New Picture Archiving and Communications System Plus New Facility Equals Critical Path Planning Challenge

Paul E. Brye, Ramesh Loharikar, and Eugene Duda

The architectural design and construction of a new imaging department is one of the most complex challenges in healthcare architecture. When a client also plans a simultaneous change in basic operating system technology from film-based to filmless imaging, the challenge for both hospital management and the facility/technology design team is even more complicated. A purposeful planning process plus a carefully composed team of internal and external experts are the two essentials for success in executing this difficult conversion of both facility and technology.

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SUCCESSFUL CONVERSION from film-based to filmless imaging, while simultaneously replacing the imaging facility in a new building, requires two essential building blocks to succeed: first, a critical path management process that satisfactorily incorporates the unique needs of the imaging service project into the broader hospital's approach to facility planning, design, and construction; and second, a unique team planning approach for the imaging portion of the broader project that coordinates an internal management team paired with an external design/technology team. Each team requires leadership that understands the contribution of approximately 12 key players representing different disciplines all of which are necessary to the successful conversion of the imaging service's technology and facility. These internal and external project leaders must establish a critical path work plan to progress from the initial project vision through to completion and occupancy. Process management and team leadership must be executed in a manner that meets the needs of the imaging service, understands the demands of technology change, and incorporates the imaging project into the hospital's approach to capital project development.

THE DUAL CHALLENGE: TECHNOLOGY AND FACILITY CHANGE

Conversion from film to filmless while constructing a new facility is the maximum challenge. To establish the case that filmless imaging technology involves the physical plant, Fig 1 presents the image management system process with a focus on the key steps and spaces that are needed to meet new design requirements of filmless operations. Each of the key spaces illustrated will require different design criteria than that required for film-based imaging. Vendor selections for both the picture archiving and communications system (PACS) and imaging modality equipment will determine the final details of design criteria for many of the key spaces. Therefore, both the information architecture and the facility architecture must be successfully joined for optimum results.

Updating the physical plant for the imaging service typically includes facility architectural and engineering improvements to support both streamlined operations and specification demands of all imaging modalities. Figure 2 illustrates a design prototype showing the layout of a new imaging service. Key features show a clear circulation plan that separates traffic flow (inpatients, outpatients, emergency patients), zoning of imaging modalities, dispersion of radiologist reading stations to support patient/physician interaction, and the new key spaces required by filmless imaging. Note that data-processing support will require coordination with the health facility's information management system. However, imaging staff will likely prefer to archive short-term PACS data in the department depending on the PACS system selected and the short- and long-term archiving strategy.

THE PROJECT ORGANIZATION CHALLENGE

Technology change presents new requirements and that facility replacement offers new opportunities to change decades old operating systems built around film and paper. When both these changes are planned to occur simultaneously with an even larger scale facility development project, the need for effective decision making within a structured

From HDR Consulting, Alexandria, VA; HDR Architecture, Chicago; and Department of Diagnostic Radiology, Christ Hospital, Chicago, IL.

Address reprint requests to Paul E. Brye, MA, HDR Consulting, 1101 King St, Suite 400, Alexandria, VA 22314.

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FILM LESS IMAGE MANAGEMENT SYSTEM

Key Operating System Steps

- ### Key Operating System Steps
- Referring Physician Initiates Order
 - Access WAN / LAN
 - Central Scheduling (Electronic)
 - HIS Monitor for Demographics
 - RIS Monitor for Imaging Order
 - Control & Acquire Image
 - CR Plate Reader/Omit with DR
 - Quality Control
 - Gateway To High Speed Network
 - Universal / Structured Cable Plant
 - Archives Long & Short Term
 - Read Image & Dictate Report
 - Interim Voice Report + Transcription
 - Review Report & Sign (Electronic)
 - Signed Report Enters RIS
 - Clinician Review
 - Radiologist Consultation
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Fig 1. Filmless image management system. A flow chart of the essentials of PACS process from initial order/entry through to remote consultation indicating the key rooms needed to support the information management aspect of film less imaging. Rooms with shadowboxes require design to support both the technology and human workplace ergonomics that film less imaging requires. Architectural and engineering design criteria must support the vendor specific requirements of technology and the needs of staff who work in the specific spaces.

process becomes paramount. Figure 3 illustrates a specific approach to the project management challenge.

The seven-step process must be thought through all the way from the initial mission to project commissioning. Each step will be broken down into many detailed subactivities; however, if any of these milestone steps are omitted or poorly executed, the project result might not meet expectations.

The added challenge that the imaging service will face is most noticeable in the initial steps. Step 1 typically involves senior management because the implications of the technology change affect the broader healthcare enterprise. In step 2, clinical performance criteria needs careful definition and this is where the PACS and information system (IS) consultants become essential for close coordination

with the hospital's IS team member because these counterpart players must agree on technical aspects of the proposed system specifications. Technology plans for imaging must be effectively supported at the enterprise level. In step 3, process analysis and redesign studies are needed to carefully plot out the changes that will occur going from film to filmless and paper to almost paperless operations. This is an excellent process improvement opportunity (PI). Most hospitals have PI activities in place and mobilizing a PI approach to this step can be done and will include several of these team members, as well as operational level staff, both in the imaging service and elsewhere in the hospital. Step 3 will take several months and can be partially overlapped with step 2 to manage time.

Successful completion of steps 1 to 3 will position the imaging service to fully engage the

FILM LESS IMAGING PROTOTYPE

- 13 Imaging Rooms
- 8 Radiologist Reading Stations

Fig 2. Filmless imaging prototype. A prototype concept for a filmless imaging service that includes all imaging modalities. Spatial organization supports a patient centered service delivery operating system concept.

facility programming and architectural team members to begin the process of creating detailed space requirements and architectural designs that will support the transformation of imaging service operations from yesteryear to the futuristic operations. Remaining steps represent classic design and construction activities where the sheer volume of details builds exponentially and where follow-up and follow-through on details within the team structure become critical.

Figure 3 illustrates the internal and external team relationships to the work plan. Each team member discipline is deemed essential to successful project completion. All team members have responsibilities across multiple steps. The contractual relationships between the health care organization and the various members of the external team will vary a great deal. However, the focus should be on effective team organization and timely involvement in the process as the key to achieving highest level

of success. Imaging service new construction projects will seldom be stand alone projects but they will invariably be the largest one department capital expenditure of any building program. This is why there is a premium on organizing for success.

THE CHRIST HOSPITAL AND MEDICAL CENTER EXPERIENCE

Christ Hospital and Medical Center (CHMC) in Oak Lawn, IL is a 750-bed hospital and part of Advocate Health Care. The Imaging Service supports campus-wide imaging, which includes Hope Children's Hospital and the Outpatient Diagnostic and Treatment Center. Approximately 195,000 imaging procedures per year are performed in all locations.

Christ Hospital is currently in step 6 of this process with construction to begin in April 1999. The project involves construction of 62,000 square

PROCESS & TEAM ORGANIZATION FOR FILM LESS IMAGING

Fig 3. Process and team organization for filmless imaging. The project team is organized to execute a 7-step process that begins with mission and ends with new service commissioning. The internal and external teams must each be lead by project directors to coordinate the range of team member responsibilities through each essential milestone.

foot replacement imaging service as a stand-alone project for Christ Hospital. The Imaging Service is to be constructed on a shelled-in floor of a large multistory diagnostic and treatment services building. Construction will be completed in 14 months and operations will begin filmless in the new facility. Lessons learned to date indicate this basic approach to the dual challenge of technology change plus facility replacement is sound and can be recommended to others as a starting point. You must have a game plan and complete internal and external teams both under effective project leaders to succeed.

The CHMC measures of success for this project are (1) extensive equipment replacement to upgrade technical and clinical capability; (2) a highly functional physical plant for imaging operations and modality support; (3) dramatically reduced imaging report turnaround time to expedite patient

care; (4) increased staff productivity; and (5) increased patient and physician satisfaction. The latter three measures are being quantified so that the differences between yesterday and tomorrow at CHMC can be studied and reported by 2001.

CONCLUSION

In conclusion, accomplishing the dual challenge of technology change and facility replacement will face many of the imaging services across the nation in the next few years. Addressing these major challenges simultaneously requires thoughtful process planning combined with properly composed internal and external project teams. Needless to say, effective team leadership both within the facility and by the external design team will be the factor that creates a result that exceeds project expectations.