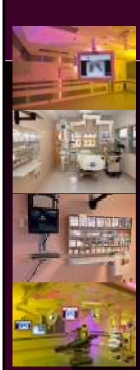

Designing an Hypertech Operating Suite and an Intensive Care Unit

- How these new design concepts improve patient safety and comfort

October 22nd 2009

Halifax 9 Pre-Conference Event : Design with safety in mind

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Learning Objectives

- Understand the complexity of two high technological services in a hospital: the Intensive Care Unit (ICU) and the Operating Room (OR);
- Learn about the design choices that were made and how these improvements contribute to patients' safety;
- Learn how design impacts positively on personal retention, and ultimately leads to better care for the patient;
- Learn about the roles of the biomed physicist (or eng.) in the planning and building phases of these high tech suites.

The Intensive Care Unit Project

1- The service columns are located at the center of the room(18,2 m²). The equipements (monitoring, ventilator , iv pumps, etc.) and the service devices (electrical, gases, data, etc.) are located on these central 'booms'. This configuration provides an easier access to the patient's head.

Old strategy

New strategy - Service columns

Taken from Haraeus - brochure 2001

The Intensive Care Unit Project

2- Better water quality for a better dialysis treatment.

Water quality is a critical factor for good dialysis treatments. Since the ICU patients are difficult to move, these treatments are done in the ICU rooms.

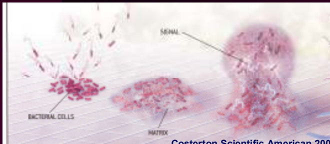
The current trend is to move from the mobile (portable) reverse osmosis water production, to a dedicated centralised reverse osmosis with a distribution system.

The Intensive Care Unit Project

2- Central reverse osmosis water production system dedicated to the Intensive Care Unit (16 beds).

The central system prevents the growth of bacteria (Biofilm), thus giving better water quality for a better treatment.

Moreover this results in less equipment in the patients' rooms, allowing more space for caring professionals (especially useful in critical situations).



Costerton Scientific American 2001

The Intensive Care Unit Project

3- PC's installed in all rooms, for direct access to the patients' data (lab results, medication dosages, nursing notes, etc.).

The computer is an important part of the room design, for a rapid access to the electronic patients records.

But, it is crucial to remember that the standard keyboard design could be an important vector for cross contamination. In response to this issue, special keyboards were chosen in the project, that allow in-dept cleaning.

The Intensive Care Unit Project

4- The presence of windows in the rooms is an important factor for the patients' circadian cycle.

It was observed that with the presence of natural light, the patients are less agitated, thus need less sedation during their stay at the ICU. The cycled light will reduce the patients' recovery time.

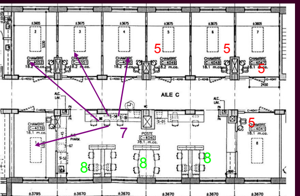
The Intensive Care Unit Project

5- Reduced the risk of cross contamination by having one toilet cabinet per room (waste elimination).

6- Installed negative pressure rooms for infectious patients.(2/8 rooms)

7- Increased the visual contact between the nurses and the patients, for increased safety.

8- Created space for the medical team's discussion, which is more private, instead of having corridor conversations between professionals.



The Intensive Care Unit Project

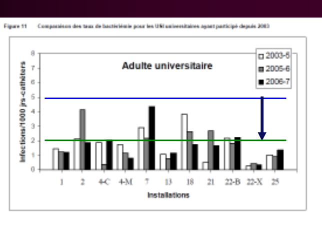
How do we evaluate this project ?

1- Fewer catheter infections. The average infection rate for an intensive care unit is 5.1/1000 days-catheter. The infection rate depends on several variables and techniques, but the reduction could be in the range 3/1000 days-catheter (15 patients/year).

($15 000 US per patient; Warren 2006)

2- Reduced nurses turnover (the cost to train a nurse for the ICU is between $18 000 and 30 000$*).

*= $ Can



LSPQ 2007

The Intensive Care Unit Project

How do we evaluate this project (subjective evaluation)

3- Fewer work accidents.
Better ergonomy means less acidents related to work.

4- By the peers recognition (prize for our ICU, obtained in 2005)

5- Other data (med, number of falls) is not available at this time.

The Intensive Care Unit Project

Lessons learned:

- The location of the ICU is critical.
- Ideally ICU's should be located near the Radiology, the Operation Room (OR), and the Emergency Room (ER).
- As the bed and the equipment gets bigger, please plan for larger elevators accordingly.
- Always buy new equipments as part of the renovation project.
- The Task force should be formed ASAP in the planning process. Our core task force was: Physicist (GBM), nurse, MD, architech.
- Larger groups also include: RT, consultant architect….

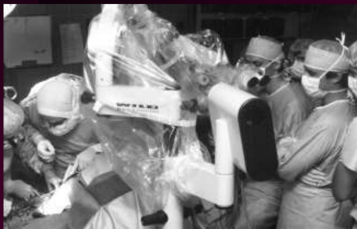
Part II : The Operating Room of the Future

Montréal
Ortho

Part II : The Operating Room of the Future

To overcome traditional operating room dilemmas by:

- reducing overcrowding (more and more professionals are needed);
- improving efficiency;
- increasing patient safety while integrating cutting-edge technology.



HND 1985

Part II : The Operating Room of the Future

Def:

SECPARS (Surgical Equipment Control, Picture Archiving and Routing Systems)

This new equipement is the answer to our operating room dilemmas

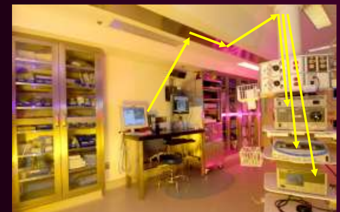
1- First function is picture routing : to send the images (Rx, endoscopic) where needed.

Part II : The Operating Room of the Future

2- The second function is equipment control

Capacity to control all the equipements in the OR directly from the nurse's desk (ex: the control of endoscopic light's intensity).

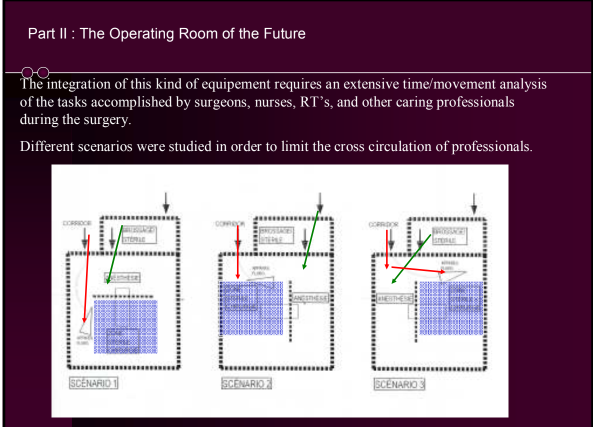
Benefit to the patient: To reduce as much as possible the number of persons enterring the laminar flow, consequently reducing the probabitity of infection.



Part II : The Operating Room of the Future

The integration of this kind of equipement requires an extensive time/movement analysis of the tasks accomplished by surgeons, nurses, RT's, and other caring professionals during the surgery.

Different scenarios were studied in order to limit the cross circulation of professionals.



Part II : The Operating Room of the Future

To reduce overcrowding and to improve efficiency, by combining the technology and a new architectural concept.

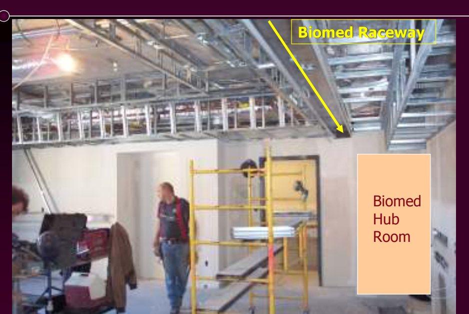
This new design adds flexibility and a certain adaptability to the constant equipment changes. The equipment cycle is 5 to 7 years long, as opposed to 20 years for the architectural concept.

This was made possible by the **Biomed Raceway** and the **Biomed Hub Room**.

These concepts contribute to reduce the number of equipments in the room, and thus increase the efficency and ergonomy for the surgical team.

Biomed Hub Room

Part II : The Operating Room of the Future



During construction

Part II : The Operating Room of the Future

Another way to reduced overcrowding is to add bird eye view cameras to this setup.

- In 1980, when we needed images for the media we needed a Cameraman
  - Limited space for surgical team and equipment
  - Increasing risk of infection for the patient

Preparation

During procedure

Part II : The Operating Room of the Future

Today: The new bird eye view is a robotic system with an integrated high resolution camera.

Camera

Telerobot

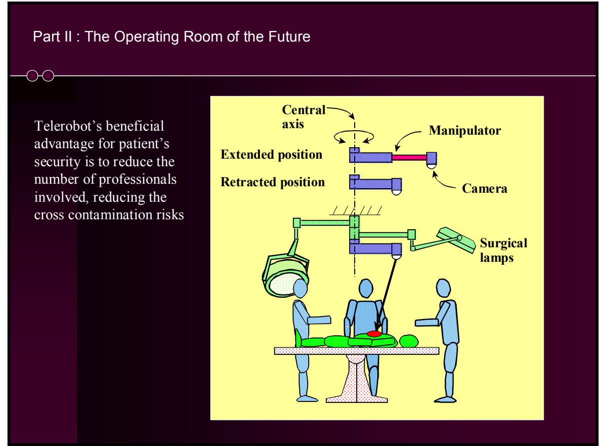
Surgical lamp

The robotic camera (a research project to evaluate the potential of this new type of mobile camera)

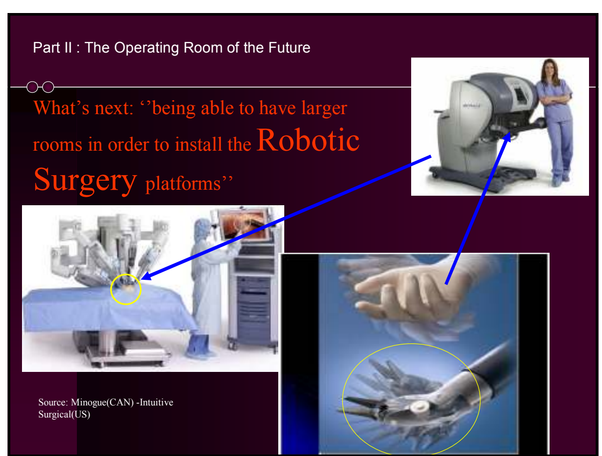
Non mobile, but offering distant camera movements

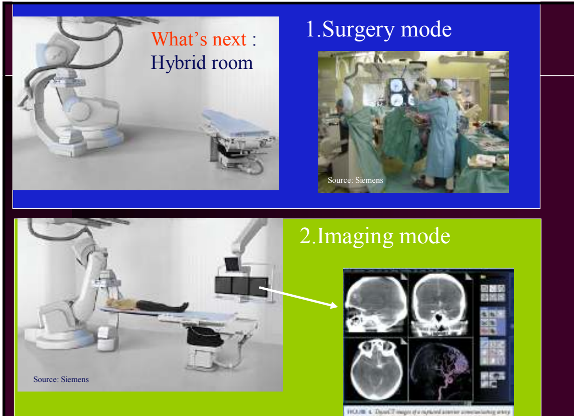
Part II : The Operating Room of the Future

The next generation of OR camera will include the same strategy as our prototype, mobile high resolution camera.


Part II : The Operating Room of the Future
Telerobot's beneficial advantage for patient's security is to reduce the number of professionals involved, reducing the cross contamination risks
Central axis
Manipulator
Extended position
Retracted position
Camera
Surgical lamps

Part II : The Operating Room of the Future
How do we evaluate this project (subjective evaluation)
1- Every team wants to work in these Operating Rooms
2- Positive comments received by companies' representatives, when they visit our Operating Rooms.
3-Renovation projects are very expensive ($M) but the repair costs for equipements are also very expensive…
(Heart-Lung Machine costs $200,000)


Part II : The Operating Room of the Future
What's next: ''being able to have larger rooms in order to install the Robotic Surgery platforms''
Source: Minogue(CAN) -Intuitive Surgical(US)



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Conclusion

More original designs need to be developed in order to accommodate the high tech equipments of today and tomorrow. The Montreal Ortho room, and the Intensive Care Unit were pilot projects allowing us to test these new technologies.

Close collaboration between the Architech, the Physicist, the nurses and doctors
was a key factor.

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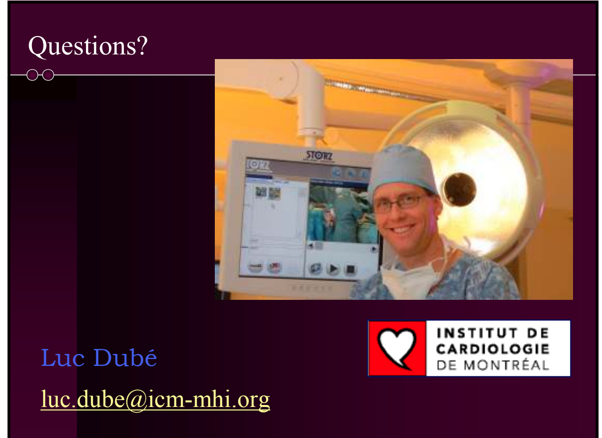
Questions?
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