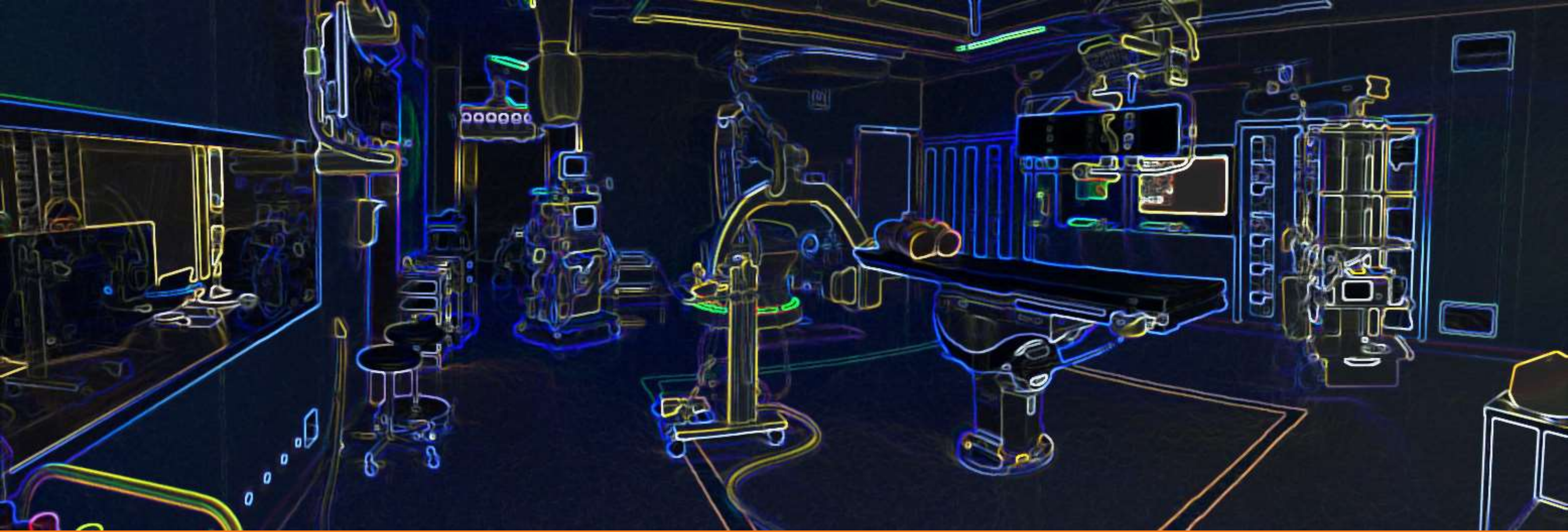
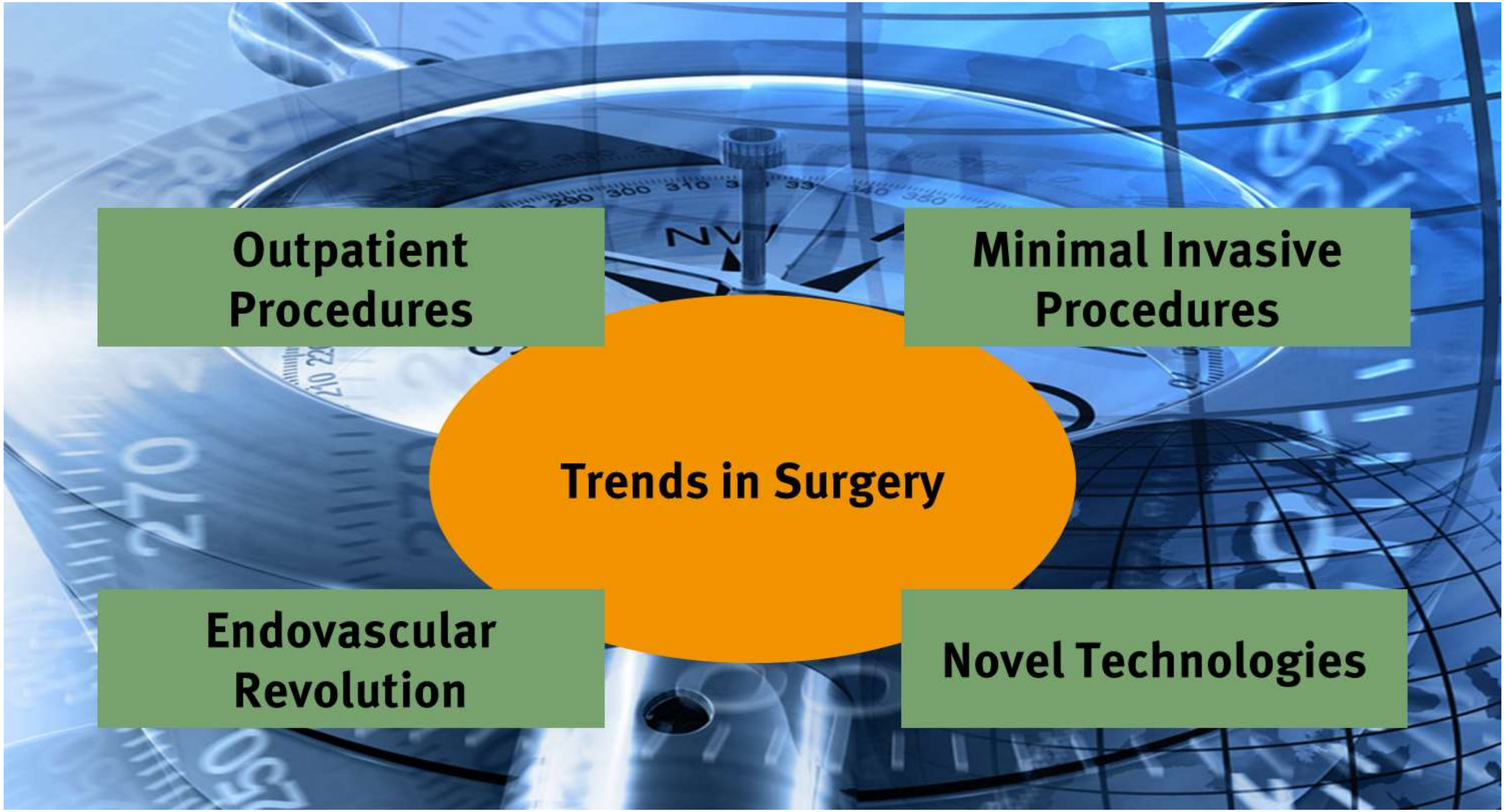


WORKLFOW DRIVEN OR DESIGN SUCCESS FACTORS FOR SAFE AND EFFICIENT SURGERY

Prof. Clemens Bulitta, MD

Novel trends change Surgery



No more “First Cut – Then See – Finally Act”

Rembrandt :
Anatomy of Dr.Tulp, 1632

Pictures: Siemens AG

We are heading towards „Cognition Guided Surgery“

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Classic OR

- No connection of individual instruments and devices
- No „interface“
- Manual device operation (i.e. keyboard)
- No navigation

Integrated/ image-guided OR

- Connection with imaging systems (i.e. DICOM), focus on video-management and endoscopy
- Proprietary interfaces and connection
- Central systems control and UI (i.e. touchscreen)
- Navigation or „stand alone“ image guidance

Vision:

Cognition-guided - Intelligent OR

- Comprehensive device integration (2D-, 3D-Imaging, AR, patient data, vital parameters, navigation, etc.)
- Open interface - platform
- Voice and gesture control / automation
- Cognition guided surgery, decision support

The Future is an Integrated OR System or better: The Future OR is an integrated System!

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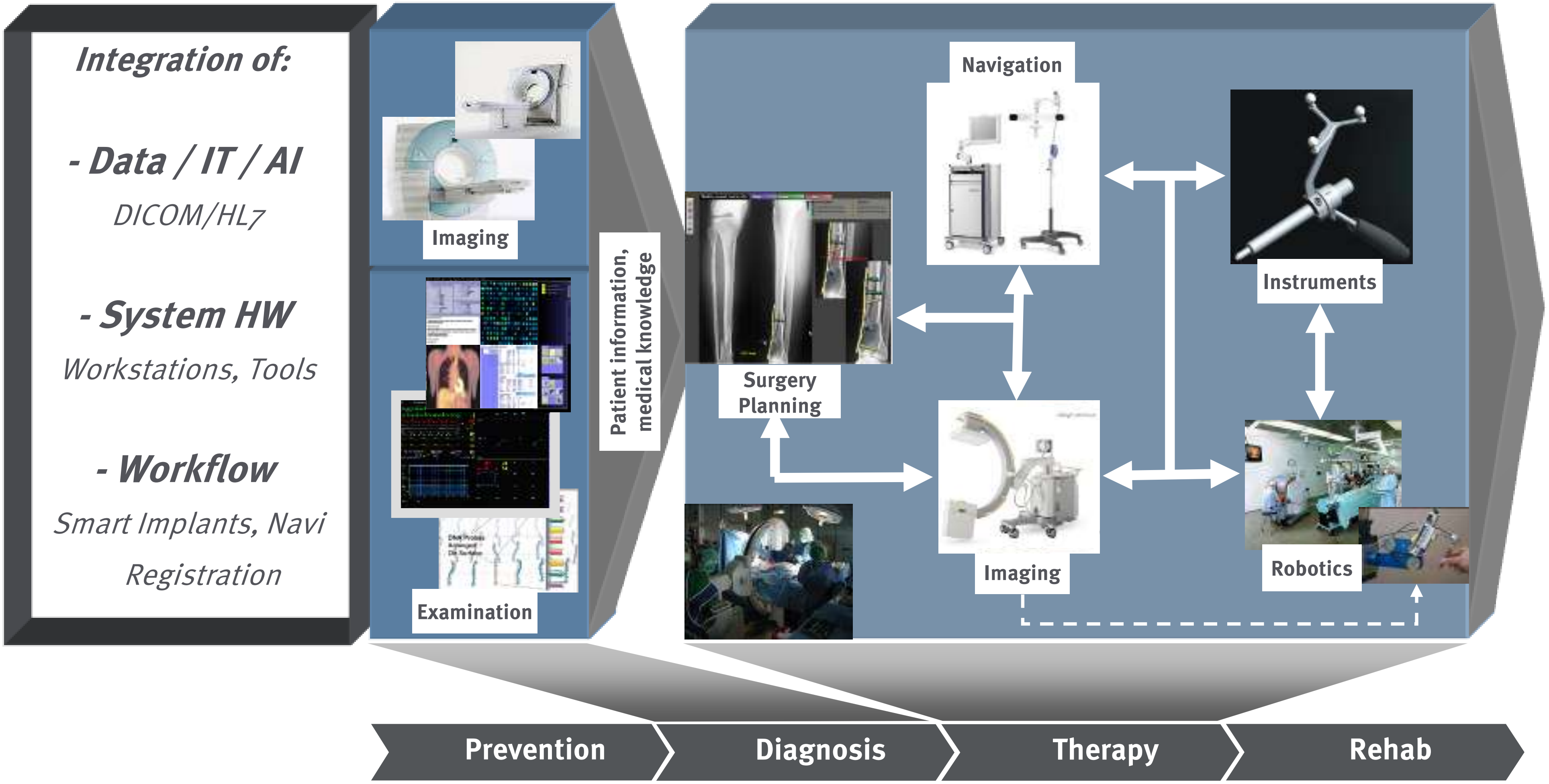

Multimodality Rooms

IHU Strasbourg

Source: Siemens Healthineers

Key for Integration: Connectivity

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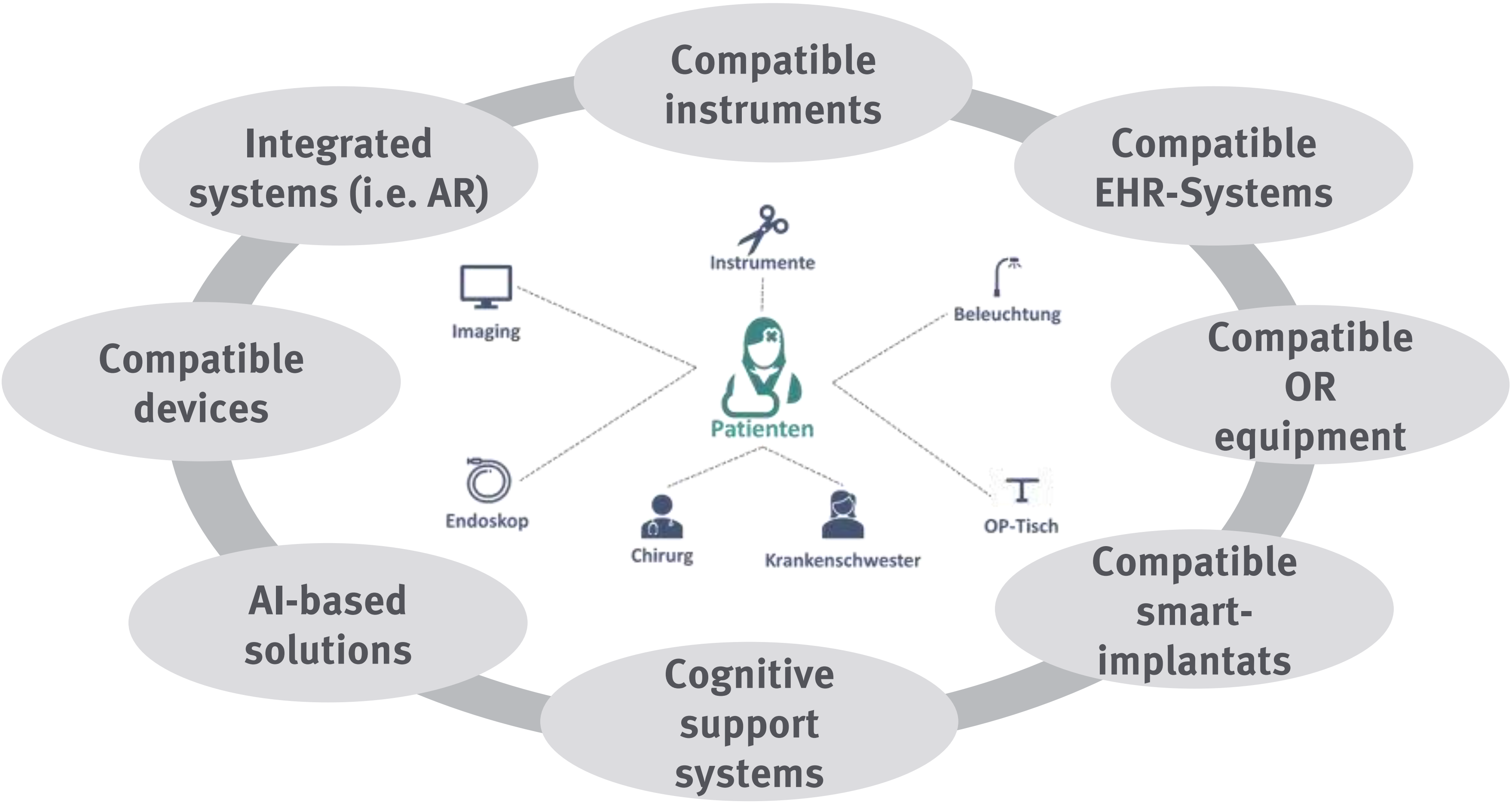

Time for Novel Concepts, Ideas and Approaches

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Surgery is a complex therapeutic field with different needs and requirements

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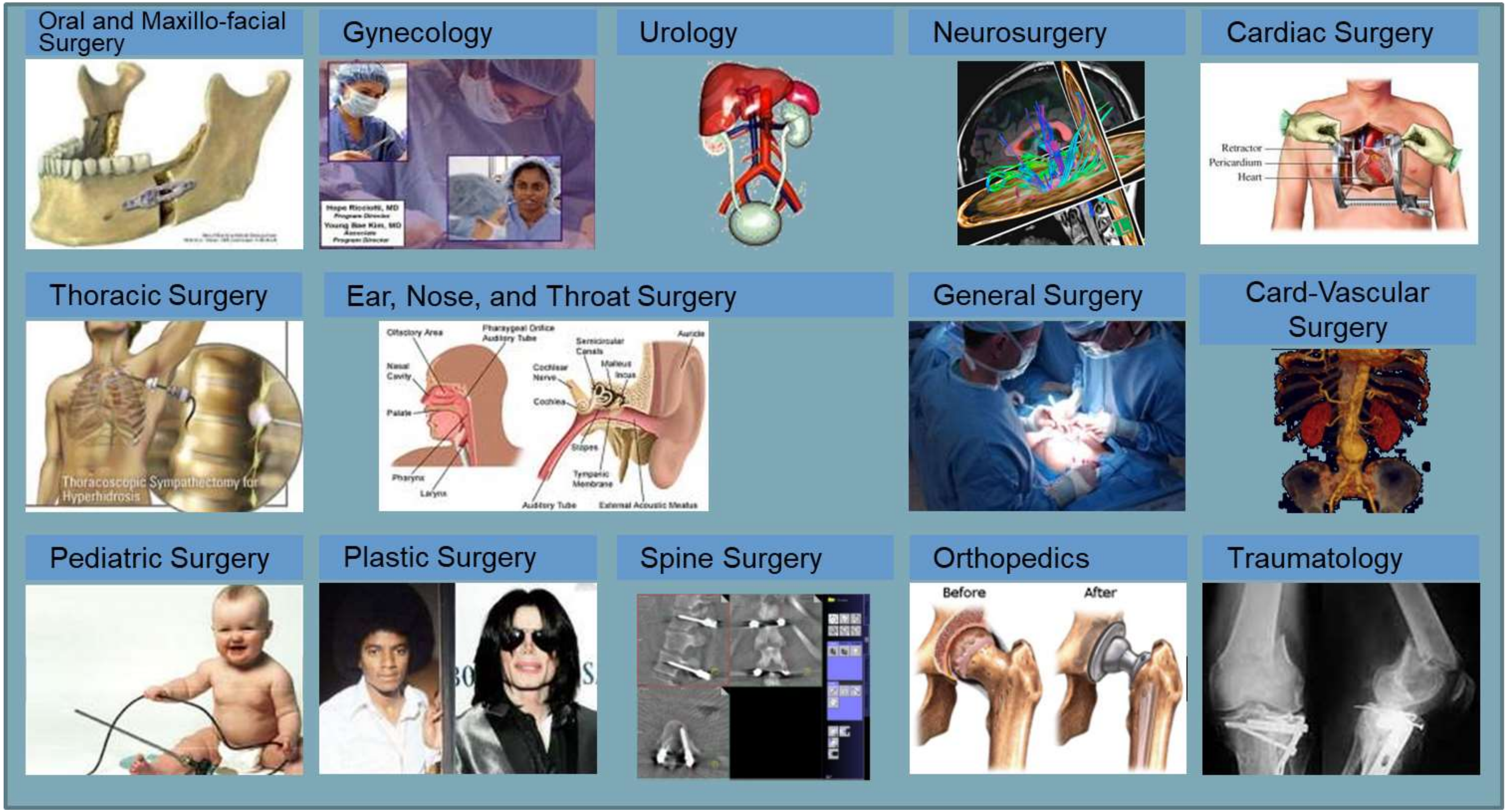

Room Planning goes further than most people expect

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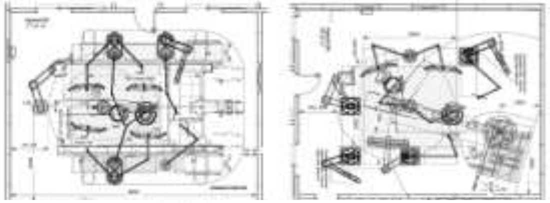
Quellen und Forschung zur Medizintechnik und Hygiene

Hybrid-Operationssaal mit Angiographiesystem

\- Planungshilfe -



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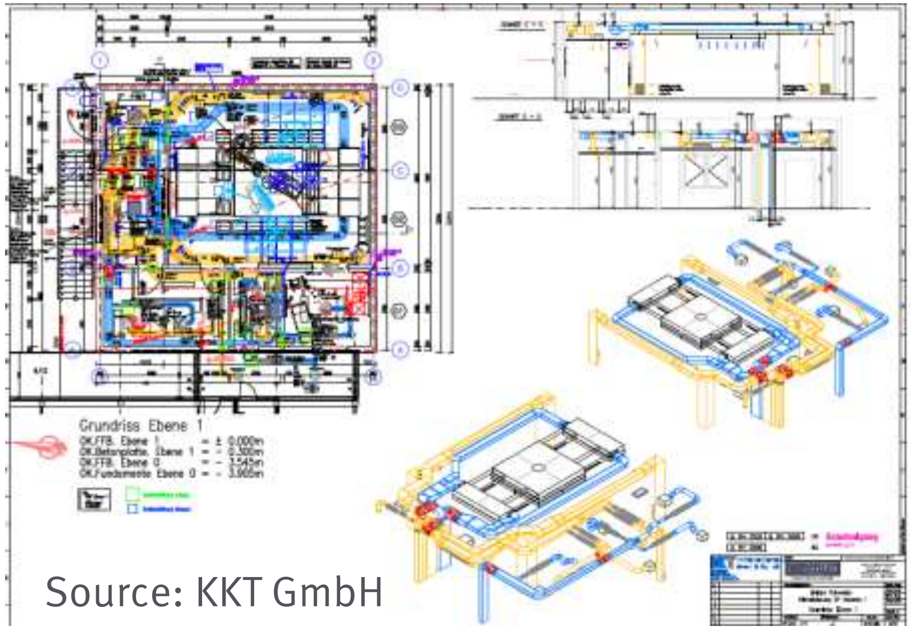
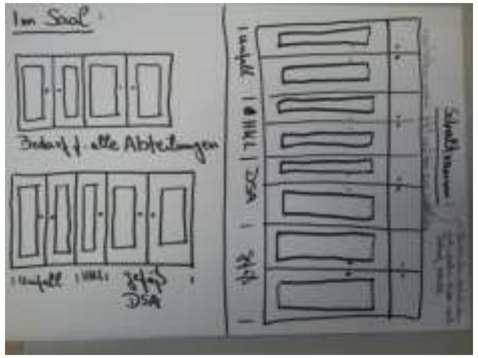
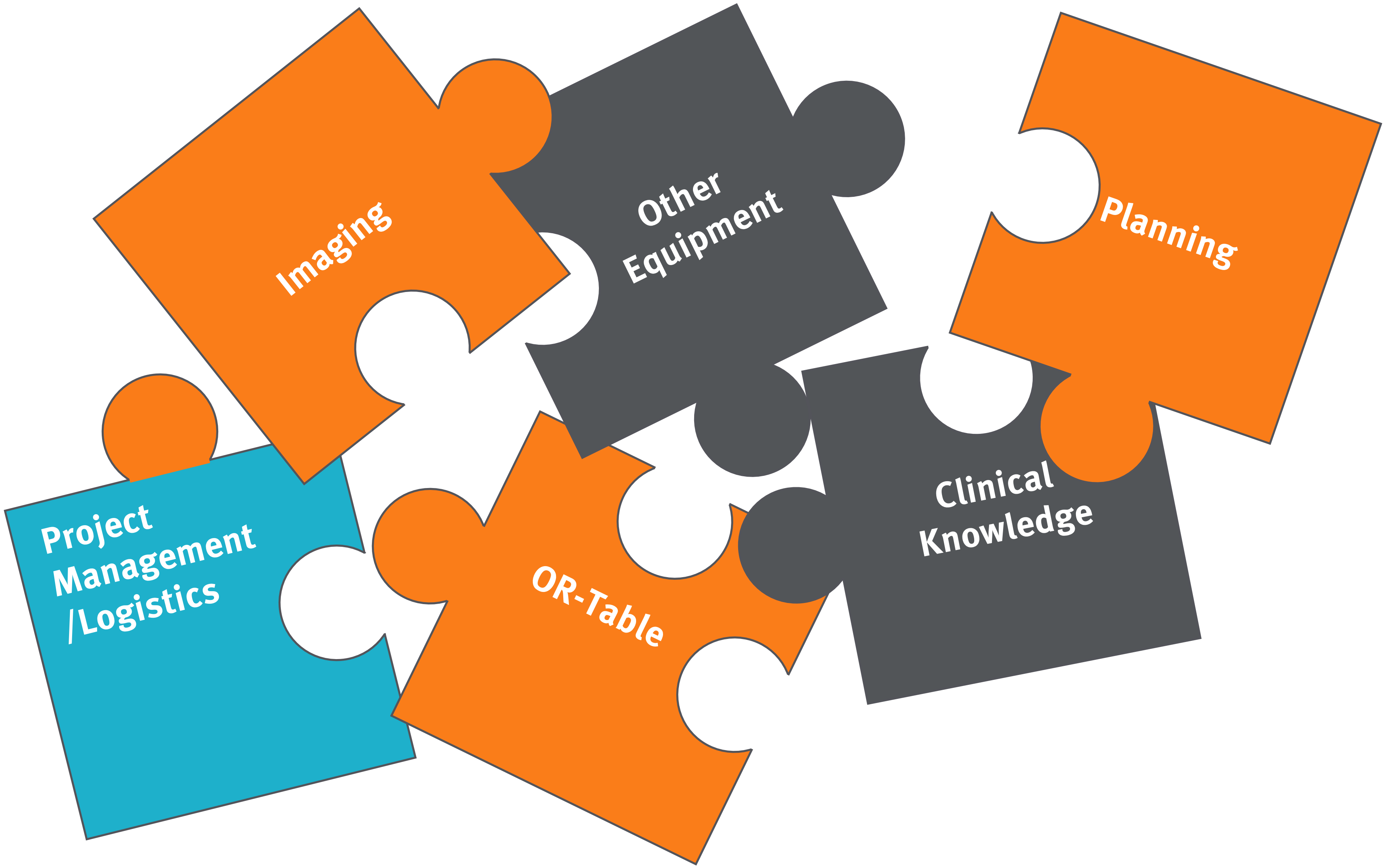


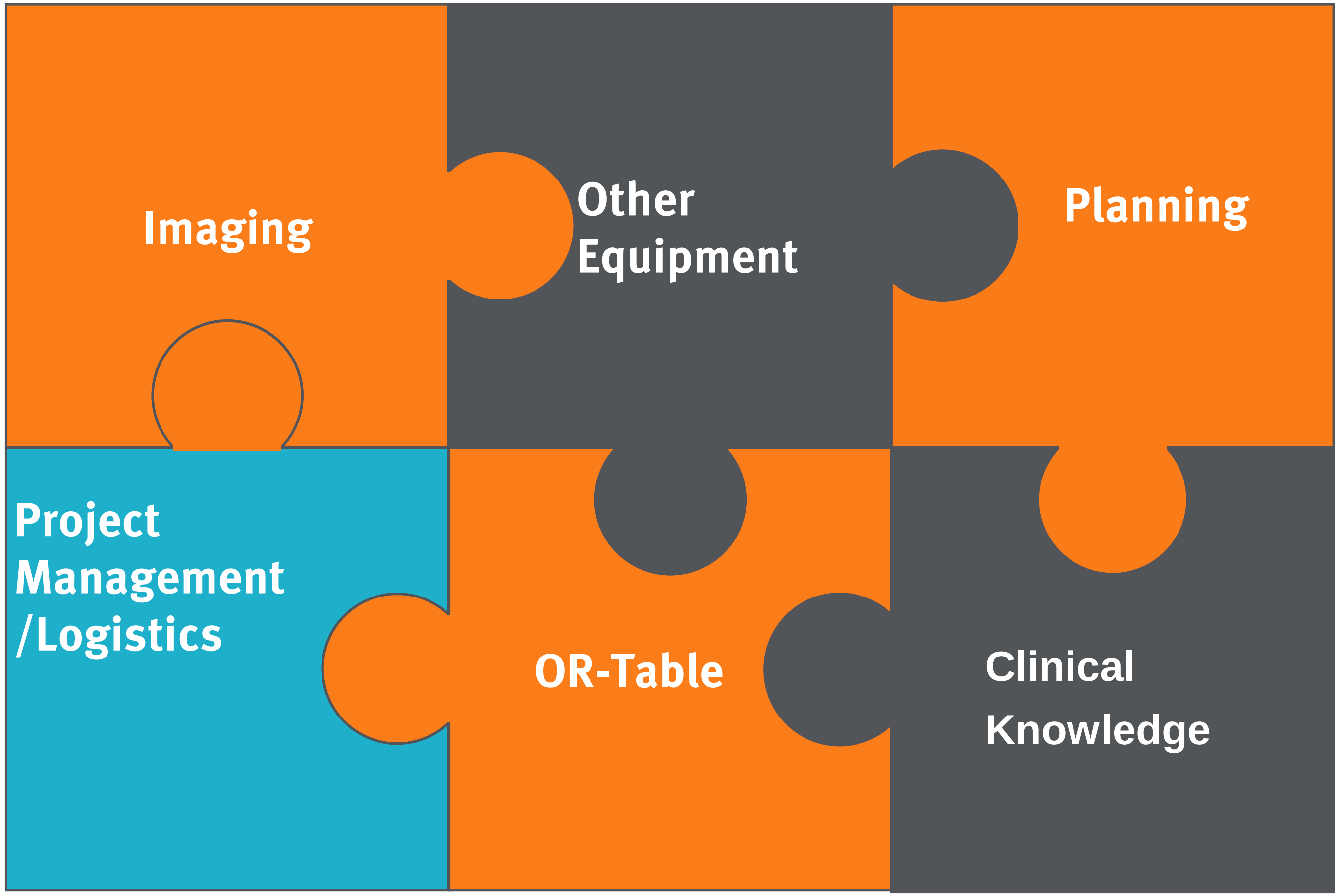
Source: KKT GmbH



OR Projects are Solution Business



OR Projects are Solution Business



The Room is the SYSTEM!!!


Workflow
is key !

Collocating Procedures

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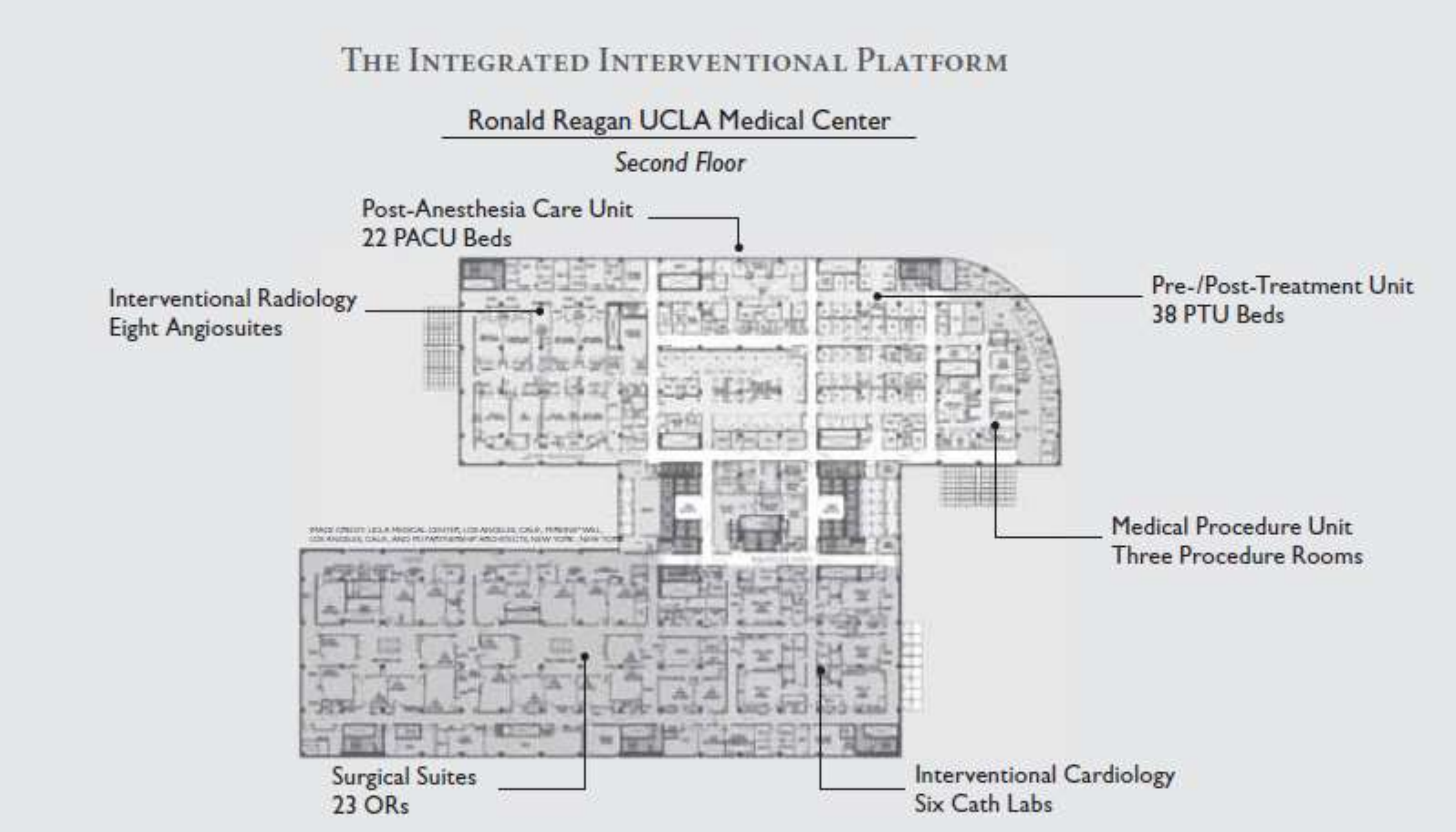


Source: Advisory Board Company

Collocating Proceduralists

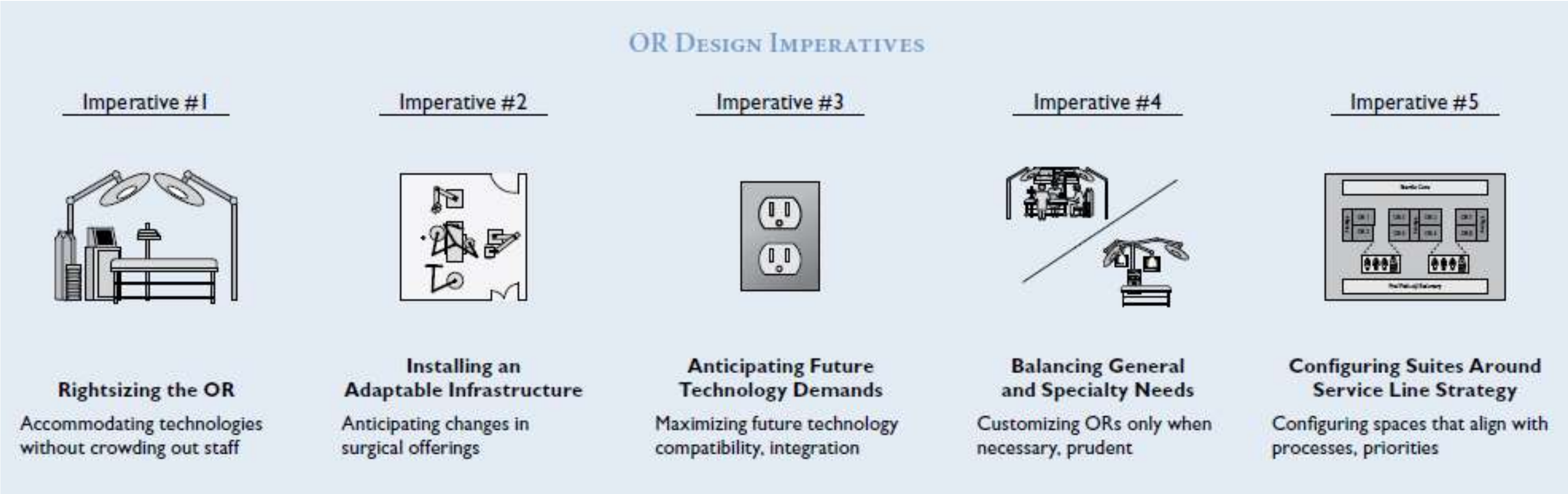
MULTIPURPOSE INTERVENTIONAL ROOM

The Hybrid Endovascular Suite

Specialists	Neurosurgeon	Vascular Surgeon	Cardiac Surgeon	Adult Interventional Cardiologist	Pediatric Interventional Cardiologist
Hybrid Room Procedures	• Aneurysm coiling	• Abdominal aortic aneurysm repair • Thoracic aortic aneurysm • Peripheral stenting	• Hybrid MIDCAB[1]/ stent procedures • Hybrid valve repair/ stent procedures • Percutaneous valve replacement/repair	• Peripheral stenting • Hybrid MIDCAB/ stent procedures • Hybrid valve repair/ stent procedures • Percutaneous valve replacement/repair	• Structural heart interventions • Hybrid Stage I procedure for HLHS[2]

Source: Advisory Board Company

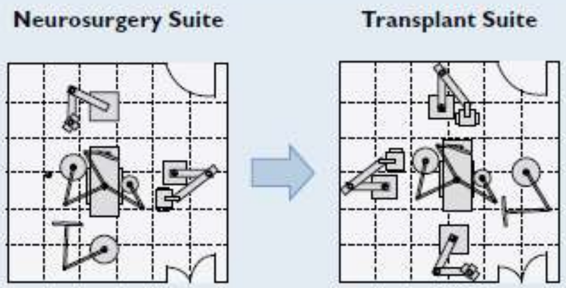
Flexible OR



Source: Advisory Board Company

Flexible OR - Versatility

OR Conversion Case Example



Two Options for Conversion

Option #1: Conventional

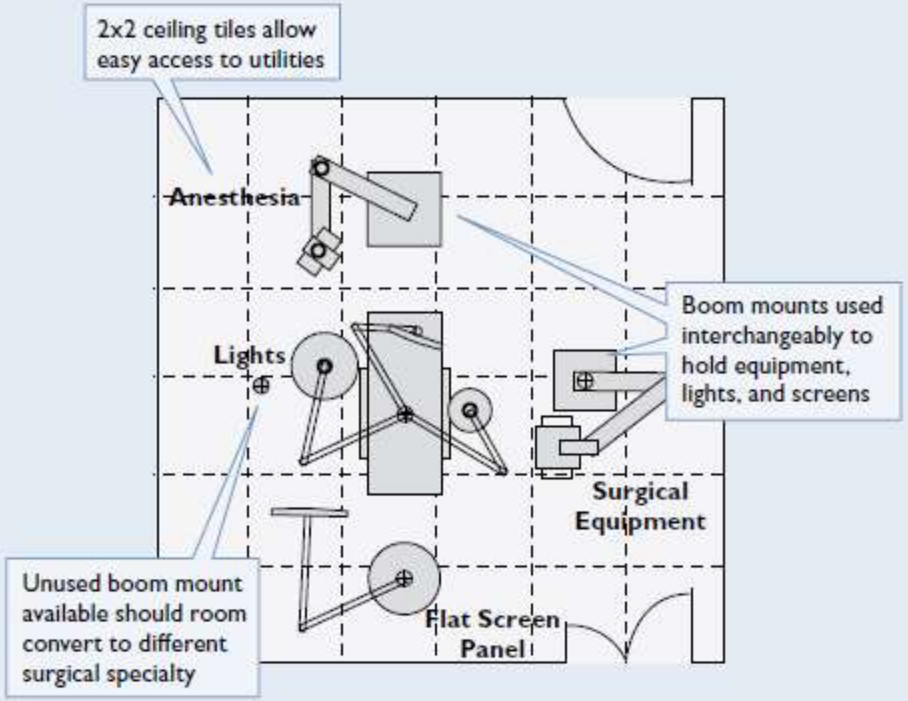
- Tear out plaster and drywall ceiling to access boom mounts
- Pull out mounts and reattach according to new room configuration
- Shift hoses, electrical wiring to new boom locations
- Mount equipment, lighting, screens on reconfigured booms

Option #2: Extra Boom

- Temporarily remove ceiling tiles
- Shift hoses, electrical wiring to new boom locations
- Mount equipment, lighting, screens on reconfigured booms

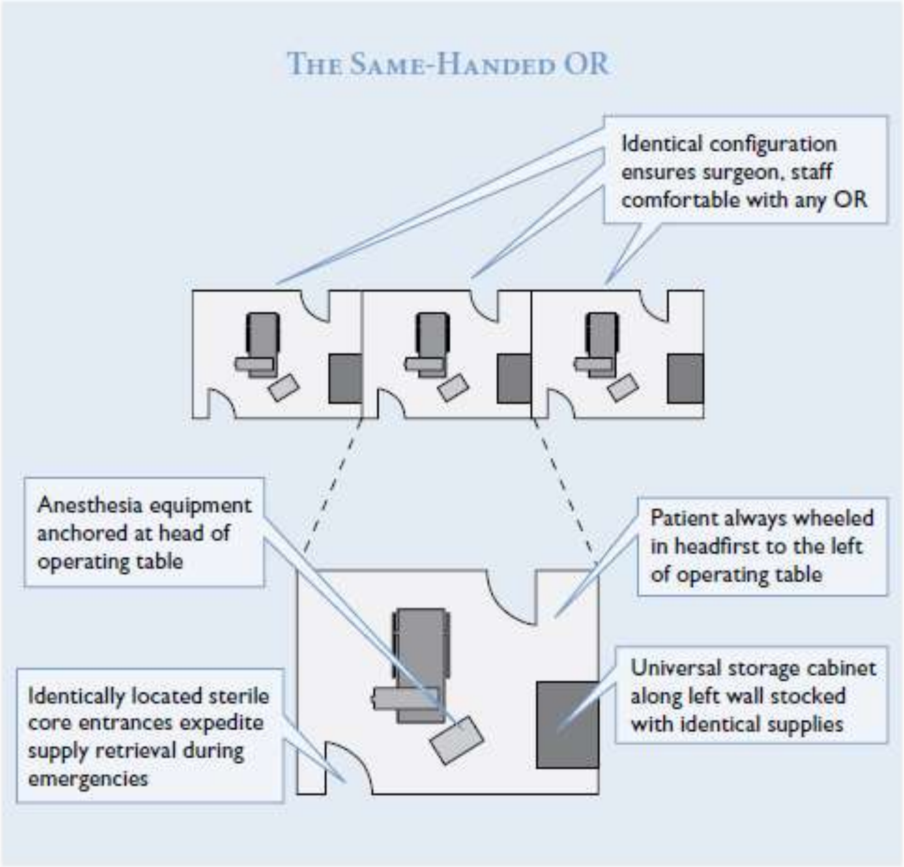
OR Downtime, Days

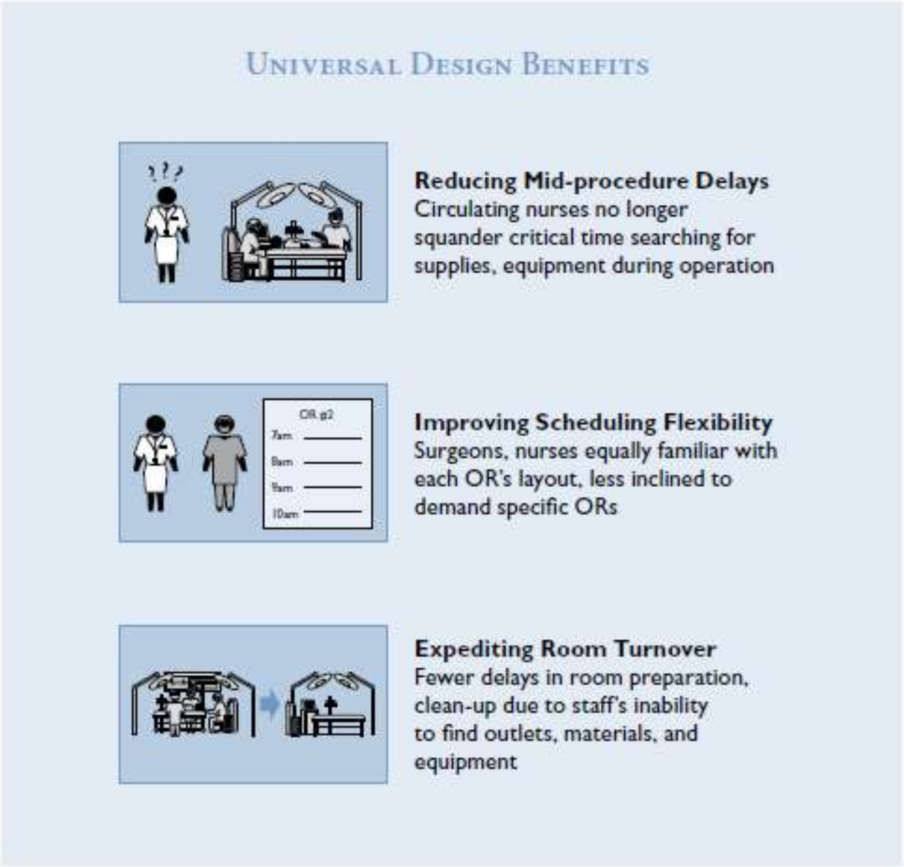
Adaptable OR Ceiling Elements



Source: Advisory Board Company

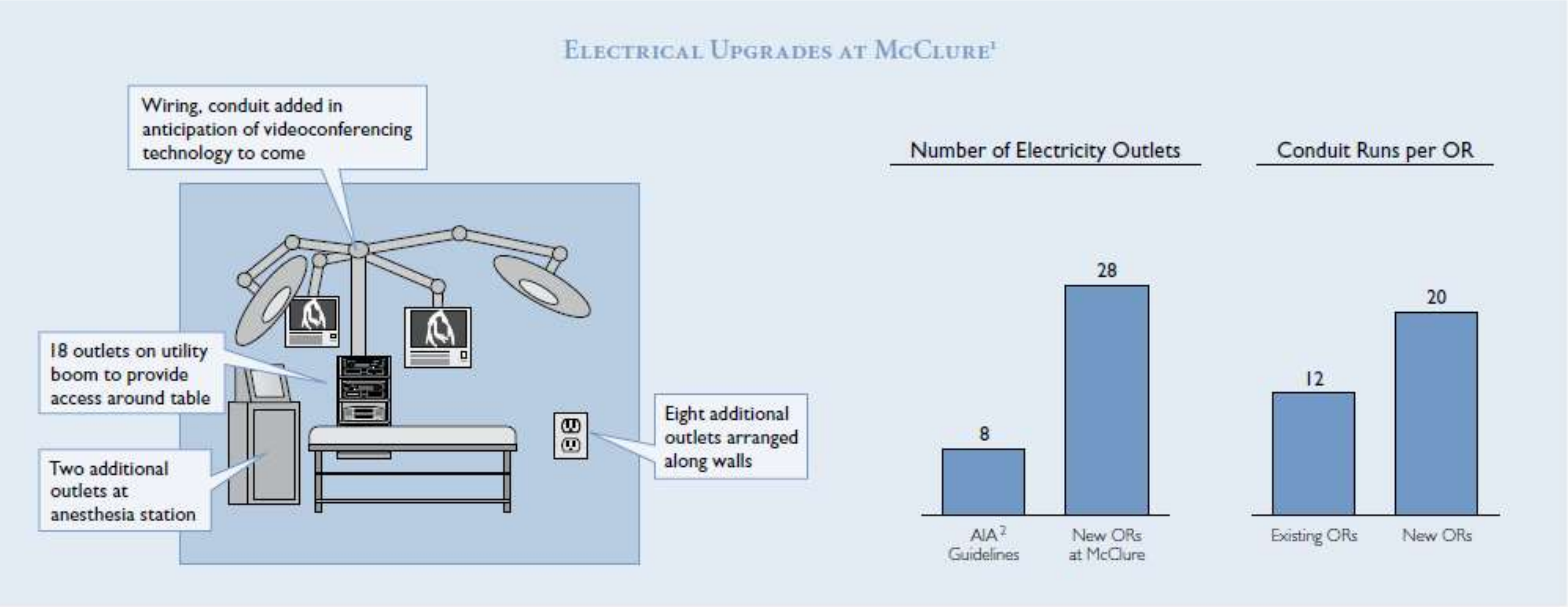
Standard Design





Source: Advisory Board Company

„Overwiring“



Source: Advisory Board Company

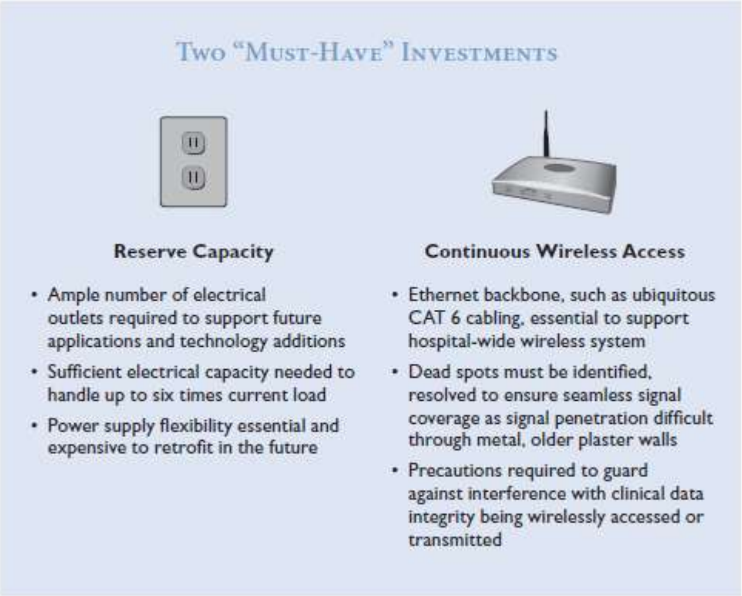
Flexible IT

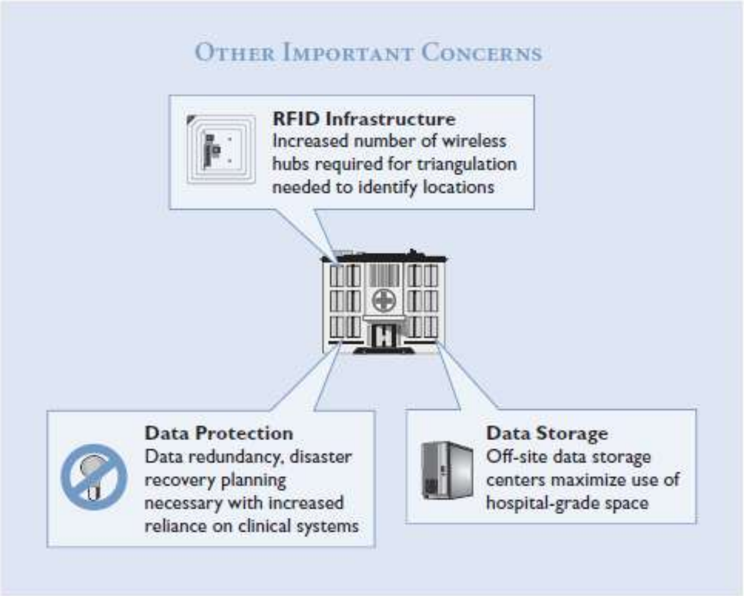
"Overwiring" the Walls

New construction projects and renovations should incorporate reserve IT capacity to allow maximum flexibility in accommodating future technologies. Although one day wireless technology may reduce the wiring burden entirely, for now hospitals should plan to install extra electrical conduit, data transmission lines, and CAT 6 cabling to enable greater amounts of data to be transmitted over networks.

Troubleshooting Wireless Access

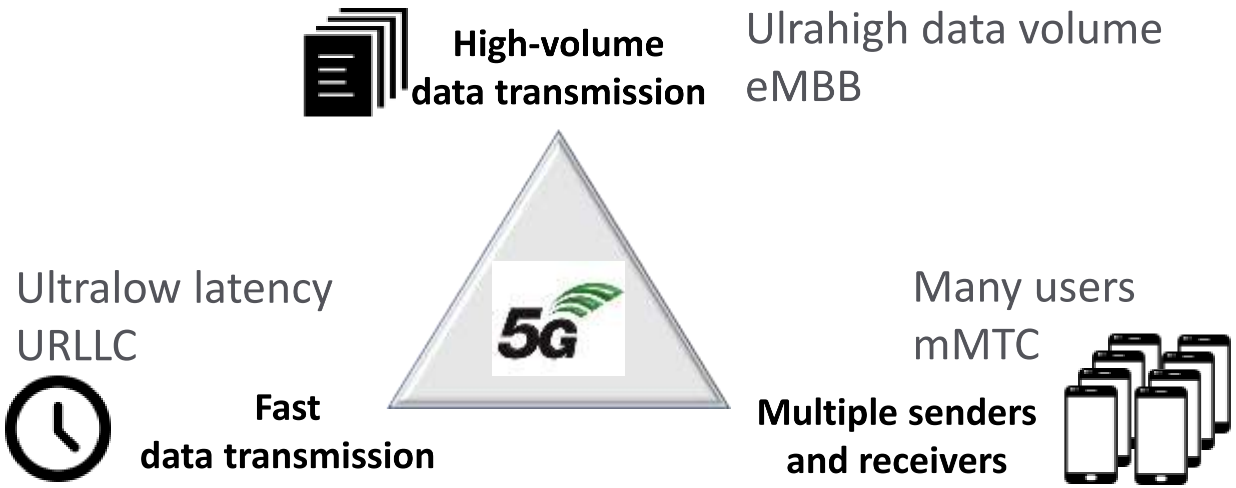
With the proliferation of electronic records and order entry, seamless wireless signal coverage is essential, which may be especially problematic in older buildings as signal penetration is difficult through older plaster and metal walls. In addition, a facility-wide RFID infrastructure requires an increased number of wireless hubs since objects are located by triangulation, meaning the object must be "seen" by several wireless points.





Source: Advisory Board Company

Connectivity – Radio Technology – 5G



1. _Enhanced Mobile Broadband (eMBB): Providing both extreme high data-rate and low latency communications, extreme coverage – well beyond that provided by 4G. Connectivity and bandwidth are more uniform over the coverage area, and performance degrades gradually as the number of users increases.

2. _Massive Machine Type Communication (mMTC): wide area coverage and deep penetration for hundreds of thousands of devices per square kilometer of coverage. An additional objective of mMTC is to provide ubiquitous connectivity with relatively low software and hardware complexity and low-energy operation.. .

3. _Ultra-Reliable and Low-Latency Communication (URLLC): Critical IoT. In this type of application, monitoring and control occur in real time, E2E latency requirements are very low (at millisecond levels), and the need for reliability is great.

Modular Construction

Modular Construction Assessment

Advantages

Saves Time
- Majority of construction done offsite
- Significantly reduces project timeline

Lowers Costs
- Cost per SF typically 30% lower
- Savings vary by level of finishes

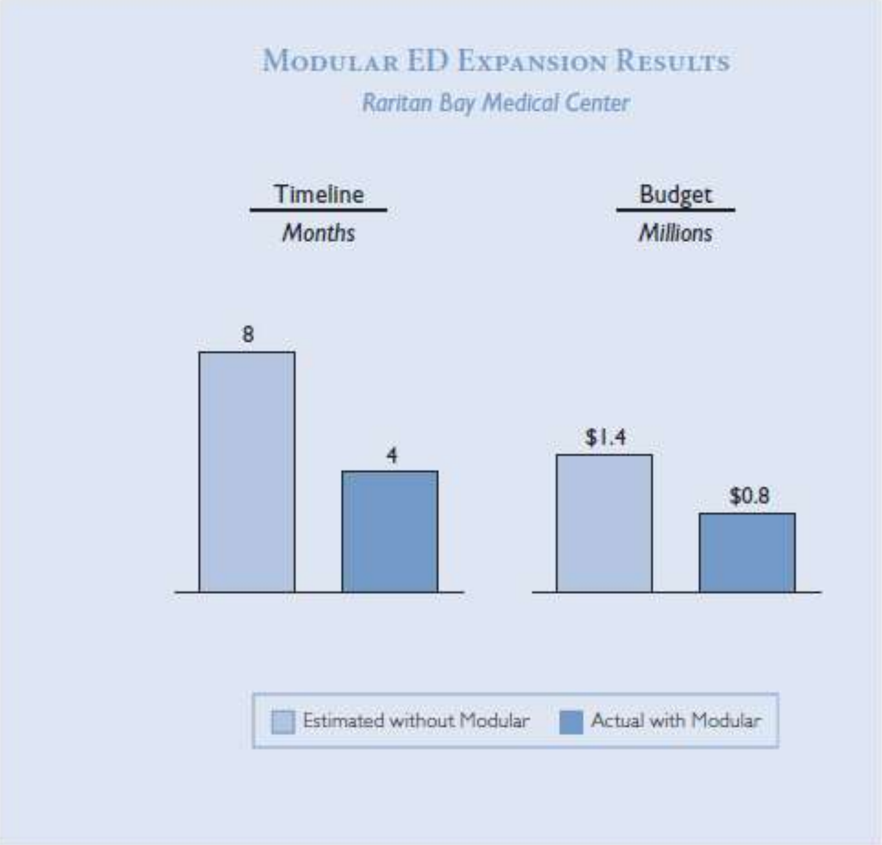
Less Oversight
- Modular firm does design, oversees construction
- No architect fees

Disadvantages

Reduced Aesthetic Appeal
- Façade potentially less attractive
- Stigma that it's "cheap"

Simpler Structures
- Best for simple additions, clinics, office buildings
- Rural facilities also good candidates

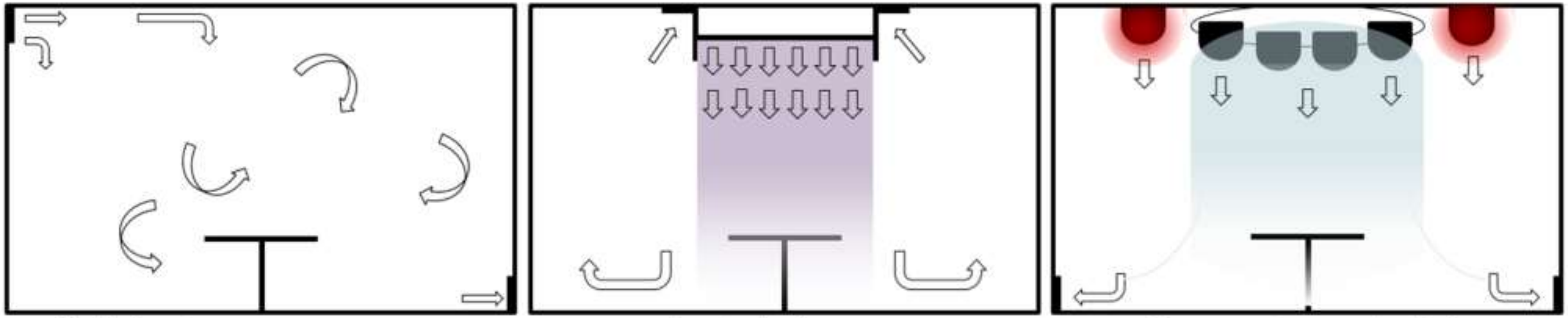
Design Discipline
- Design decisions, budget finalized upfront
- Limited opportunity for change orders



Source: Advisory Board Company

Infection Control and Ventilation

- **Multiple impacting factors**
- **Complex thermodynamic system**
  - Staff behavior - Human Factors
  - Changing „environment“



Turbulent
Mixing Ventilation - TMV

Low turbulence
Displacement Flow - TAV

Temperature controlled
Airflow - TcAF

Source: M. Alsved et al. / Journal of Hospital Infection 98 (2018) 181-190

The Importance of Communication & Scope Definition

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What the customer explained

What sales ordered

What engineering designed

What marketing advertised

What was delivered

What the customer really needed

Clinical Workflow

know how

means,

comprehension of clinical operations:

- Clinical and operational processes
- process interfaces as well as

  technical interfaces and application of the various technologies

➔ Who – What – How – By what means

The steps to sucess:

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- Requirement and Workflow Assessment
- Planning and Design
- Project Management and Controlling
- Education and Training
- Standardized Use






Involve all stakeholders as early as possible in the project for workflow and requirement assessment

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Discuss layout/concept with all involved parties on hospital and vendor side

Involved parties include but ar not limited to:

- Surgeons
- Cardiologists
- Interventionalists
- Technical director
- Hygienist
- Anesthetist
- Scrub nurses
- Radiographer
- Project Managers
- Vendor representatives
- Medical Equipment Planers
- Consultants
- ....

Conclusions and Lessons Learnt:

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- Build a „**business case**“
- **Clearly define your workflow(s) and establish workflow standards**
- Engage **ALL** end-users in decision making
- The more people involved the better
- Design the room to accommodate future innovations (and those that budget does not allow at this time)
- **No detail is unimportant**
- Educate yourself (Visits – Showrooms)
- Hightech and Hybrid OR projects are about **“Trade-Offs”**
- Follow a rigorous process
- **Getting started requires training**
- **The journey never ends**
- **The room is the system!**

Never forget: It is a TEAM effort

DIN 91422 (6/2025) – Standardized Approach

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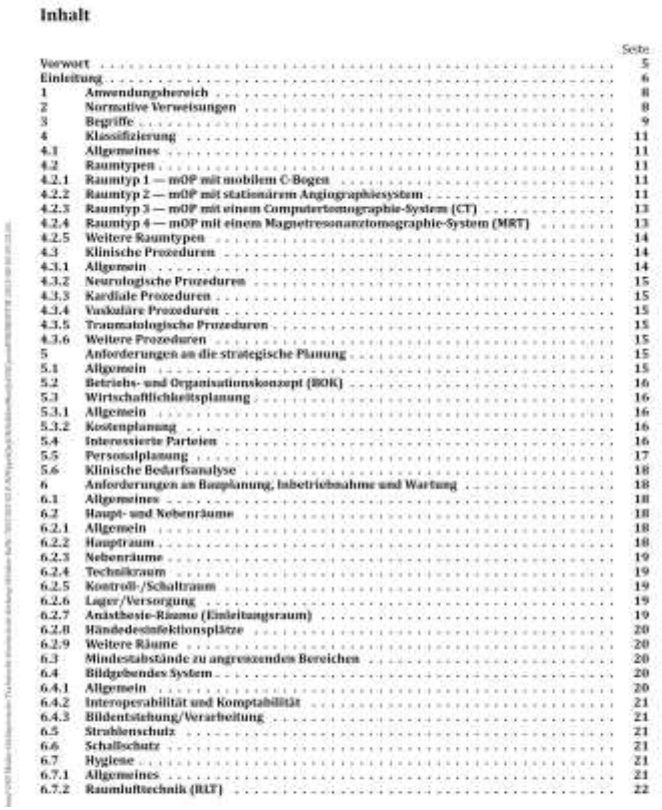
Requirements for planning and safety in the multifunctional high-tech working environment surgical theatre/interventional suite



Inhalt

Seite

Questions ???

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HOSPITAL ENGINEERING TRENDS

Architecture meets Technology

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http://www.oth-aw.de/hospital-engineering-trends

14.-16. September 2026

Amberg, Germany

Contact

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THANK YOU!