Lab Space Planning and Facilities Design

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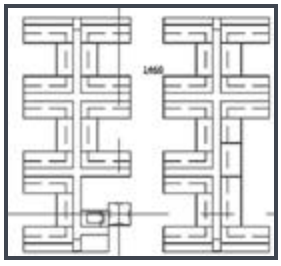

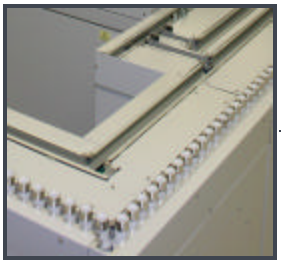

How to Apply Lean to Your Lab
<u>Before</u> You Call the Architect and Contractor

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Presentation Objectives

- Describe the elements of a design project.
- Describe how to plan a design project for a clinical laboratory.
- Describe some key features of effective lean design.
- Present some examples of using lean to improve operational efficiency.
- Describe the impact of system workstation consolidation and the use of system capacity analysis tools.
- Describe the impact of automation on lean design.
- Describe some things to avoid.
- Present a limited case study of using lean to design a core laboratory.
- Answer any questions that you may have.

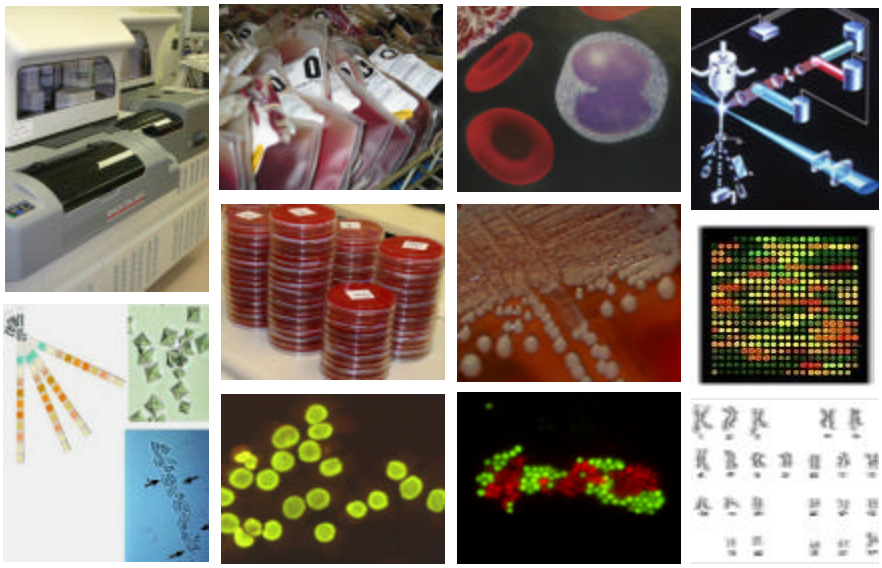
Lab Design Requires a Multidisciplinary Approach

Lean Six Sigma Tools
- Lean - Reduction of waste
- Standard work processes
- Single piece workflow
- FMEA
- SIPOC
- DMAIC
- DMAVI
- 5S
- Visual management systems
- Mistake avoidance
- Work balancing
- Value stream map

Operational Requirements
- Multiple disciplines
- Meet service requirements
- Reduce expenses
- Flexibility for growth
- Flexibility for new requirements

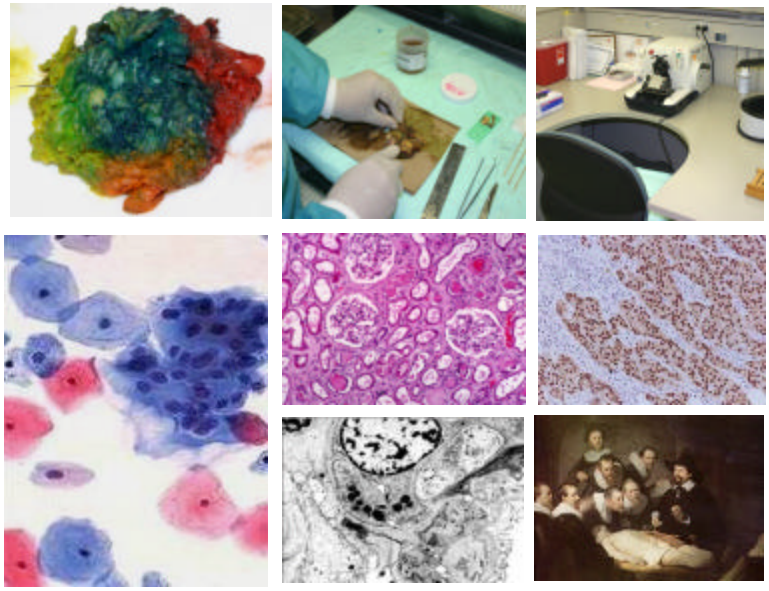
Design/Engineering Activities
- Site selection
- Space programming
- Sub-block adjacencies
- Workstation requirements
- Work cell design
- Facility/building system surveys
- Schematic design

Clinical Pathology:
Multiple Disciplines with Highly Automated and Manual Procedures



PNA FISH = Peptide Nucleic Acid Fluorescence In Situ Hybridization

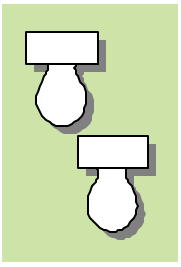
Anatomic Pathology:
Multiple Services with Technical and Increased Professional Components



Support Space:
Phlebotomy/FNA, Teaching, Staff Amenities, Offices, Admin Support



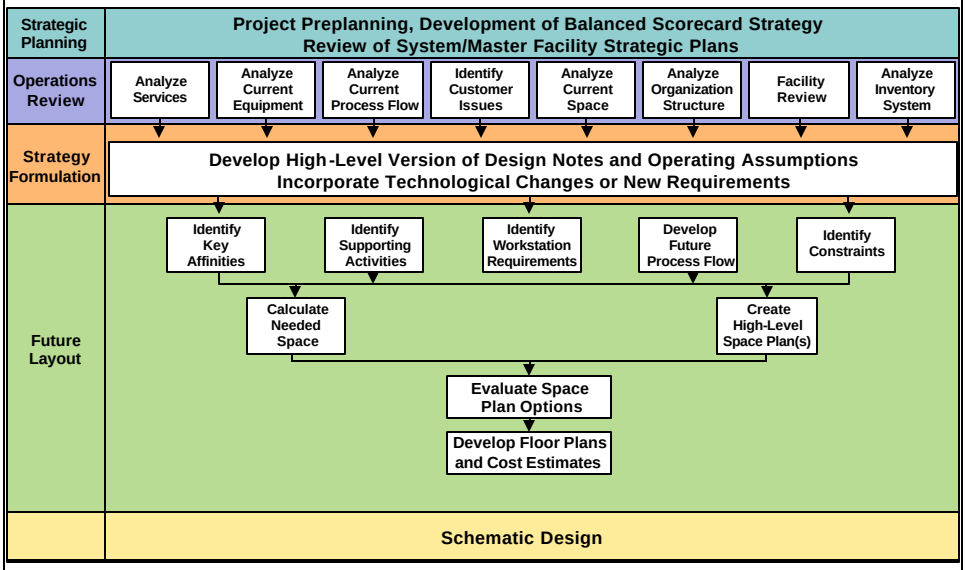





Application of Lean Six Sigma to Design Projects

- **Applying DMAVI for the overall design process.**
- **Identifying operational processes that need improvement through a detailed operations review.**
- **Using lean concepts for the actual facility layout.**

Lean Facility Design and Planning Process



A Lean Approach to Pre-Design Activities:
Develop a Project Plan

- Define the purpose and scope of project
- Timeframe
  - Design of new lab vs. renovation
- P
  - When will the project start and when is it expected to be completed?
  - Replacement cycle
    - Will replacement be part of design project?
  - Prepare for growth needs
    - Volume
    - New or replacement technology
  - Consider impact of workstation consolidation
  - Are you planning on automation?
  - Consider impact of other major activities (e.g., LIS upgrades/ changeovers)

A Lean Approach to Pre-Design Activities:
Develop a Project Plan (cont.)

- Develop a Lab Design Project Team and Executive Steering Committee
- Financial issue
  - Senior Management
  - Medical Director(s)
  - Cost per SF ranges from $250 to $1,350 with median of ~$500
    - 50,000 SF Lab @ $500/SF = $25,000,000
  - Return on Investment (ROI)
    - Many projects will have acceptable ROI of two to five years due to operational savings
    - Consider life of building to calculate FTE savings
      - 75K per year X 20 years = $1.5 million over life of facility
    - Consider financial impact of alternative use of space
  - Lab Consultants
  - Architect/Engineering

Using Lean Effectively for Design Projects

- Identify customer requirements through interviews and applying service metrics as part of a balanced scorecard approach.
- Identify/classify lean opportunities by performing an operations review.
- Develop the facility plan to meet customer requirements and to minimize wasted space and personnel movement.

Balanced Scorecard Approach:
Cost is Important and So Are Other Factors!

Strategy
Growth of 5 % per year

People
MT To MLT/Lab Asst = 1:2

Service
Absolute TAT = 30 Minutes

Financial
Target CPR = $ 7.50

Customer Requirements Drive Service Model

Document:
- Any service deficiencies
- New requirements
- Define/measure service metrics
- Specimen collection and results reporting processes

Identify/interview key customers:
- ED
- ICUs
- Nursing Floors
- Outpatient PSC
- Outreach
- Specialty Clinics

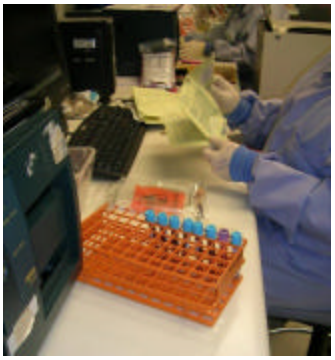
Schematic Design Notes:
Customer Requirements/Specimen Collection

- ***Currently, accessioning for outpatients is performed at both the main specimen processing area and at some patient service centers (PSCs). It is assumed that this activity can be fully performed at the PSCs with minimal necessity for accessioning activity space in the core lab and to improve billing/collection processes (e.g., ABN compliance).***
- ***Bedside bar code scanners/printers will be employed for specimen collection and to accomplish positive patient ID goals.***
- ***Phlebotomy and nursing staff should send specimens using as small a batch as possible to facilitate continuous workflow and improve turnaround time.***
- ***A pneumatic tube system with a diameter of six inches will be used to transport specimens and blood products to/from patient service areas and the lab.***
- ***A direct connection is desirable to key service areas such as Transfusion Services, Emergency Department, Operating Rooms, Labor and Delivery, and Intensive Care Units of the hospital.***
- ***The core laboratory should provide an absolute turnaround time of 30 minutes for selected automated tests. Current performance is 90% completion at 60 minutes.***

Lean Opportunities in the Lab:
Identification of Waste/Use of 5S

- **Waiting: Specimens in receiving area awaiting sorting**
- **Over Processing: Taking requisitions in/out of bags**
- **Transportation: Unnecessary walking to deliver specimens**
- **Over Production: Process/sort several items before passing on**
- **Inventory: Buildup of specimens due to batching**
- **Moving: Back/forth physical movement due to poor workstation layout**
- **Fixing Defects: Mislabeled/improperly labeled tubes**
- **5S (Sort, Straighten, Shine, Standardize, Sustain)**

Operations Review:
Reduce Over Processing/Improved Efficiency Will Reduce TAT, # Workstations



First member of processing staff removes requisition from specimen bag.

Same staff member returns requisition to specimen bag.

Next processor has to repeat removal.

Operations Review:
Reduce Batching /Improved Efficiency Will Reduce TAT /Error Reduction

- Insufficient work area
- Batch data entry
- Batch labelling
- Increases possibility of specimen mislabel

Typical Results

Item	Current	New Procedure
Number of steps before specimen is available for testing	34 steps	20 steps
Time to process 10 requisitions before testing	25 minutes	6 minutes

- Effective use of triage
- Elimination of unnecessary/redundant activities
- Change in order of processing steps
- Put problem requisitions aside
- Perform patient registration in billing area

Operations Review:
Identification of Inefficient Processes for Specimen Storage and Retrieval

Use of bar code-based software system for specimen storage and retrieval

Sub-Block Design:
Use of Lean Techniques for Supply Storage

Operations Review:
Identification of Inefficient Processes Due to Design and Organization

- Differential area is >60 feet away from automated hematology area
- Manual testing reported to a different supervisor than the automated testing areas

- You may have to consider changing organizational reporting structures

Operations Review:
Use of Techniques to Improve Efficiency/TAT

- Develop paperless systems
- Use of auto-verification
- Revision of delta criteria

This laboratory went from less than 30% of Chem Panel results within 60 minutes to more than 90% in 30 minutes or less without track-based automation systems!

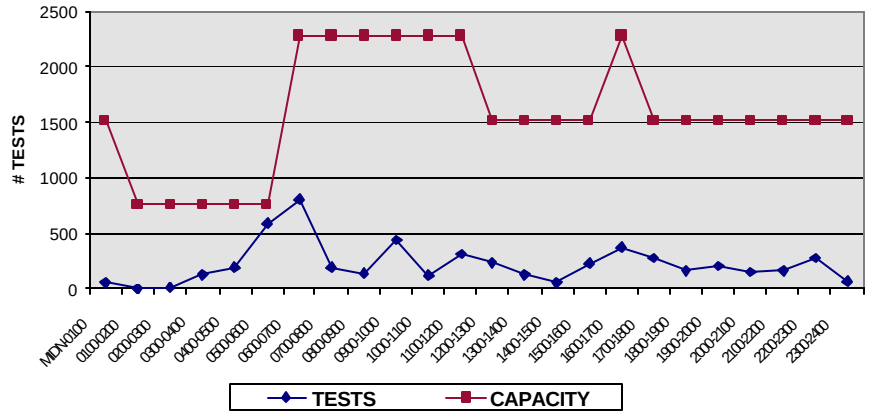
Operations Review:
Equipment Consolidation: Chemistry/Spec Chem/Tox/Endocrinology/Immunology

(2) Roche 917
(4) DPC ImmuLite
(1) Abbott Axsym
(2) Roche Elecsys
(1) Beckman Array
(1) Biorad Variant
(3) Abbott TDX
(2) Abbott IMX
(1) Nova 5
(1) Nova 16
(1) AVL
(1) ABL
(1) Abbott Commander
(1) Biosite Triage

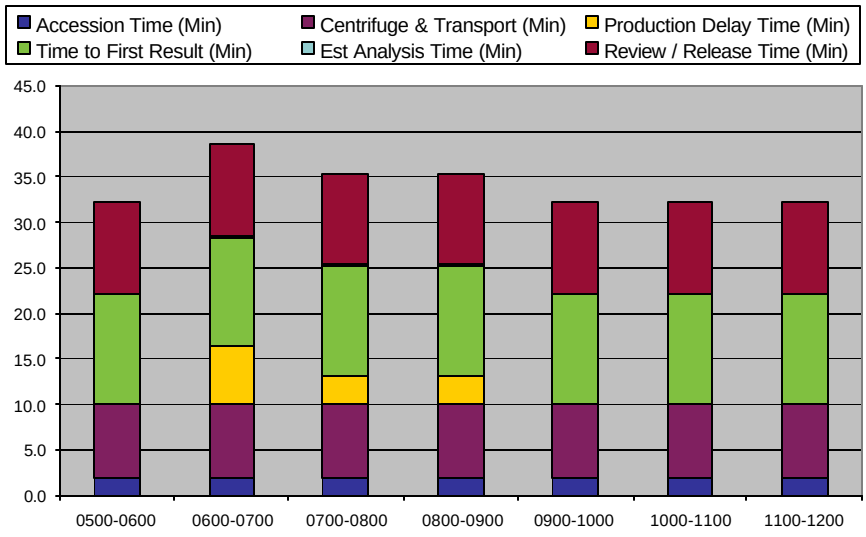
- Reduction of operating / capital cost
- Need for system capacity analysis
- Impact on turnaround time
- Impact on space planning

(2-3) Automated Chem
(2-4) Immunoassay

System Capacity Analysis



Turnaround Time Analysis



Sub-Block Design:
Consider Impact of Consolidation/Automation/New Technologies

Typical system of two or three Chemistry analyzers and two Immunoassay analyzers requires 800-1,500 SF for equipment only.

- Design for flexibility…Manufacturers are adding new capabilities to

Identification of Inefficient Processes Due to Design

An open lab is *not* the same thing as a lean-designed lab!

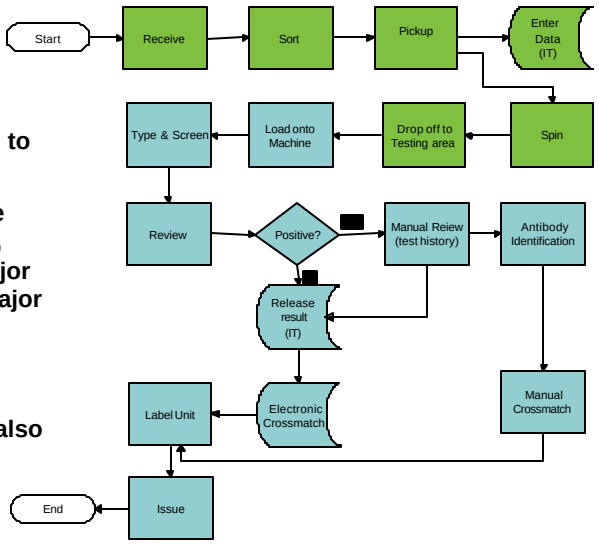
Change of Process

Schematic Design Notes:
Core Laboratory

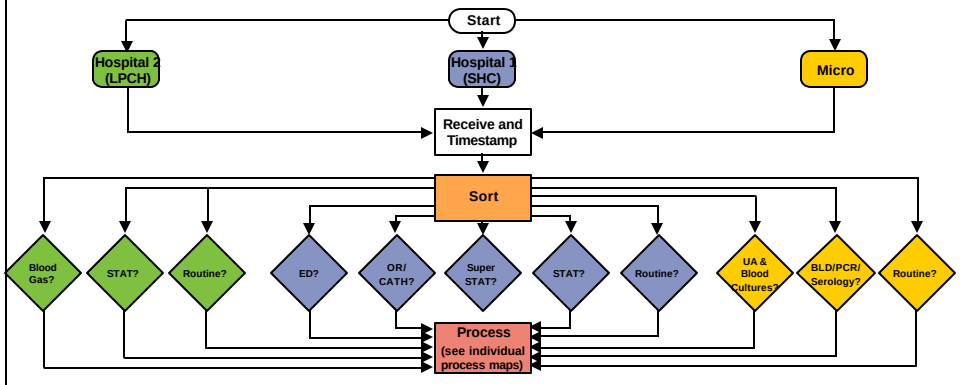
- ***The laboratory will use online data storage and strive to be paperless.***
- ***Automated equipment interfaces will use auto-verification, and the Delta check criteria will be revised to be consistent with linear ranges and medical necessity.***
- ***Supplies will be stored within the laboratory areas to operate for up to a 72-hour period. They will be replenished daily by Materials Management using reorder points that will be reviewed quarterly.***
- ***High density storage systems will be used to store supplies within the lab storeroom.***
- ***The cold room or refrigerators will be rear-loading with glass doors in front to facilitate supply rotation.***
- ***A bar code-based specimen management system will be used. This will be performed automatically on the automated chemistry/ immunoassay system and the automated hematology system. Other sections will use a PC workstation equipped with suitable software.***

Process Maps

- A critical component of applying lean tools to laboratory design begins with the mapping of the entire laboratory process from specimen collection to result reporting.
- This should be initially be performed at a high level, but should include all major customer interactions, major input activities or events, and major reporting activities.
- The process review may also reveal design issues that have to be addressed.



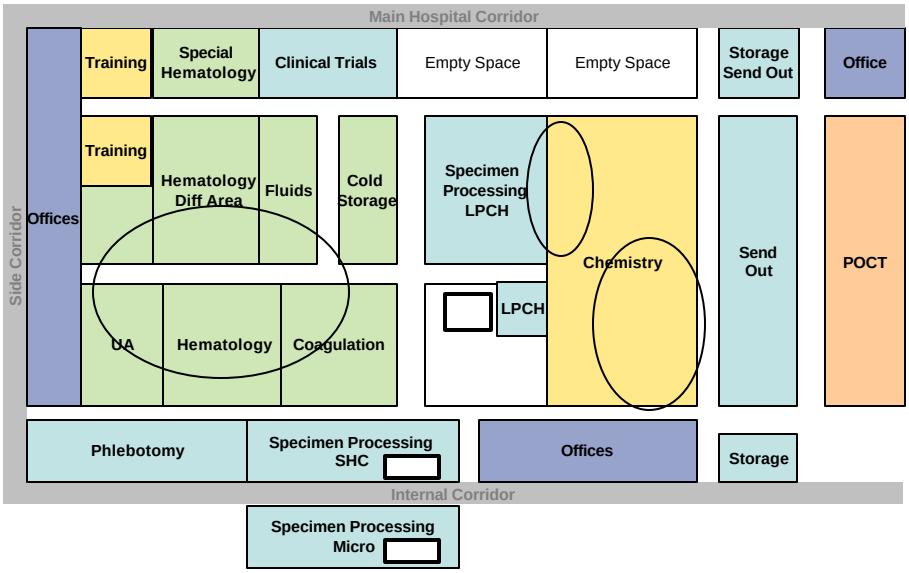
Core Laboratory: Analysis of Current Workflow



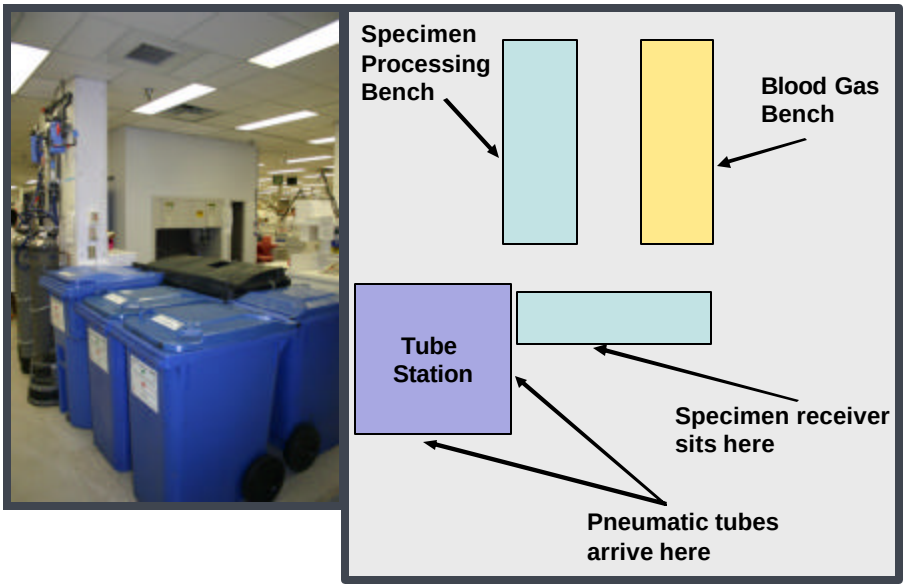
Three departments sort in a total of eleven different ways:

- Sorting and time stamping = Key non-value added steps
- Duplication of functions = Increased need of staffing/inefficient allocation of staffing
- Increased risk of errors = Impediments to improved quality care

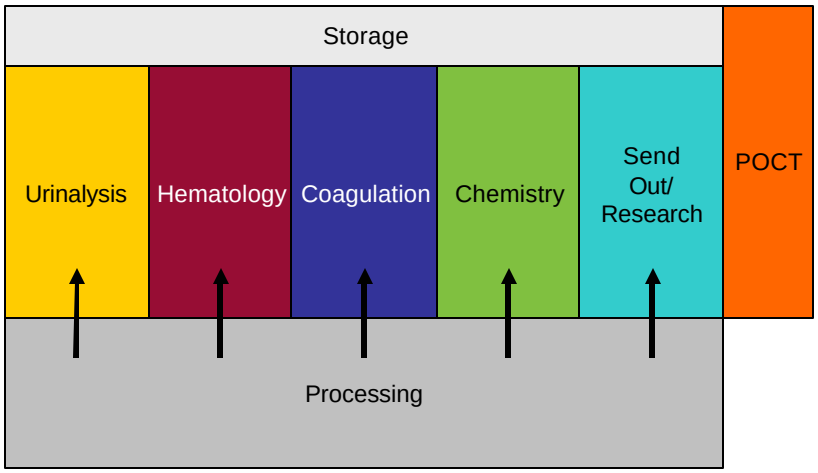
Core Laboratory: Current Space Layout



Specimen Receiving/Processing



Core Laboratory
Concept of Future Schematic Layout

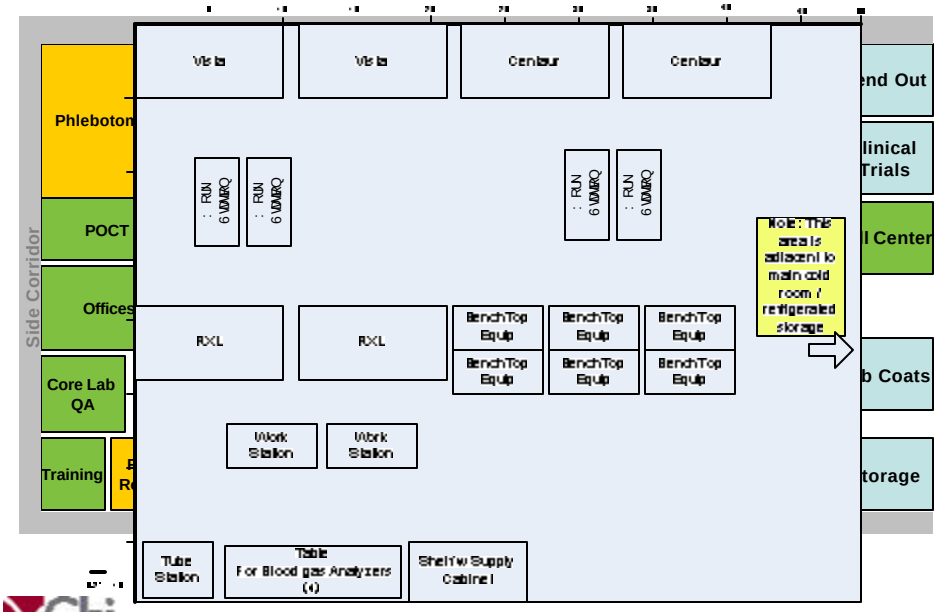


Note: This layout is intended to show relative positions and is <u>not</u> to scale.

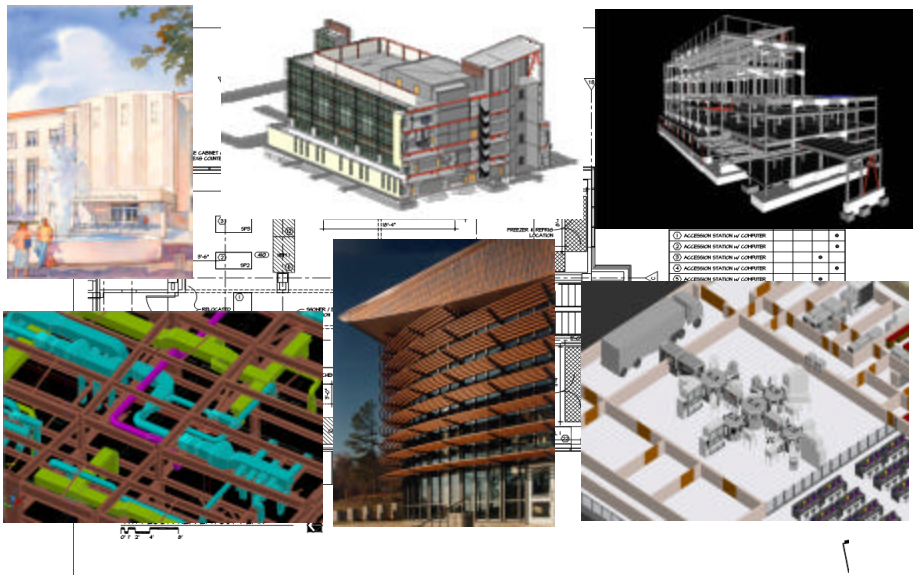
Schematic Design Notes:
Core Laboratory

- ***Physically reorient the floor plan of the core laboratory so that key service areas such as phlebotomy and specimen receipt are adjacent to the main corridor connecting the ED and nursing floors.***
- ***Plan the core laboratory so that specimen processing is tightly integrated into the overall operation, and eliminate the current use of multiple processing areas.***
- ***Current production is based on at least 11 different categories and/or workflow processes. These will be simplified to employ First In/First Out (FIFO) for all specimens (except those for blood gas determinations) and use automation and sufficient equipment to meet projected TAT requirements.***
- ***Organize the core laboratory sections by specimen type to the greatest extent possible.***
- ***The tube systems will be relocated within the core lab to facilitate improved workflow processes.***
- ***Automated equipment interfaces will perform the "specimen received" function vs. performing this procedure manually in accessioning.***
- ***Develop the overall floor plan of the testing sections to ensure a smooth workflow with adequate storage areas and space for future growth.***
- ***An absolute TAT goal of 30 minutes will be used for all tests on the STAT menu.***

Core Laboratory: Future Space Layout



What Happens Next:
Architectural Design, Engineering, and Construction



Summary

- Develop a project plan with a realistic schedule.
- Form an Executive Steering Committee to get support for your project.
- Develop a balanced scorecard for your department with maximum input from customers to ensure your department meets their needs.
- Analyze your current operation in terms of processes used and workflow, and develop metrics.
- Identify lean opportunities as process and/or design issues, and develop solutions for the process issues as interim improvements.
- Use lean strategically, not in isolation!
- Develop a strategic plan for instrumentation that considers new or changing technologies and use of automation.
- Develop a strategic plan to meet service requirements and use these requirements, to develop a set of schematic design notes with operating assumptions and specifications for the architect to use.

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Thank You!

Questions and Answers