Title: Biomedical Equipment Repair Cycle

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Abstract: A case study of ABC Medical Facility and make recommendations.

Biomedical Equipment Repair Cycle

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EMGT 563/663
Reengineering the
Technical Enterprise

Team Case Study
Biomedical Equipment Repair Cycle

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INDEX

ATTACHMENTS

Executive Summary

Reengineering programs are not the fix for everything. Reengineering requires the very heart to be torn out of an organization before ground-up reconstruction begins. Such drastic measures are appropriate in many situations, as confirmed by a huge number of case studies. But behind the success stories we find solid planning, high-level champions, and people who understand the dynamics of reengineering. These successes are not by chance, but by people who know what to do, what not to do, and above all if the situation is right for reengineering [4]. It is based upon our understanding of such facts that we review ABC Medical Facility and make recommendations.

2.0 Introduction

A member of our team is employed by a health business that for the purposes of this paper, we name ABC Medical Facility. ABC used to be viewed as the best facility of its type in the area but in recent years has lost that reputation. While learning about reengineering our team member observed ABC's equipment repair process from the time that a Biomedical Technician first becomes aware of disabled equipment, and noted worst and best case time scenarios for getting it back on line.

Upon tracing the path of a repair cycle we see many obstacles in terms of functional walls that must to be jumped, and subsequently impede a potentially simple repair operation while incurring lengthy down-times, excess costs and frustrated staff. Reportedly, such inefficient process are rampant throughout ABC and we see these as root causes of ABC's problems.

It is not surprising to learn that MedTek Insurance Company (also an alias name for this paper) is aware that ABC's costs are higher than other facilities, and in response, MedTek is considering the removal of ACB from its list of Pre-Approved medical providers.

We thus write this paper as a proposal of how ABC may take a reengineering approach to process optimization. The processes we focus on center around equipment repair, but we recommend that upon fixing this area, ABC expands reengineering into all other areas. We use the SECURE methodology to analyze the current situation and recommend new process implementation.

3.0 Existing Process

3.1 Description

The existing way of doing business follows the hierarchical approach whereby tasks are defined by functional organizations which result in many hand-overs, potential errors, and downtime as people "hurry up and wait" for things to happen. *Attachment 1* shows the fastest possible response to repairing equipment (green and blue arrows). Broken equipment is found by medical staff who in turn notify a secretary who then notifies the Biomedical Engineering Supervisor. He in turn assigns a technician who assesses the equipment and either repairs it by making

simple adjustments, or by getting spare parts from stores and then fixing the equipment. This best scenario takes up to 90 minutes and accounts for 85 percent of the repairs.

15 percent of the time replacement parts are required that are too infrequently used or are too expensive for standard inventory, or parts that somebody simply forgot to order. These cases require procurement authorization from the Biomedical Engineering Supervisor before the stores can order the parts and set the supplier into motion to produce and deliver accordingly. This additional flurry of activities, seen in red, results in part replacement and subsequent machine repair taking up to eight weeks. Although such delays are represent the smaller percentage of equipment repair they are highly visible.

4.0 Justification For Reengineering

In today's competitive environment rapid change is normal and ABC hospital must move at such a rate, or get left behind and eventually close its doors [5]. Previously ABC was the leader of its field but as of late other hospitals are ahead and offer more efficient services. As a result ABC's prime customer, MedTech Insurance Company, has stated that operating costs must come down, otherwise ABC may removed from their list of Pre-Approved medical facilities.

ABC's TQI (Total Quality Improvement) programs produced incremental improvements, but evidently these are not adequate since the staff seem to be working harder than ever but only small improvements are seen. Reengineering is understood to be the fundamental rethinking and radical redesign of business processes to achieve dramatic improvement in critical, contemporary measures of performance, such as cost, quality, service and speed [7]. These are qualities ABC needs so reengineering is our selected methodology.

Our justification for reengineering is thus summarized in the following four bullets:

- Our prime referral customer, MedTek Insurance Company, is concerned with our care costs relative to other medical facilities available to them.
- MedTek is receiving comments from patients that our in-patient/out-patient time can be sluggish.
- If our costs and through times do not become more efficient, MedTek will remove us from their Preferred Medical Facility list.
- Competing medical facilities have already improved their processes and in doing so, knocked us from the number one spot for providing the best regional care facilities.

New Process

We focus on two processes as a foundation from which to grow: 1) Equipment repair and 2) Spare parts procurement. These areas are accepted as the most inefficient so in addition to fixing the biggest problem first, we see this as a model example to be used when expanding reengineering initiatives to the remainder of the hospital at a later time. This serves as our reengineering showcase. The structure employed to execute reengineering is SECURE – Scope, Engineer, Confirm, Ultraplan, Realize, Enhance.

5.1 Scope, Vision, Values and Goals

To provide focus for all team members we establish the scope:

- Medical equipment maintenance
- Spare parts procurement
- Cross-functional communication systems
- Equipment operator training
- Equipment purchase/replacement
- Team process building with MedTek Insurance Co. and ABC Medical Facility
- Cross-functional involvement of all staff during reengineering initiatives

Our Vision confirms the justification for reengineering by stating we will regain our standing with MedTek Insurance within six months, and that to do so we optimize equipment maintenance, interdepartmental communications, insurance billing cycles, and employee training.

As cement for the *Scope* a set of values is established: 1) We must openly share information across departments so as to optimize and communication. 2) We will never give up – we will succeed. 3) We are a team – a team's strength is based upon individuals. 4) We are responsive to each other and customers – lack of responsiveness is impolite and costly. 5) Our internal environment is connected to the external global environment.

And quantifiable goals are:

- 85 percent of equipment fixes will happen within 20 minutes
- 15 percent of equipment fixes will be within 24 hours
- Medical staff receive equipment service training so that simple cases, such as equipment resetting, can take place without the involvement of service technicians.
- Technology leveraging is central to process optimization.

5.2 Engineer

We expanded the project team to include:

a) An ABC executive (czar) to champion the reengineering initiative.
b) Project director, the head of biomedical engineering department.
c) Project group, R&D, purchasing dept., nursing, vendors, functional departments, computer department, and insurance agency.

Next, reengineer tasks by throwing out all considerations of department hierarchies, and document these based upon common sense approaches *Attachment 2.* Identify two categories of repairs 1) Those that can be fixed by simple equipment

adjustment, or by installing replacement parts that are standard stock inventory. Such repairs can be addressed within 20 minutes and account for 85 percent. 2) Repairs that require non-inventory parts and need special procurement from a suppler. These are 15 percent of cases.

The process is designed around the latest inventory/accounting databases and removes the secretary and biomedical engineering supervisor from the work-flow. In the straightforward cases, medical staff are re-trained to make simple equipment adjustments so even the newly titled "Case Technician" is not needed. When the Case Technician does become involved on more complex cases and cannot make simple "adjustment" fixes, he accesses the new database to get spare parts. Upon doing this the data base automatically tracks inventory levels and electronically orders new parts from the pre-approved supplier, who then deliver parts as needed, which in turn triggered the hospital database to make payments through an automated accounts payable file.

In the remaining 15 percent case category, the Case Technician finds the needed part is not in standard inventory since it is too expensive and/or too infrequently required to make storage costs effective. In these situations the database tells the Case Technician that a pre-approved supplier has been notified of the need for a part, and the supplier then electronically notifies the Case Technician of the part delivery time which must be within twenty-four hours. Upon arrival of the part the technician receives it, or has arranged with another Case technician to do so, and the inventory database is notified which in turn triggers payment to the supplier.

5.3 Confirm

After we engineer the new repair and purchasing processes, we have to test for bugs. This validates work-flows and detects potential errors in order to correct them before implementation. *(Attachment 4)*

For this stage we develop a pilot test of a small-scale reengineered operation. We select the unit that has the highest rate of equipment break-down. Then we divide the new processes in to small parts and test the parts that are critical. After we collect some raw data, we analyze it. If we detect some errors, we will make the corrections and perform the test again. When we are sure that our new processes are ready, we will move to the other steps and implement the new processes.

Plan for testing:

1. Check that the technicians who are assigned to the equipment in that specific unit can remedy the broken equipment within 20 minutes.
2. Check that the cross functional database system works per plan and check the linkage between the hospital cross functional database system and the supplier's database.
3. Check that the software used to keep the track parts operates accurately.
4. Check that expensive equipment that is not in minimum stock can be supplied within 24 hours.
5. Check that we have an appropriate training program to educate process users.
   - 5.1 Computer training program for the technician
   - 5.2 Basic concept of the medical equipment training program for medical staff
   - 5.3 Medical equipment training program for the technician

5.4 Ultraplan

Ultraplanning is the detailed planning that takes place for implementation of the reengineered system and processes. A critical milestone is to present the plan to executive management and get his buy-in to move forward. All tasks, deliverables, assigned resources, key personnel and delivery dates must be established since without such organization, implementing such a radical new process will become chaotic *(Attachment 4)*. Whereas the VP of Hospital Operations is in a position to buy-off many of the milestones during *CONFIRM,* the VP becomes a presentee to the CEO for getting implementation authorization in *ULTRAPLAN.*

The cultural environment must continue to be primed and nurtured, for this is the stage where human *resistors* begin to feel most uncomfortable – their old habits are about to become obsolete and they may still not fully understand the new way of doing business. It is critical for the process reengineering team to maintain communication that is loud, repeated, clear, and understanding of human concerns. To back this, top down support must be in place otherwise resistors will seek ways to undercut the reengineering program. *(Attachment 5)*

When the system is implemented a great step forward has taken place. Obstacles and challenges are overcome that started at the *Scope* and prevailed through right through to the current stage. Although much work is still ahead a celebration is well deserved before the next phase begins.

5.5 Realize

With the new database and processes up and running we see goals are met. 85 percent of equipment fixes happen within 20 minutes of breakdown and all other fixes take place within twenty-four hours. The secretary and Biomedical Engineering Manager are no longer involved in the repair loop, inventory is maintained automatically via electronic linkages with the supplier, the accounts payable department (also "online") is no longer swamped in paperwork, and the Case Technician is enjoying his more efficient work.

But although this reengineering initiative is closed work remains to be done. A lot of people underwent major changes and discomfort, and success must not just be celebrated verbally but through substantive means such as improved stock options, salary compensation, or by any other legitimate means that can be measured and appreciated by the staff. ABC should be ready to provide such recognition since not only is their profit margin improved, but teams need to be expanded for the next process improvement activities and their continued support is at the heart of reengineering success programs.

Most importantly, reengineering initiatives are designed looking outward toward the customer, and ABC is no exception with the driving force being the need to improve operating costs and remain on MedTek's list. ABC must continue to meet customer expectations in the future and keep pace with the fast changing industry, as mentioned at the beginning of this paper. In other words it must stand ready to tweak and expand, otherwise ABC will find themselves in another backsliding motion. For this the final phase of SECURE is addressed -- *ENHANCE.*

5.6 Enhance

We have outlined an approach to get ABC back in the favor of MetTek. But the reengineered equipment repair and procurement processes serve as a model to move forward from. Staff can see and have lived through their first adventure and this must serve as leverage to reengineer other major hotspots within ABC, and stimulate meaningful TQI initiatives in areas that are more appropriate for incremental fixes, as opposed to the do-or-die reengineering approach.

Our next goal is to expand the database and reengineer the complete finance department, and all remaining purchase processes such as stationary, furniture and medical supplies. Beyond this, there will be an ongoing TQI program to ensure ABC never again becomes static. Some theorists would argue that reengineering is indeed a function within TQI, and when TQI sees the need for fast, radical change, TQI itself will spawn and manage a reengineering effort. At other times the ongoing TQI program identifies the need for smaller, incremental changes and uses more of a traditional "enhancement" approach. This combination is appropriate for ABC during the *ENHANCE* phase.

6.0 Who Looses, Who Gains?

After reengineering, the organizational structure will be changed from hierarchical to flat. Decisions and interdepartmental issues that used to require managers and managers' managers now are made and resolved by teams during the course of their normal work [8]. This is the result of empowerment. The question that is often asked after reengineering is who loses, who gains?

Middle management, i.e. the biomedical engineering supervisor, loses much of his authority. In large organizations that have reengineered large swaths of middle-managers find themselves without their former positions and naturally, having spent decades of their careers building organizations, resent the new way of doing business that leaves them out in the cold [3]. Those managers that do remain in the organization take on more of coaching/facilitating/coordinating position and some actually find this preferable to their old dictatorial way of doing business. These dictators turned facilitators may be seen as winners, but the managers who lose their jobs altogether fall in the loser category.

The technician, now a *Case* technician is a winner. He used to spend time chasing paperwork and waiting for managers to authorize his routine steps. Now he makes decisions, utilizes a database to get fast responses from the supplier, and gets equipment back on line faster than ever before. The Case Technician is a winner.

Medical staff also win [1]. They are trained to make "adjustment" fixes whenever possible at which times there is no waiting for repair services, or they communicate with the Case Technician and can explain the problem directly whereby a secretary does not become involved in the loop. Ultimately they get equipment back on line faster than before.

The secretary also wins. No longer does she communicate messages between the medical staff and technician, or maintain paperwork to track repair records [6]. She can spend more time focussing on issues such as travel plans for executives, typing documents, and administrative issues.

Procurement staff have winners and losers. Much of the manual paperwork and parts ordering via telephone is replaced by automatic inventory tracking and ordering on the database. This process automation relinquishes most of the procurement staff of their positions and thus they are losers, unless other positions can be found for them. One or two inventory personnel are still retained to oversee the storage database, and ensure that parts are physically in stock. Their jobs are more straightforward and people retained for these positions are winners.

Accounting staff have winners and losers. Much like the procurement group, many accounting functions are automated which reduces the staffing requirement and places only those staff who are retained, in a winning position.

ABC Medical Facility is a huge winner. There cycle times are once again competitive, costs are down and MedTek Insurance reinstates their Preferred Customer standing. ABC now talks about expansion instead of Chapter 11.

7.0 Conclusion

ABC's most inefficient environment is within the equipment repair and procurement groups. The current processes are beyond salvage and need ground-up reengineering initiatives driven by executive management. After these areas are addressed, resulting technology should be expanded for subsequent reengineering efforts. Finally, an active, meaningful TQI program should be re-implemented to serve as the watch-dog and ensure that ABC pays attention to customer's needs [2]. The suggested reengineering methodology is SECURE, and one month should be expended for each phase thus allowing for 6 months from start to finish. Start time should be September 1998.

Changes must be fast, and organized based upon tasks that follow common-sense workflows. The old hierarchical structure is an impediment not only to future success but to current day business survival. Competitors have already responded to today's need for flexible, efficient business practices, and ABC must do the same -- and do it *now*.

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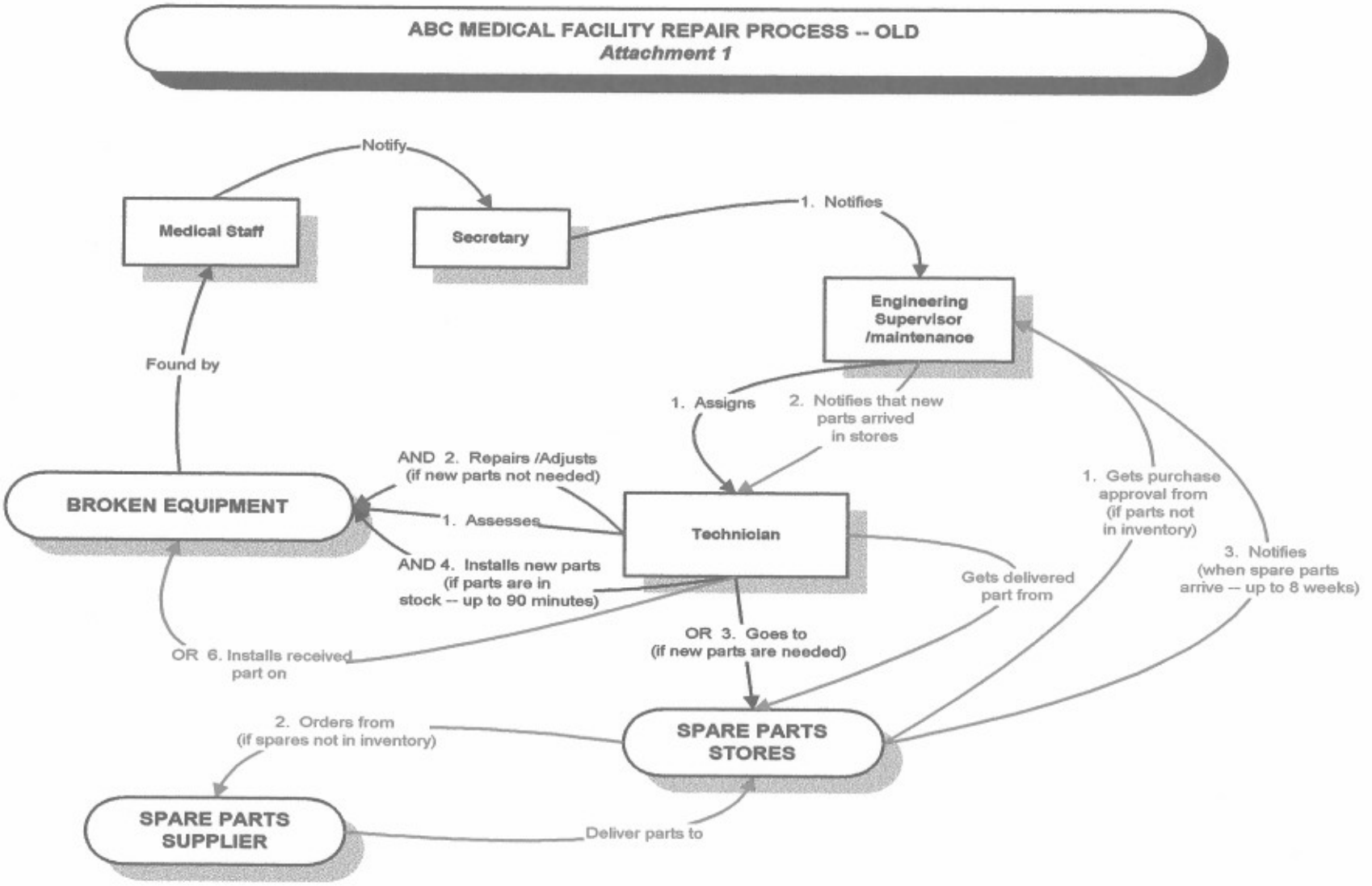
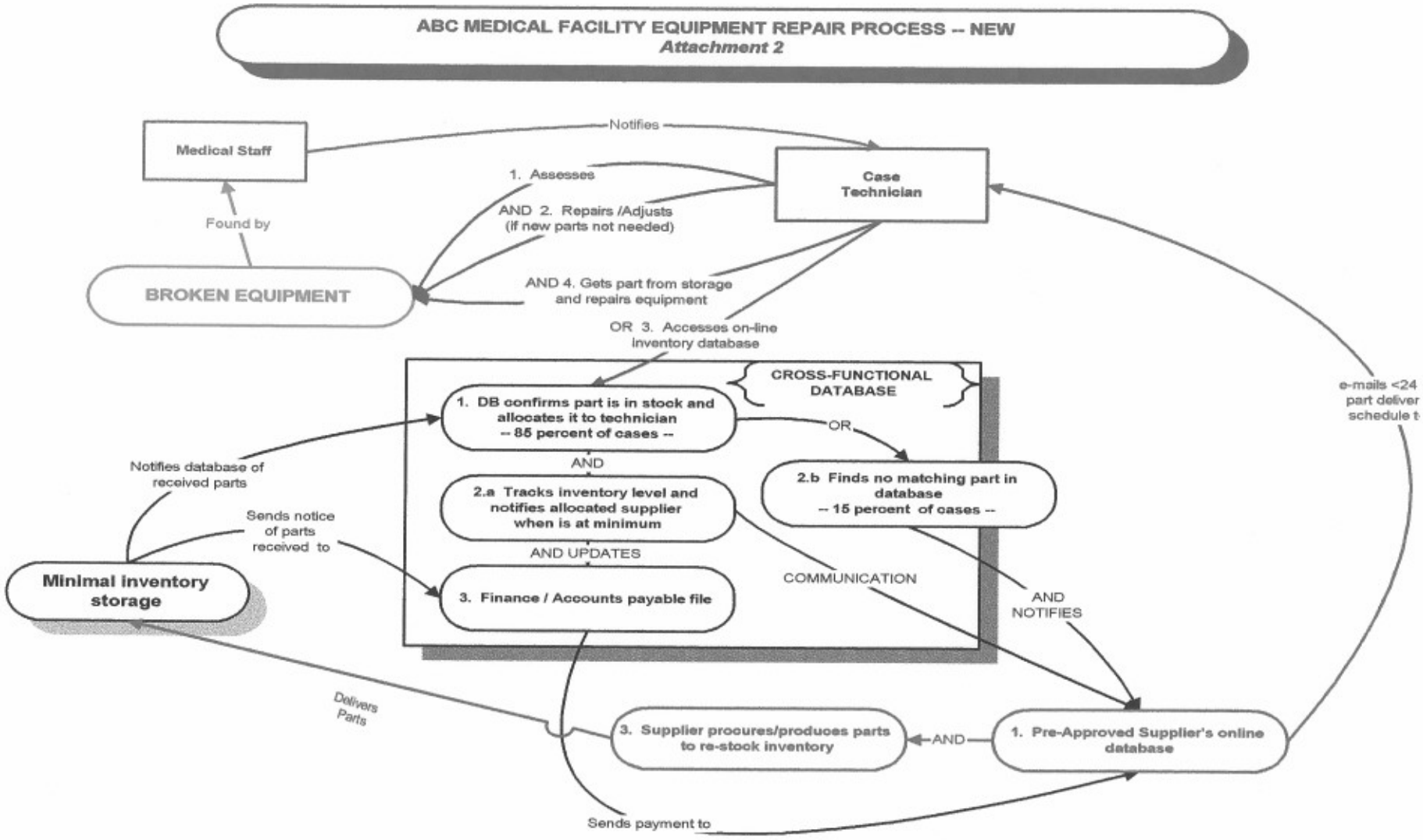

ABC MEDICAL FACILITY REPAIR PROCESS -- OLD
Attachment 1
Notify
Medical Staff
Secretary
1. Notifies
Engineering Supervisor /maintenance
Found by
1. Assigns
2. Notifies that new parts arrived in stores
AND 2. Repairs /Adjusts (if new parts not needed)
BROKEN EQUIPMENT
1. Assesses
Technician
1. Gets purchase approval from (if parts not in inventory)
3. Notifies (when spare parts arrive -- up to 8 weeks)
AND 4. Installs new parts (if parts are in stock -- up to 90 minutes)
Gets delivered part from
OR 3. Goes to (if new parts are needed)
OR 6. Installs received part on
2. Orders from (if spares not in inventory)
SPARE PARTS STORES
SPARE PARTS SUPPLIER
Deliver parts to


ABC MEDICAL FACILITY EQUIPMENT REPAIR PROCESS -- NEW
Attachment 2
Medical Staff
Notifies
Case Technician
1. Assesses
AND 2. Repairs /Adjusts (If new parts not needed)
Found by
BROKEN EQUIPMENT
AND 4. Gets part from storage and repairs equipment
OR 3. Accesses on-line inventory database
CROSS-FUNCTIONAL DATABASE
1. DB confirms part is in stock and allocates it to technician -- 85 percent of cases --
OR
AND
2.a Tracks inventory level and notifies allocated supplier when is at minimum
2.b Finds no matching part in database -- 15 percent of cases --
AND UPDATES
3. Finance / Accounts payable file
COMMUNICATION
AND NOTIFIES
Notifies database of received parts
Sends notice of parts received to
Minimal inventory storage
Delivers Parts
3. Supplier procures/produces parts to re-stock inventory
AND
1. Pre-Approved Supplier's online database
Sends payment to
e-mails <24
part deliver
schedule t

Attachment 3: "Handoffs" -- Old Versus New

	OLD PROCESS Manual Handoffs	OLD PROCESS Automated Handoffs	NEW PROCES Manual Handoffs	NEW PROCESS Automated Handoffs
Medical Staff	1	0	1	0
Secretary	1	0	0	0
Biomedical Eng. Supervisor	2	0	0	0
Technician	6	0	4	0
Inventory Staff	3	0	1	9
Supplier	1	0	1	2
	14	0	**7**	11

* After reengineering the number of manual handoffs is reduced to 7 (50% reduction)

Attachment 4 --
CONFIRM

Action	Resp.	Start Date	Comp Date	Resources
Document test database internal linkages	MIS	2-Nov	5-Nov	Case Technician and Inventory personnel
Document test database external linkages	MIS	2-Nov	5-Nov	Accounts Payable, Storage Personnel, Case Technician and Supplier
Review and approve test plans	V.P Operations	5-Nov	6-Nov	All
Install test Database	MIS	9-Nov	11-Nov	All
Operate test database internal linkages	Case Technician	12-Nov	17-Nov	MIS
Operate test database external linkages	Inventory Personnel	12-Nov	17-Nov	MIS
Reiterate / improve / retest HW/SW (if necessary)	MIS	17-Nov	24-Nov	All
Submit test results to V.P Operations	MIS	25-Nov	25-Nov	All
Reiterate if V.P Requires (or) finish *CONFIRM* phase	All	26-Nov	27-Nov	All

Attachment 5 --
Ultraplan

Action	Resp.	Start Date	Comp Date	Resources
Present test database results to CEO	V.P Operations	1-Dec	1-Dec	Include Process Reengineers in presentation
Ensure CEO approval for implementation planning	V.P Operations	2-Dec	2-Dec	V.P. Operations, Finance Manager and Case Technician
Plan internal linkage implementation	MIS	3-Dec	5-Dec	Case Technician, Medical staff and inventory personnel
Plan external linkage implementation	MIS	3-Dec	5-Dec	Inventory personnel, Finance and Supplier
Post informational bulletin company-wide	CEO	3-Dec	3-Dec	V.P Operations
Advertise training for staff	MIS	5-Dec	5-Dec	MIS and Case Technician
Present implementation schedule to CEO	V.P Operations	7-Dec	7-Dec	MIS
Install new database and processes	MIS	8-Dec	18-Dec	All
Put database and processes into operational status	MIS	19-Dec	19-Dec	All
Celebrate success and upcoming Christmas vacation	All	20-Dec	20-Dec	All

WELCOME

Welcome to your new position as a manager at Oregon Health Sciences University. As you already know, learning where to find the information you need to manage effectively is a high priority for new managers. Making the right connections can be time-consuming and frustrating sometimes. The Administration component of OHSU wants you to be able to access our services as easily as possible. In the interest of making that possible, we have put together this resource guide to the activities through which we exist to serve you and your work groups. Please let us know whether there are things we could do to make this Guide even more useful to new OHSU managers. And call us - we're here to support your success.

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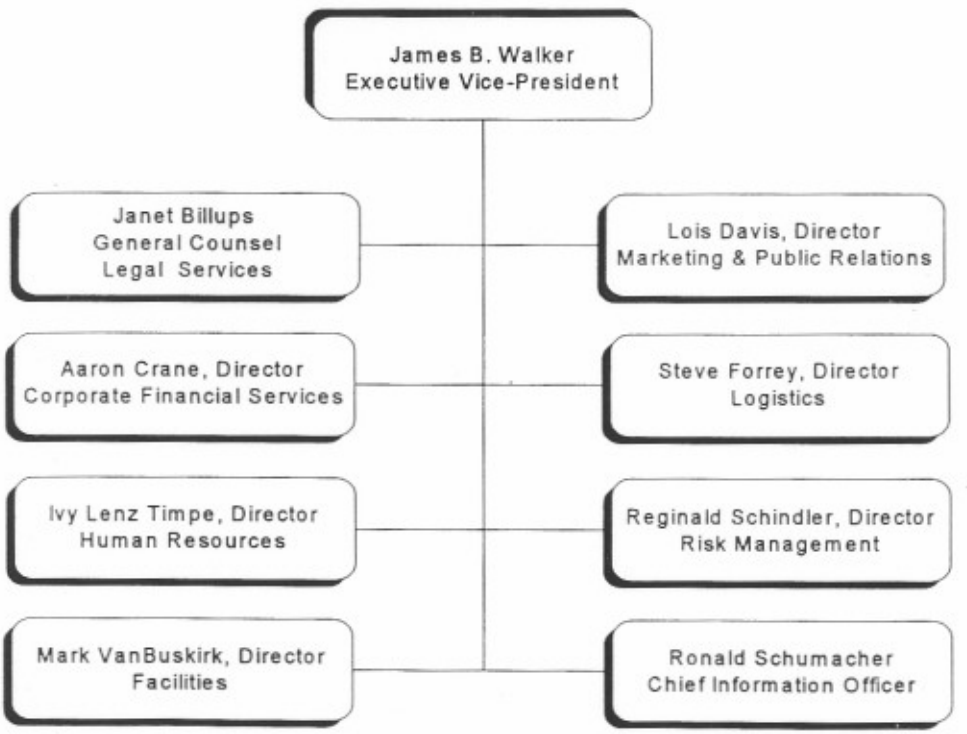

ORGANIZATION CHART

Department of Clinical Engineering
May 14, 1998