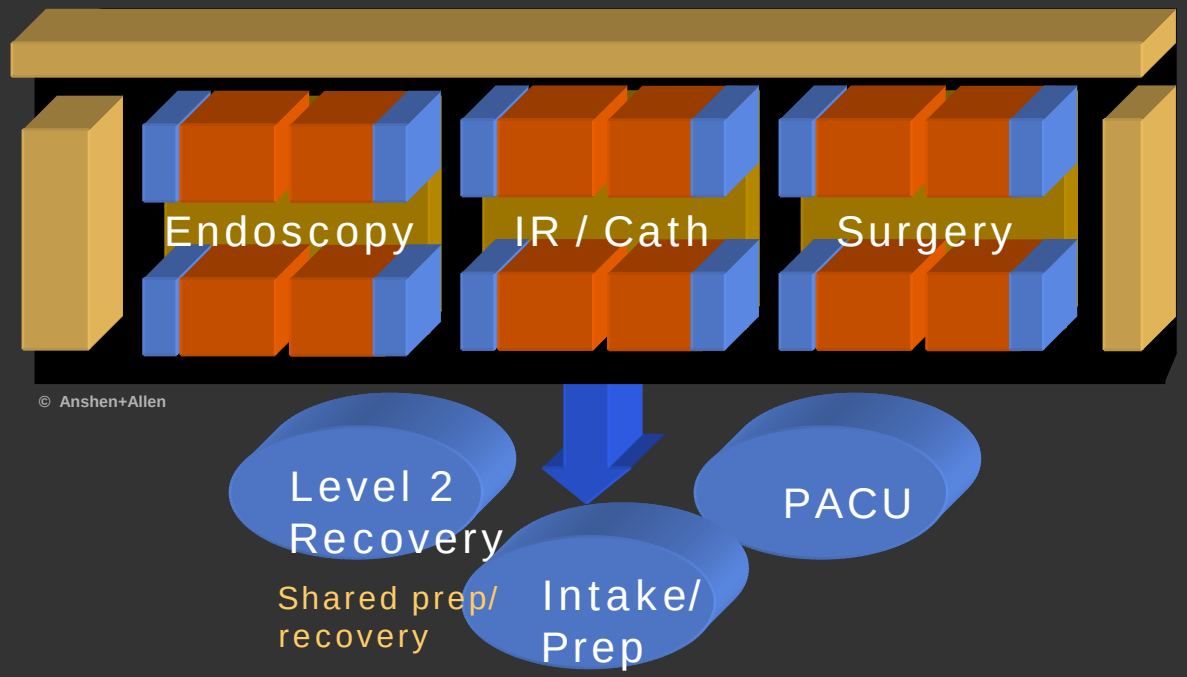
- Positive distractions
- Hide ancillary equipment
- Erode barriers between patients and caregivers
- Give patients control of environmental features

Photos courtesy of SmithGroup

Erosion of Departmental Boundaries

- Avoid duplication of scarce staff, expensive equipment and limited space
- Provide flexibility for complex medical procedures
- Accommodate future conversion of modalities
- Envision multi-disciplinary collaboration

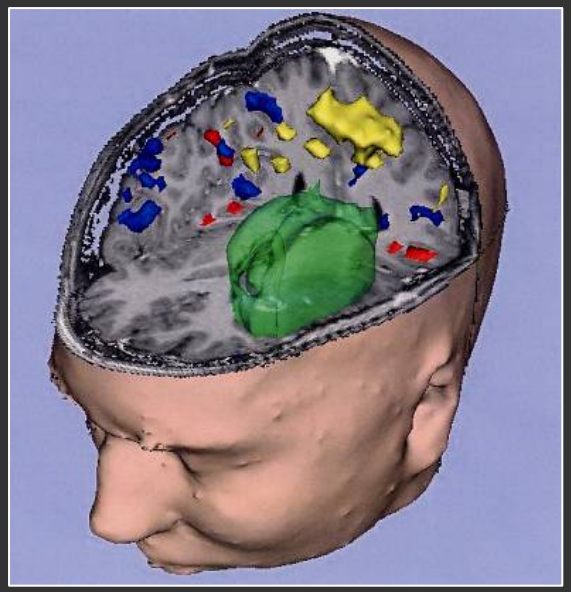
The Integrated Interventional Suite

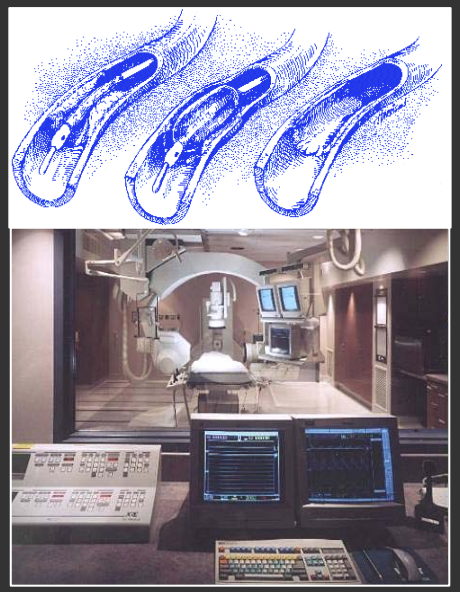


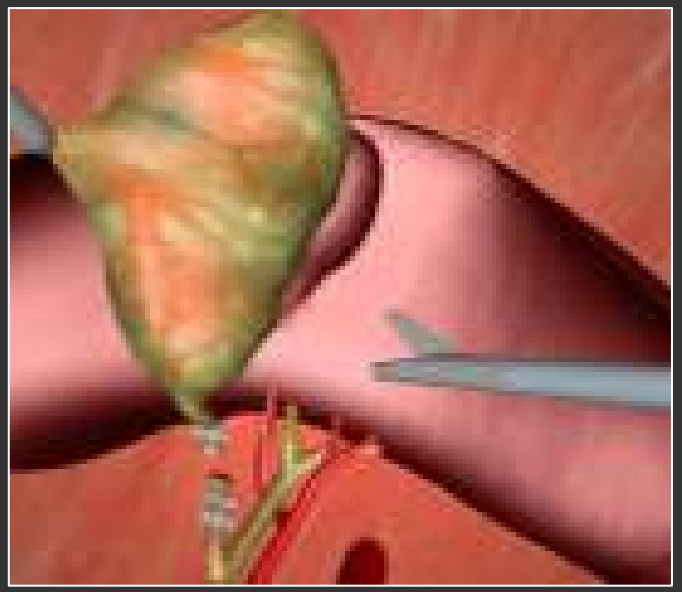
The Integrated Interventional Suite

Potential Benefits:

- Consolidation of Prep, Recovery and Support areas / staff
- Integrated material and supply distribution
- Improved infection control for interventional procedures
- Long term flexibility/adaptability



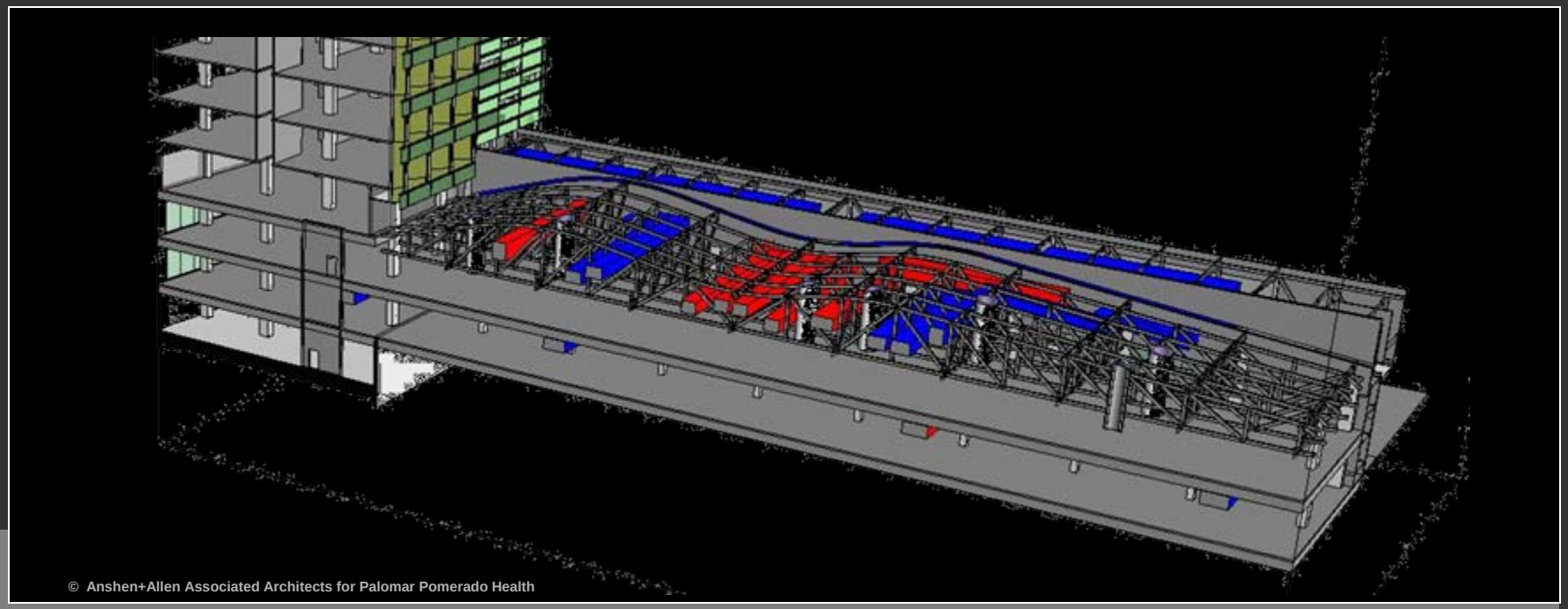




The Integrated Interventional Suite

Planning Infrastructure:

- Flexible structural system
- High floor to floor height
- Robust floor loading capacity
- Strategic placement of soft space
- “Loose-fit” programming



The Integrated Interventional Suite

Challenges:

- **Collective vision to minimize turf battles**
- **Differing protocol for infection control in Surgery, Interventional Radiology and Interventional Cardiology**
- **Contiguous space for multiple services**
- **Cross-training for some support staff**
- **Cost of excess infrastructure capacity for future areas of change**

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MRI Safety

Photos, courtesy of the Stein-Cox Group

MRI Safety

Landmark Incident (2001)

Call for oxygen led to MRI death

Michael Colombini

How the accident happened

A sequence of events in the accident that fatally injured 6-year-old Michael Colombini at Westchester Medical Center July 27:

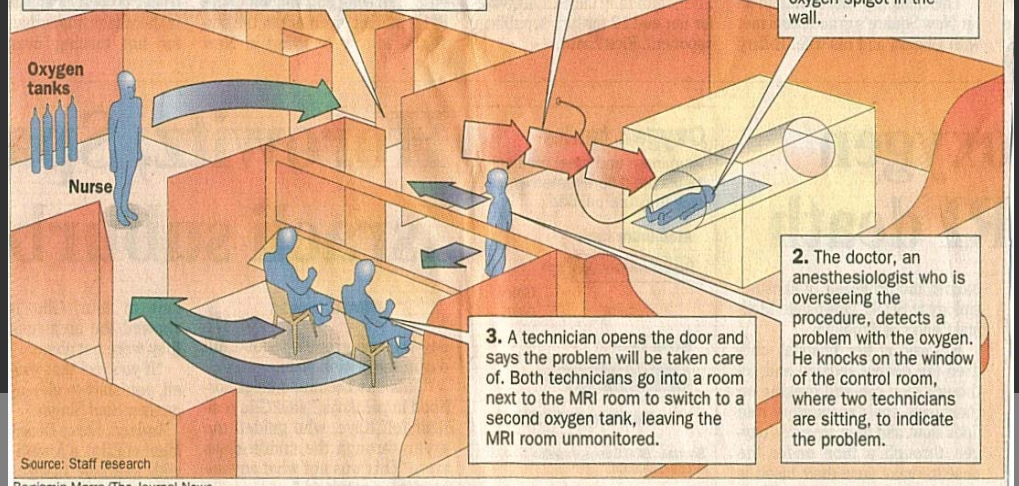
1. Michael is transferred to the MRI area for a postoperative exam in the early afternoon. Sedated, Michael is put head first into the MRI and receives oxygen through a tube under his nose. The oxygen tube is connected to an oxygen spigot in the wall.

2. The doctor, an anesthesiologist who is overseeing the procedure, detects a problem with the oxygen. He knocks on the window of the control room, where two technicians are sitting, to indicate the problem.

3. A technician opens the door and says the problem will be taken care of. Both technicians go into a room next to the MRI room to switch to a second oxygen tank, leaving the MRI room unmonitored.

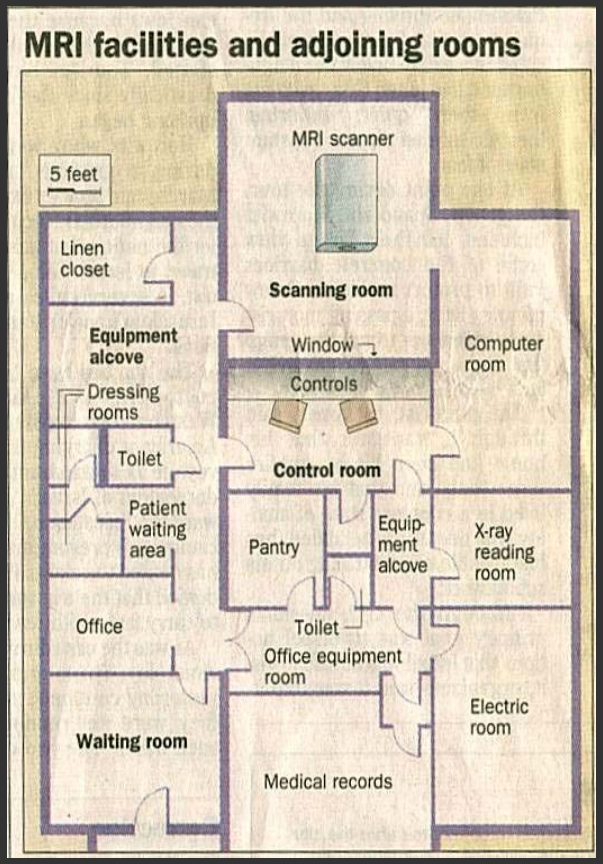
4. The doctor becomes concerned that the boy needs oxygen. He says he opens the door of the room in which the MRI was located, and indicates he needs oxygen, and a radiology nurse hands him a tank. He says he never stepped outside the MRI room. The nurse says the doctor walked outside the room to ask for oxygen and she handed it to him.

5. The powerful magnets in the MRI pull the metal oxygen bottle into the tube of the machine, striking Michael in the head.



Source: Staff research

Benjamin Marra/The Journal News

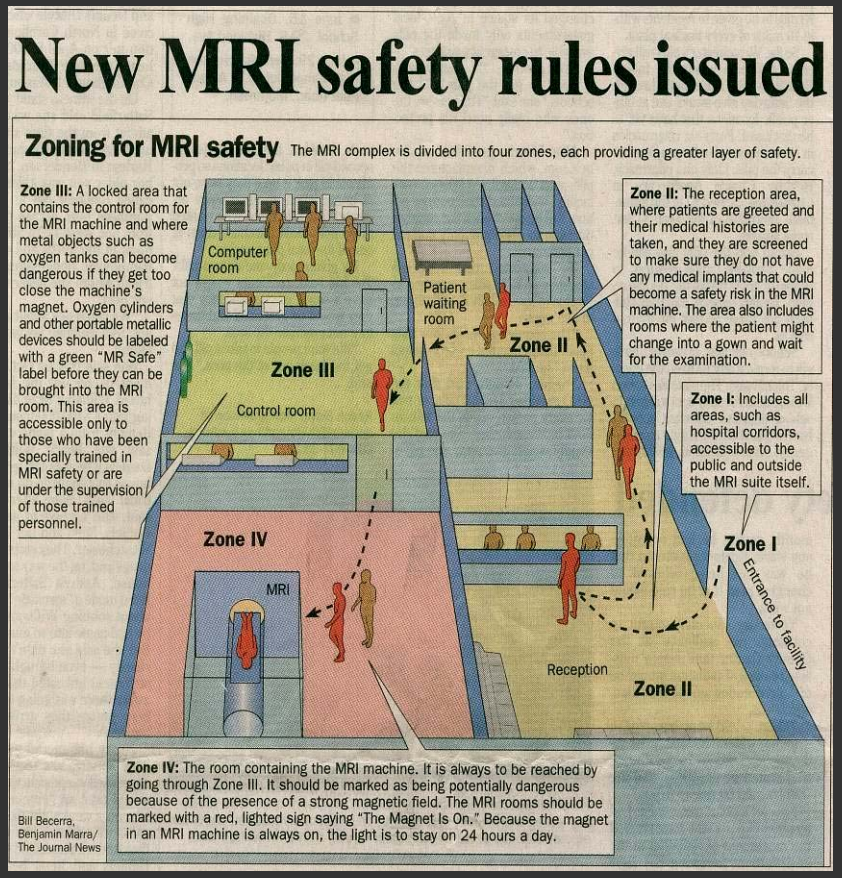


July 27, 2001:
Westchester (NY) Medical Center

Source: The Journal News June 1, 2002

MRI Safety

American College of Radiology (ACR) MRI Safety Guidelines



Source: The Journal News June 1, 2002

ZONE 1: Unrestricted
[outside MR suite]

ZONE 2: Restricted to supervision by MR personnel
[reception, waiting, toilets, dressing]

ZONE 3: Highly restricted area where serious injury can occur
[control room, computer room]

ZONE 4: Most highly restricted where all non-MR personnel must be in direct visual supervision of Level 2 MR staff at ALL times
[MR scanner room]

MRI Safety Planning Implications

Scrutinize MRI Workflow Issues:

- Secure access to entire dept
- Highly supervised entrance to Scan Room vicinity (Zones 3-4)

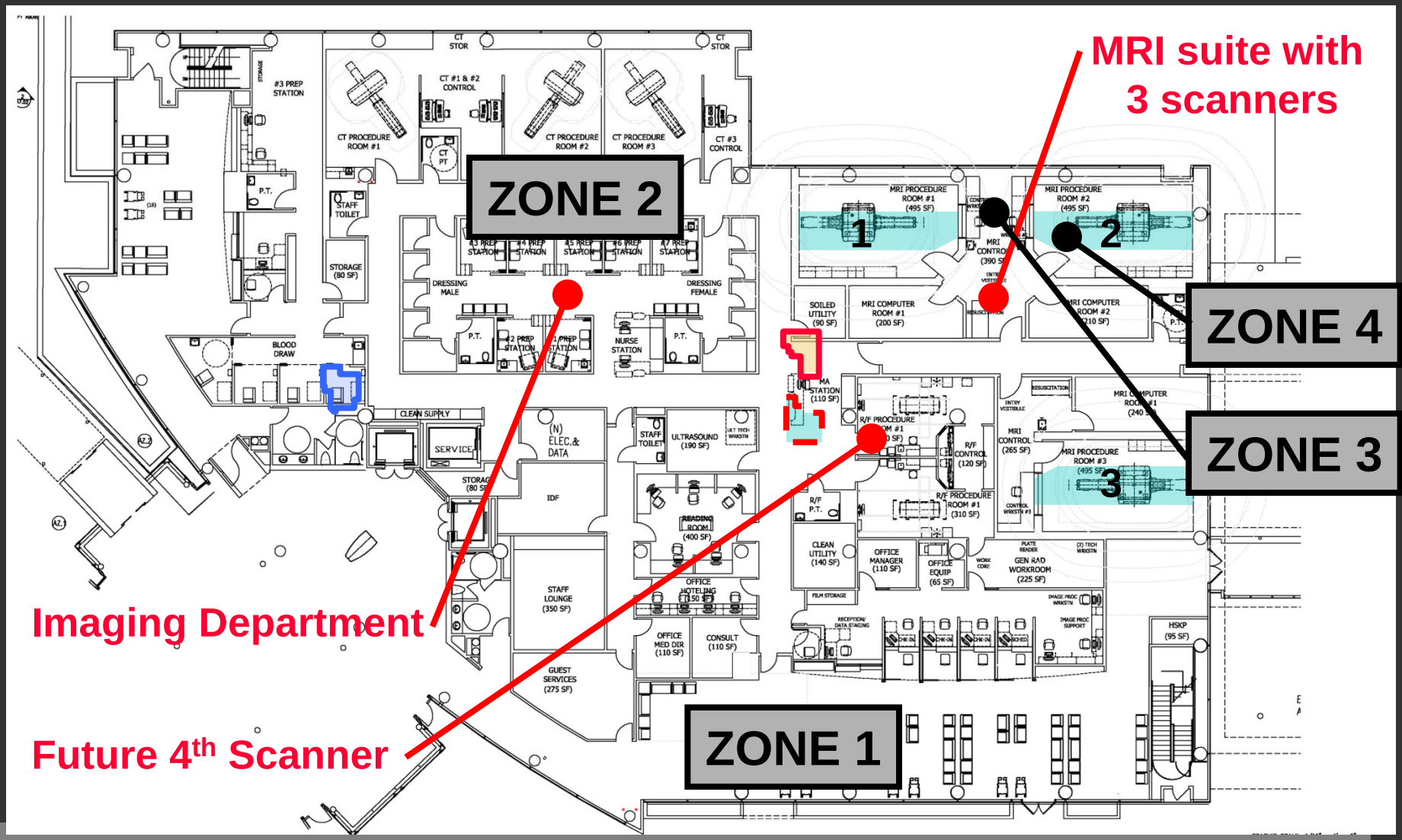
Potential conflicts between security and life safety:

- MR safety personnel as first responders, not fire-fighters

Design Control Room to maximize visual supervision:

- Maximum supervision of both patient couch and scan room entrance
- Ante room between scan room entrance and corridor?

MRI Safety Planning Implications



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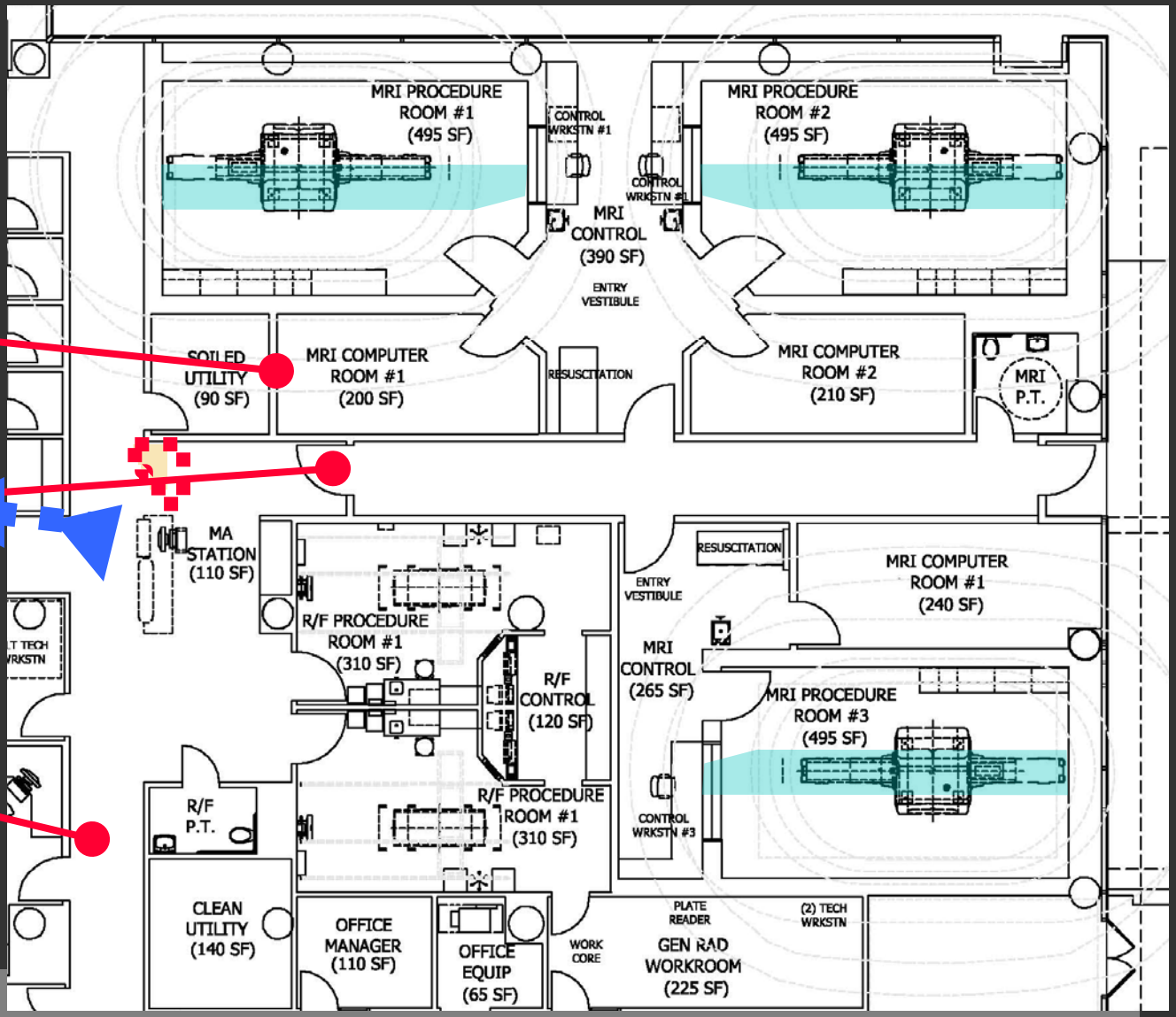
MRI Safety Planning Implications

- **Secure MRI suite boundary (Zones 3 & 4)**
- **Secure MRI suite door**
- **Through-traffic does not enter MRI suite**



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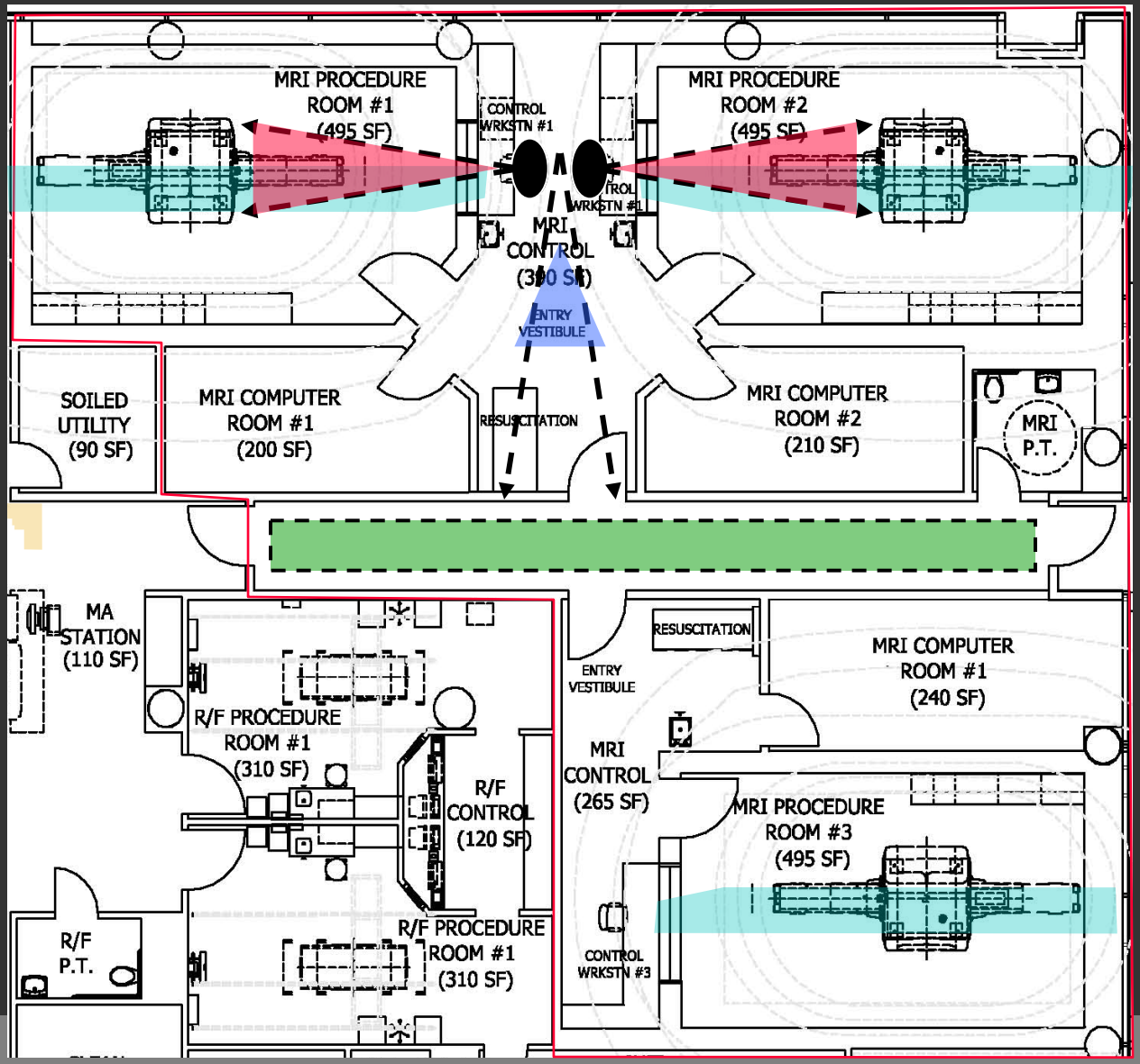
MRI Safety Planning Implications

- One Tech can see 2 MRI rooms
- Both Techs can see entrance to “Security Vestibule”
- Security-controlled Corridor



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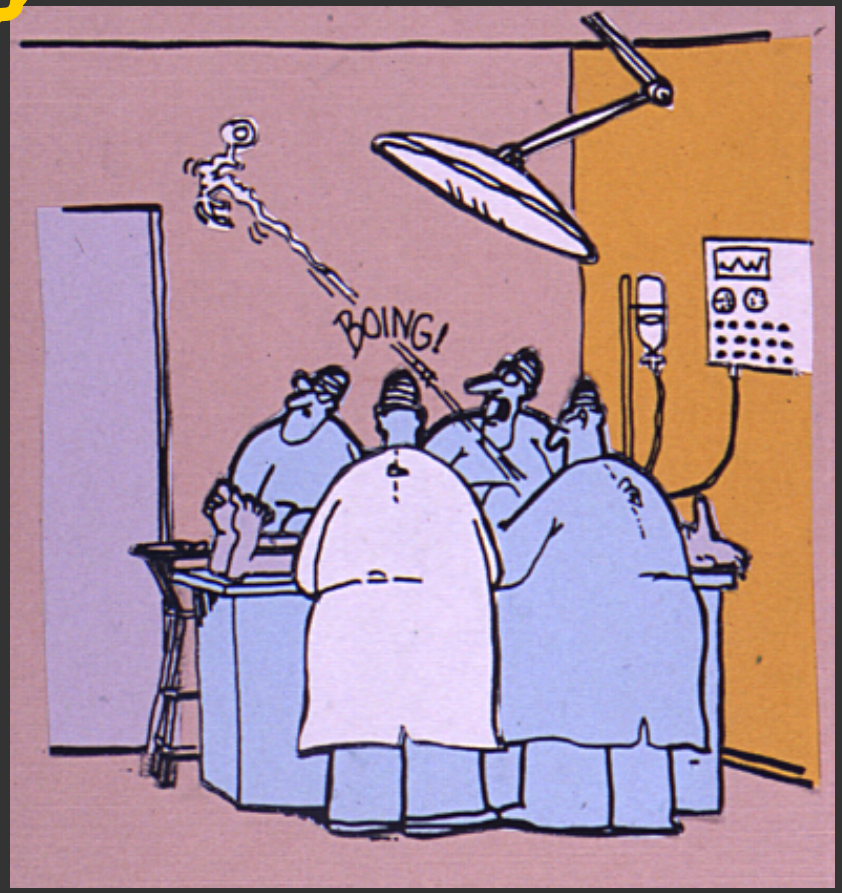
MRI in the OR

DESIGN IMPLICATIONS



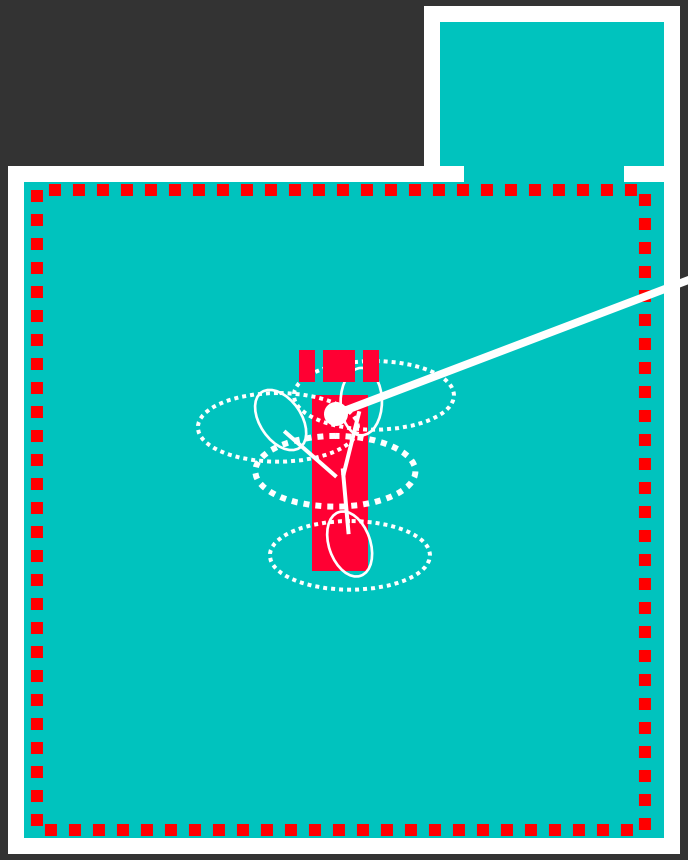
MAGNET TYPES

- Stationary
- Pivoting
- Traveling
- Portable

ROOM TYPES

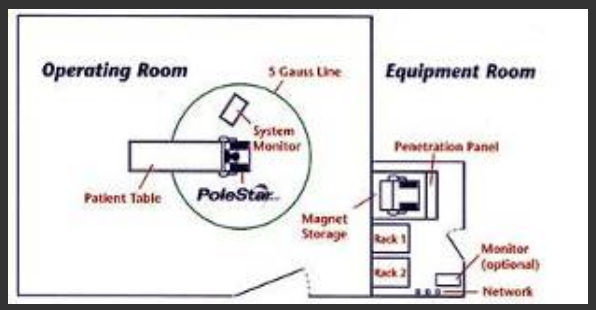
- Single Room
- Dual Room
- Many Rooms

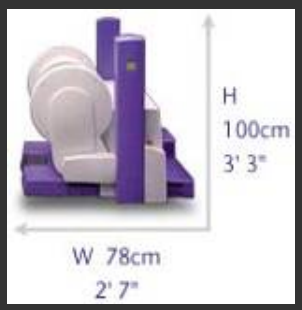
MR/OR in One Integrated Room



RF shield entire room
or only the surgical zone

Imaging and Procedure Zone
(MR compatible surgical instruments)

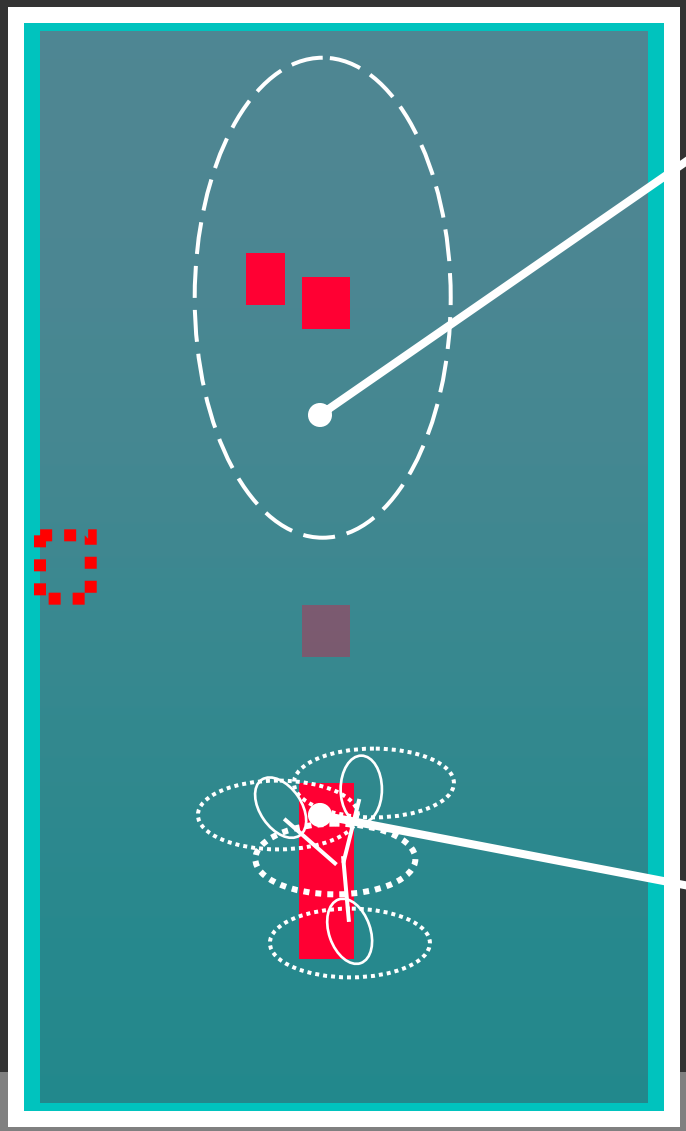




Source: Odin Medical / Medtronics

Portable Magnet

MR/OR in One Integrated Room



RF shield entire room

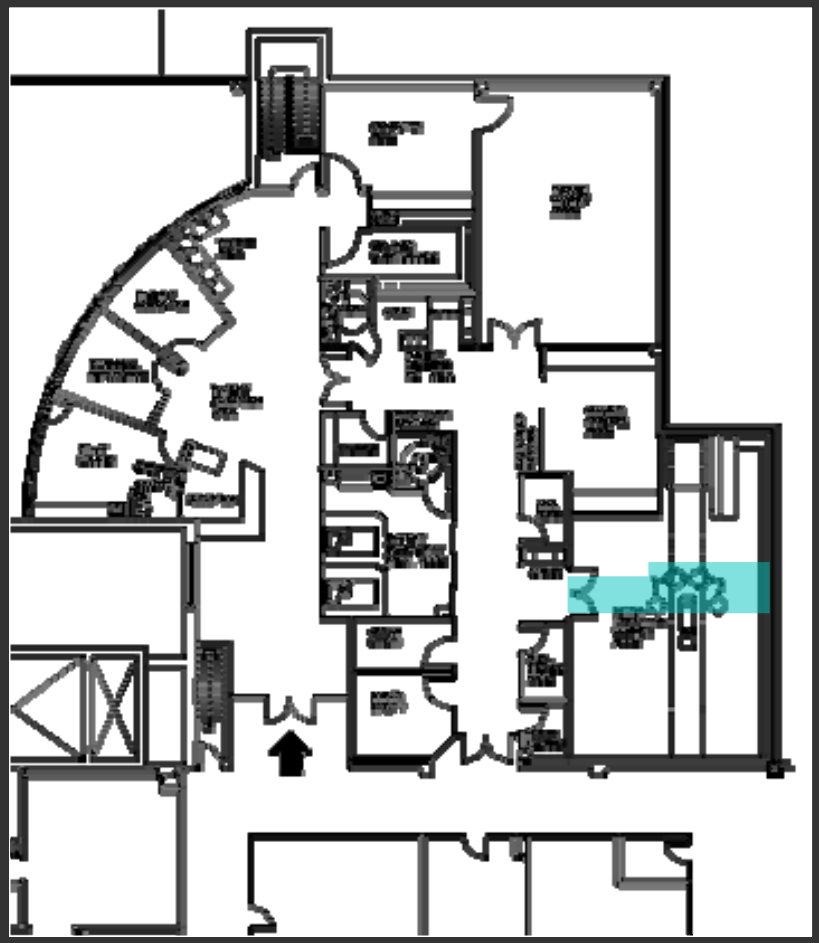
Imaging Zone

Image: University of Minnesota

Procedure Zone

Traveling Patient

MR/OR in One Integrated Room



Foothills Medical Centre, Calgary Alberta
Courtesy of Stantec Architects, Ltd. Calgary, AB

RF shield entire room

Traveling Magnet

MR/OR in One Integrated Room

RF shield entire room

Courtesy of Stantec Architects, Ltd. Calgary, AB

Traveling Magnet

MRI in the OR

DESIGN IMPLICATIONS

- Design for MRI safety (ACR safety guidelines)
- Locate MRI for either “scrubbed” or “street clothes” access
- Protect against RF and/or magnetic interactions with adjacent occupants
- Increase structural, air and cooling capacities

Questions?