Plant Operations
Facilities Maintenance

FY 2007 Annual Report
Published: October 25, 2007

ACCOMPLISHMENTS FY 2007

FM-Administration & Leadership
- Pandemic planning for the department and Plant Operations as a whole has been completed. Plant rollouts were completed the first quarter of calendar year 2007.
- Service vehicle parking guideline completed and distribution completed first calendar year quarter of 2007.
- B&F employee satisfaction survey completed in October 2006.
- Customer service training classes were envisioned, created, implemented and completed for 489 employees. Improved FM department overall Customer Satisfaction scores.
- New Service level agreements under development or completed this year:
  - MITC-Michigan Academic Computing Center (an Internet 2 site).
  - Arbor Lakes – MCIT Parallel Computing Center
  - Student Publications Building
  - MAIS - generator maintenance
  - Housing Fire Testing Services
  - Arbor Heights
  - Stamps Auditorium
  - DPS Console Support

FM-Building Automation Services:
- Continued growth in number of monitoring points – approaching 102,000 (10/2007).
- Cimetrics point data assessments being received with maintenance adjustment actions implemented as determined necessary.
- FY’07 milestone of reaching over 500 Building Automation servers (506, to be exact) in 120 buildings.

FM-Electric Shops
- Selection of Mike Gramza as new Electrical Maintenance Manager
- Shop re-organization planning and SWOT process, full staff involvement.
- Variable speed drive replacement (energy efficiency) efforts under full implementation
FM-Mechanical Systems

- Selection of Craig Butcher as new General Foreman
- Improved communications (shutdown notification system) with LSI customers regarding actual and potential system problems.
- Implemented needs reporting process within the AC shop to identify physical system issues and concerns (WRQ, Engineering, repair, FCA).
- Expanded tracking of systems costs to identify labor and material costs required to winterize equipment.
- Implemented Chiller system improvement teams to identify and resolve system performance problems (improve efficiencies and reliability).
- Reorganization of shops and function (Temperature Controls, Chiller Systems, and Mechanical Refrigeration) continues to improve our focus and efficiency.
- Improved monitoring and reporting of actual energy usage by chiller plants. This will alert staff to impending chiller problems, improve shop accountability to customers and identify opportunities for improvements.
- Hangtag system implemented for M3700 to improve communication with customers.
- Improved Test and Balance services:
  - Data collection, report generation, storage and publication have been streamlined and time from test to report has been reduced. Customers can now review their data online.
  - Response process has changed to work T&B work requests.
  - Fume hood service backlog has been eliminated. Shop now responds to all fume hood requests within 24 hours.
  - Training/software installed improving communication with fan coil equip. at 300 N.I.B.
- Vacuum systems are being replaced with more efficient and effective equipment. DCW fed lab vacuum sources are being replaced with electrically driven pump and steam condensate is used for vacuum steam heating system instead of DCW.

FM-Plant Hospital Facilities

- Implemented 24 hour Monday through Friday management coverage.
- Reported customer survey results for the mid-year.
- Reviewed and updated MAXIMO job plans for building systems.
- Filled position of Maintenance Schedule/Planner.
- Implemented campus boiler services at all Hospital sites and clinics.
- Hospital contract 5 year renewal discussions completed October 2007

FM-Roofs, Metal Shops & Elevators

- Established new/additional strategic planning goals in all shops based upon B & F and Dennison survey results & incorporated them into existing Shop Business Plans. All shops have "hang tags" for customer service communications.
- Weld Shop structural metals rack installed improving material handling ergonomics.
- Performance Plans developed for non-supervisory office staff.
- Work load and backlog analysis completed for all shops.
- Negotiations completed for renewal of hospital elevator contract.
• Funding established for elevator replacements in Hutchins Hall, Dental and WK Kellogg Institute, Taubman Medical Library and College of Pharmacy. Design and planning underway.
• Funding established for roof replacements in Health Services, Med Sci I and SPH II. Design and planning underway.
• All RMSE shops have been involved with new space and major renovations: Weill Hall, Thayer Building, Walgreen Drama Center, Computer Science Engineering Building
• Roof inspections during construction
• Elevators, dock lifts, dock levelers, other vertical transportation devices during installation and commissioning
• Handle contractor punch list issues on a customer pay basis
• Millwright support of cooling tower issues, non-electrical dock lifts and dock leveler issues.

FM-Training
• Customer service training module developed and launched in December 2006, completed March 2007.
• Zero based budget training scheduled for January and February for FM lead team and members of other Plant Operations lead teams.
• BOMI classes are now offered on-site for maintenance mechanics. 2nd module this year underway.
• TACS implemented and undergoing further refinements.
• Recruitment of training assistant.
• Establishment of travel coordination in direct relation to approved training programs.

FM-Zone Maintenance
• New Business Manager selection of Jim Vibbart
• Refurbishing of machine rooms – completed at SPH and LSI and underway in other buildings.
• Zones newsletter established and distributed.
• Continual improvement in preventive maintenance processes.
• Equalized workload distribution. Continued positive progress in OSEH SLA performance for campus fire extinguishers program, recruitment of dedicated staff, fruition of student program realized.

Introduction

Fiscal Year 2007 continued as both a year of continuing department budget cuts and aggressive campus growth in buildings maintained by the General Fund. For the third consecutive year over the last six years, Facilities Maintenance (FM) as a whole just missed balancing these cuts with the growing service requests and growing maintenance needs of this institution. This fiscal information is discussed further within this report as well as the other program and department accomplishments from our various shops.
FY 07 Financial Summary for Facilities Maintenance

Yearly Financials
Facilities Maintenance (FM) finished Fiscal Year ’07 with a General Fund (GF) margin of ($70,184) on the $27.1 million GF budget allocated.

The FM Enterprise completed $44.1 million in work, finishing with a positive balance of $2.66 million after covering the above mentioned GF losses. This represented outstanding progress within FY 07 towards our allowable 5% budget reserve of $2.21 million. Our Auxiliary rebilling revenue increased this year by 3.6%, on top of the 14.4% increase of FY06 and a 4.7% increase in FY 05. Our average enterprise monthly billing rose $127,000 to $3,676,349 million.

General Fund work made up 56.3% of our billing in FY07.

- The Hospital Maintenance contract started the year with a negative margin of ($295,584) and finished with a slight improvement to a negative ($282,972). The Hospital contract is roughly $12.5 million annually and the present balance represents the life of the contract since inception in 1997.
- We continued to work with ISES to define our operational costs at an APPA Gold Level of service for our new World-Class buildings. In addition, we continue to “step out” on developing identical service report relationships with other knowledgeable facilities consultants. We identified the collective net addition of building systems (coined “Phantom Building”) to our existing campus buildings supported by the General Fund. We were successful and appreciative in seeing $174,000 in support for these new systems being added to our budget for FY 08.
- We were supported in FY 05 with a positive business initiative decision to address our future manpower needs through the third year (FY08) of four years in promised funding of $300,000 to increase our apprenticeship ranks. This is an investment addressing the projected attrition of our Trades staffing.

Year-End Operational Highlights

FM Campus Programs

- The highlight of FY 07 has to be the increase in customer service scoring through the B&F Customer Survey. A very deliberate and concentrated effort was put into understanding the results of the 2005 Customer Survey, and putting together a plan addressing all facets of the department’s services. Most notably was the “Customer First” class discussed in the Training section of this report.
- The FM Associate Director chaired the Plant wide Pandemic planning effort for the Division, this included acquisition of supplies, coordination with other F&O Divisions, and rollouts to all Plant Operations employee’s.
• We participated with other Plant Departments in the benchmarking of our program through Sightlines. Operationally we offer good value in our services, our supervisory to employee ratio’s are in alignment with peer institutions, and overall we compared well. This report showed we still have opportunity’s to truly meet our customer expectations.
• We continued to work towards the establishment of Service Level Agreements (SLA’s) as enumerated in the introduction.
• Staffing is at 452.22, up from 433 FTE in FY 06; notably the Key Shop was transitioned into FM in FY07.
• General Fund support hours were up just slightly; 359,521 from 358,866.
• Average labor hour rate $59.93, up from $58.82
• Material cost/billed labor hour $15.10, up from $13.55.
• Maintenance General Fund budget allocation/SF: $1.85 from $1.76

Notable Challenges for FY08
• Campus resources to support our many code deficient programs such as fire alarm and systems testing, refrigerant compliance, spill prevention containment, and a definitive arc-flash program with corresponding safety training.
• Research related equipment and systems support for fume hood and exhaust systems, high purity water systems, cold rooms and refrigeration, vacuum and lab gas support, secondary electrical systems for generator and uninterruptible power supply systems.
• We continue to work with Utilities to define a new regional chiller program enterprise.
• Continued support in planning & construction activities for the new 1.1 million SF Women’s and Children’s Hospital.
• Skilled Trades labor negotiations; the existing contract expires July 31, 2008.
• We continue to see an evolving need for the next new Zone in the Business School area with the recent completion of Weil Hall, and eminently the addition to the Art Museum, replacement of a majority of the Stephen M. Ross Business School, and the pending Law School changes.
• We are working to position ourselves for supporting the Hospitals growth programs. Specifically for a “machine room” on North Campus, and for a “Kids Camp” out at the Fresh Air Camp.
• Our overall PM labor hours are approximately 16% of all assigned work. This remains a goal for improvement across the department.
Plant Operations
Facilities Maintenance-Building Automation Services

ACCOMPLISHMENTS FY 2007

FM-Building Automation Services:
- Continued growth in number of monitoring points – approaching 100,000 (1/2007)
- FY’07 milestone of reaching over 500 Building Automation servers (506, to be exact) in 120 buildings
- Obtained a service level agreement (SLA) to monitor the Hospital’s Arbor Lakes Parallel Computing Center
- Extended SLA’s for the Mental Health Research and Athletics facilities.
- Mapped 67% of BAS networks to develop network infrastructure capital replacement plans (remaining 23% will be completed in FY’08)

Section I: Introduction

Building Automation Services (BAS) continued to grow in FY’07, adding 15% due to new building construction and ongoing renovations. Changes to the telecommunications systems within BAS helped mitigate the effects of the increased workload.

BAS staffing was unchanged for FY’06 with 12 employees, functioning 24 hours per day, 365 days per year. BAS is responsible for the monitoring, maintenance and development of the
building automation computer systems throughout the general fund UM Ann Arbor campus buildings.

The “Continuous Commissioning” project was placed on hold for FY’07, limiting the available reports to those received in October, 2006 to close out the FY’06 effort. Funding was restored in late FY’07. The project will monitor twice the FY’06 points in FY’08. BAS system data is exported to a third-party database and analyzed for potential energy savings opportunities. It allows us to see an extended period of operation and effectively catches intermittent problems.

David Anderson  
BAS Manager

Section II: BAS Organization Chart

Section III: FY 07 Financial Summary

BAS started FY’07 with a surplus of $41,062, and ended with a deficit of $64,198, or 3.2% above budget. The project to map all 255 networks and provide estimates of the capital replacement costs required for each building to meet current wiring standards accounts for the deficit. This will be carried over to FY’08, and with the conclusion of the mapping project and the addition of new space funding, BAS is expected to end FY’08 within budget.

BAS applied 103.2% of the allocated funds in FY’06 to further the mission of the University. In addition to operational efforts, BAS funded projects to update 2% of its remote panel-mounted servers, well below the 5% required to achieve a 20-year life cycle. Another 1% were upgraded as part of building renovation projects.
General Fund

<table>
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<th>Budget and Operating Results</th>
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<td>General Fund</td>
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<table>
<thead>
<tr>
<th>BAS</th>
<th>Budget</th>
<th>Actual</th>
<th>Variance</th>
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<td>Expenditures</td>
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<td>$2,040,822</td>
<td>-$64,198</td>
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</table>

Section IV: Year-End Operational Highlights

Building Automation Services

Building Automation Services (BAS) is part of the University of Michigan’s Facilities Maintenance department. BAS serves the University’s General Fund Buildings, and a few non-general fund buildings (for a fee). BAS implements schedule and operational changes for various types of HVAC equipment and lighting systems, and monitors the general fund campus building automation systems for alarm conditions and energy efficient operation.

The system has been growing at a rate of over 15%/year.

Tim Kennedy (BAS supervisor) completed his Voices of the Staff-Employee Recognition term.

Areas for Improvement

The BAS system is a combination of networks and computer systems, ranging from new to 20+ years of age. The challenge for FY’08 and beyond is maintaining interoperability among a wide range of legacy servers and networks. The mid-level servers will need to be replaced in FY’08 with rugged wall-mounted versions capable of withstanding harsh environments without air conditioning, placed in strategic locations where communications lines merge.

Additional support will be required to effectively meet the increased demands placed on BAS by the Wolverine Teams energy savings program, and to implement the goals, steps and tasks to maximize BAS effectiveness and efficiency in FY’08 and subsequent years.
Electrical Heat Trace System installed in the gutter at Yost Ice Arena to prevent roof damage and pedestrian safety concerns at building entrances by preventing the possibility of ice build up.
Section I: Introduction

This fiscal year Plant Operations Central Electrical Shops remained made up of four shops combined recognized as one centralized unit. Two of these shops were administered under Utilities & Plant Engineering (UPE) and two under Facilities Maintenance (FM) having one foreman for each shop respectively. The administrative staffs supporting these shops were comprised of one Electrical Utility and Maintenance Manager, one Work Control Coordinator, one Construction Project Coordinator, one Material Expeditor and one Office Services Assistant.

There are 31 Electrical Tradesmen combined between the Electrical Construction and Electrical Technical Shops supported under Facilities Maintenance. There were times these shops were supported with up to eight electricians from our strategic vendor (Turner Electric) contract.

ACCOMPLISHMENTS FY 2007

During the first quarter of fiscal year 2007 the Electrical Shop Admin staff participated in a strategic planning analysis process to review Strength Weaknesses Opportunities and Threats (SWOT) existing within our shop. This was to examine our current organizational structure core services and effectiveness. The SWOT analysis took into account information based upon the 2005 B&F Employee Satisfaction Survey results and subsequent shop action plans put together with employee involvement along with Customer Satisfaction Survey results. The analysis identified areas for making improvements in internal business work flow, improved customer service and employee satisfaction. In short, the analysis results pointed out, by redefining roles and responsibility areas of the four central shops related to O&M vs. Construction work, simplification of work assignment between shops could be achieved improving internal, external customer service and communication in turn employee satisfaction. A formal proposal was presented to both FM and UPE Associate Directors and the Plant Operations Executive Director in March of 2007. The proposal was accepted in part in May 2007 for implementation at the beginning of Fiscal Year 2008.

Beginning July 1, 2007 the four electrical shops among the two FM and UPE departments were separated along with their respective Tradesman and administrative support staff. This included a decision made by the current Electrical Utilities and Maintenance Mgr to continue with the current Utilities Department administration level and a lateral transfer solely under the UPE Department. This also required a new Electrical Maintenance Mgr position for the FM Department be posted and was done in May. An Interview Committee was formed, reviewed applicants, conduct interviews in July / August and selected Mike Gramza from these applicants.

Our shop’s involvement with the Facilities Condition Analysis identified the need to replace obsolete and or aging Variable Frequency Drives (VFD’s) late in FY 06. This was due to reoccurring problems with units serving critical equipment and replacement parts, there availability and associated cost. After supporting Data was retrieved and reviewed by engineering to establish a prioritized replacement cost and schedule, funding was established. 51 of these drives identified were scheduled to be replaced in FY 07. The two FM shops jointly
participated in the capital replacement or upgrading of approximately 31 of these VFD’s completing nearly 60% of those scheduled.

We have been able to send many staff within the FM Electrical Shops to training in various areas within the broad electrical field again this year. Some of which is mentioned in the Training Coordinators section of this report, both FM Electrical Shops play an important role in the overall training of our Electrical Apprentices as they are rotated through the apprentice training system. Our shop staffs have actively participated in O&M training provided as part of new construction deliverables. Staff have also been sent to specific training like Variable Frequency Drive training, Portable Generator Operator training, Uninterruptible Power Supply O&M.

FM Electrical Shops successfully navigated these organizational challenges and expanded its enterprise operations over all. More changes are still needed to improve our performance in order to fulfill operational and strategic goals within the Plant Operations Mission.

Joe Iott
Electrical Utilities and Maintenance Manager

Section II: Electrical Shops Organization Chart
Section III: FY 07 Financial Summary

Financially, the labor services provided by the Electric Shops presented in the Everest Enterprise Reports indicate we ended up in a positive margin. The FM Electrical Shop Enterprise increased by a little over 6% in growth from approximately $4.6 million in FY 06 to $4.9 million in FY 07. This year’s enterprise ended with 4.7% positive margin nearly meeting the Plant Executive Directors goal for achieving a 5% positive enterprise margin overall.

The positive budget surplus shown in the table below shows we accomplished our directive to stay in the black. It is not a true accounting of how we finished overall considering many preventative maintenance requirements were not completed as a result. This year we ended up with a $366,696 surplus helping out the overall Facilities Maintenance shortfall within other departments.

<table>
<thead>
<tr>
<th>FM Electrical Shops</th>
<th>General Fund Shop Budget</th>
<th>FY 2006</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beginning Budget</td>
<td>Ending Totals</td>
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<tr>
<td>Labor</td>
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<tr>
<td>Material</td>
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<td>224,775</td>
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<tr>
<td>Total</td>
<td>1,580,108</td>
<td>1,213,412</td>
</tr>
</tbody>
</table>

76.79%

We will continue to focus our attention to maintain a balanced general fund budget again in FY 08 as a top priority.

Section IV: Year-End Operational Highlights

Electrical control system installed for Compressed Air and Dryer system for the North Ingalls Mechanical Building.
Electrical Construction & Maintenance / M6300  Paul Kroll, Foreman

The Electrical Construction Shop consists of one foreman and fourteen electricians. It is responsible for electrical construction and repairs within all General Fund buildings and for a large percentage of auxiliary buildings on the University of Michigan’s Ann Arbor Campus. The work includes customer pay, fixed price, AEC and Utilities & Plant Engineering designed projects. All construction projects comply with the National Electric Code and the University of Michigan master specifications. The shop also supplies additional labor workforce for special events like the Annual Ann Arbor Art Fair or for supporting athletic events (football, basketball, baseball, softball, and hockey) with electricians working standby duties.

Highlights of Projects completed this year

- Completed an energy conservation project within Plant Operations Building by connecting new building daytime lighting control to the DDC system to balance lighting levels based on available out door daylight.
- Numerous card readers and automatic door openers systems installed throughout campus buildings in conjunction with the Fire Protection Shop based on Key Office priority and their funding schedules.
- Installed new electrical service for Clements Library building and the President's Residence along with the main service infrastructure system feeding these facilities at Hatcher Library for Utilities and Engineering eliminating the old 2.4kv system as part of UPE master planning.
- A heat trace system on Yost Ice Arena has been installed (as shown on front cover of our departments section) along with similar installations at, Buhr Building and, Campus Safety Services Buildings (CSSB).
- A Redundant laser link from CSSB to Dennison Building was installed for the campus multi site 800 MHz radio system as part of The University of Michigan emergency preparedness plans.
- A new 480volt feeder system from the School of Education Building 13.2kv substation was installed to replace the ITCOM Departments failed 2.4K substation in the basement mechanical room of the School of Education building. This also follows the Utilities master plan for decommissioning the 2.4kv primary system.

Areas of Improvement

With the new shop structure in place moving forward in FY 08, staying on top of the existing workload with the expectation of additional work coming from the Zones, right sizing of shop is critical. Refining the correct foreman to Trades staff ratio and administrative support to maintain our ability to reach our goals (maintain work requests within budget, meet the goal of a 5% positive margin in our enterprises, improve customer communication and maintain or improve our response time) so our services are not compromised is necessary. The revised responsibilities and expectations to be established for the Electrical Construction Shop will warrant funding for permanent support staff dedicated specifically to this shop.
Emergency Generators and Paralleling controls are serviced via Service Level Agreement by the FM Electrical Technical shop for the MITC / MACC Building on S State St. Pictured on the right are 2 of 3 total Diesel Fired Generator units capable of producing 2megawatts of power each in support of the facilities emergency, critical and essential power requirements.

**Electrical/Technical Shop / M6250**  Debra Ault, Foreman

The Electrical/Technical Shop at the University of Michigan is normally comprised of 14 electricians along with up to two apprentice electricians at times. Our primary duties consist of repair and replacement of variable frequency drives, operation and maintenance of stationary emergency and portable generators, uninterruptible power supplies, electrical support for Direct Digital Control (DDC) system installations, electrical support of operations and maintenance for the Air Conditioning Shop, special power quality monitoring request by Engineering or Customers, management and labor support for special event and or emergency power needs.

The Electrical Technical Shop is responsible for performing preventative maintenance on over 1,200 variable speed drives, 57 Stationary and Portable generator units and over 30 Uninterruptible Power Supply systems throughout University of Michigan’s North, Medical, Central and Athletic campuses.

**Highlights**

- We purchased a new infrared camera for monitoring of electrical equipment or connections in order to provide early detection of possible equipment failure. We have invested money for training one of our staff to certify them to be a trained trainer of this new tool. This trained trainer process is in the second stage of three stages that need to be completed for this certification. Once this certification is done, our person will be able to train other staff and allow cross training in order to accomplish “depth on the bench” an appropriate amount of coverage. This allows for the use of infrared camera to be included as one of the PM Basics for preventive maintenance of all electrical equipment introduced into the program. This could develop into use of trained staff for other bldg maintenance not just...
electrical components. This PM program could include Roofing Shop, Closure Shop, Energy Star Program, Plumbing Shop, A/C Shop, and many others.

- Replaced the dimming system for the Campus Safety Service Building conference rooms with a retrofit unit using an “ETC Unison” dimming system. The old dimming system was obsolete and parts were difficult to get.
- Repaired the dimming system at CC Little Bldg. The dimming system is obsolete and parts are difficult to get. This system will need to be retrofitted to another type if a failure occurs again.
- We provided a 350KW generator and an on-call electrician while the failed 2.4kv substation was replaced. This provided back up power in case the DTE standby source failed.
- The Rotary UPS at North Campus Administrative Complex failed on Sept. 25th 2006 due to bearing problems. Our shop provided a 15 KVA battery UPS as a temporary measure until the rotary was re-installed. We discovered the Mfr of the UPS is no longer in business and parts were not available. It was determined the existing concrete pad was out of level and partially to blame for the units premature bearing failure. The unit was shipped out to be rebuilt by Bennett Electric in Norwalk, Ohio; structural modifications were made to the unit frame recommended by Bennett Electric Engineers to further prevent heating and vibration to the bearings. While the unit was being repaired we replaced the concrete pad. We also upgraded the installation with an external by-pass system in order to perform routine PM without service interruption at the same time. The unit is energized and has been running at normal operation.
- Our shop co-developed a Fuel Delivery SOP for filling the (2) 10,000 gallon underground storage tanks at the Biomedical Systems Research Building with the Medical School Facilities staff and the Department of Occupational Safety and Environmental Health. The finalized SOP is posted near the bldg filling station.

Areas of Improvement

- Currently we are short two staff in our work group due to the FM Electrical Shop restructuring. This included moving the VFD installation construction our work group had been doing into the Electrical Construction Work Group. We must facilitate an effective exchange in manpower between the FM Electrical Shop Work Groups to get them back.
- Again several new buildings have come on line this past year with new high-tech equipment to be serviced and maintained. We must review the manpower requirements in order to manage the increased work load. This is vital to the success of the shop and the campus-wide preventive maintenance program for variable frequency drives, emergency generators, automatic transfer switches, uninterruptible power supply units, and boilers.
- Four of our portable generators (R837, R839, R840, and R841) still do not have new Michigan license plates. I have not had any success retrieving a title or a Statement of Origin from Michigan Cat. If we cannot locate the titles or Statement of Origin, we will have to obtain an Assurity Bond per Risk Management requirements.
- Continue trying to improve communication between the Construction Management project coordinators and the Plant department. In order for my shop to maintain the equipment, we need to know; what is planned to be eliminated or saved, when the new equipment start-ups are done, modifications to the equipment that may have been done, and when training should be scheduled.
The View from the Tube Sheet: Steam to Heating Hot Water Heat Exchanger
MECHANICAL SYSTEMS AT A GLANCE

- Responsible for the repair, maintenance and operation of the mechanical systems (Plumbing, Heating, Ventilating, and Air Conditioning) in general fund buildings, as well as for a large percentage of auxiliary buildings on the University of Michigan’s Ann Arbor Campus.

- One General Foreman, Seven Foremen, two Work Control/Project Coordinators

- 104 skilled trades, 6 of whom were apprentices in FY 2007
  - 37 AC Mechanics, 2 Apprentice AC Mechanics
  - 21 Steamfitters, 3 Apprentice Steamfitters
  - 18 HVAC Controls Specialists
  - 10 Pipecoverers
  - 7 Plumbers, 1 Apprentice Plumber
  - 3 Sanitary & Storm Water Systems Specialists
  - 2 Mechanical Systems Skilled Crafts Specialists
  - 2007 General Fund budget: $8.45 Million
  - 2007 Enterprise budget: $16.16 Million

- Overall MGF Expenditure Percentage: 52.3% of Enterprise Total

<table>
<thead>
<tr>
<th>Shop Name</th>
<th>Shop</th>
<th>Staff Count</th>
<th>MGF</th>
<th>Total Enterprise</th>
<th>MGF $ as % of Total $</th>
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<td>Plumbing Systems</td>
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<td>$974,274</td>
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<td>$2,141,410</td>
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<td>12</td>
<td>$1,245,871</td>
<td>$1,555,593</td>
<td>80%</td>
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</table>

Staff Count does not include General Foreman (1) and Work Control Coordinators (2).

During the past year, we initiated or continued many vital programs central to energy conservation, system reliability, and customer satisfaction.

- Energy Conservation and Outreach (ECO) Program continued into its fourth year.
  - Steam trap replacement and maintenance program.
  - Building temperature control and mechanical systems tune up.
- Refrigerant Compliance Program.
- Best Practices Management program to clean the University storm water system on a semi-annual basis.
- Continuation of Service Level Agreement (SLA) with Dining Services for FY 07.
- Addition of SLA agreement with the Michigan Parallel Computing Center.
- Improved and extended water treatment program.

FY 2007 marked the first full year of operation under the Air Conditioning Shop’s new structure. This was the fruition of a three year strategic reorganization which established shops dedicated to
four separate HVAC focus areas (HVA/C Controls and Energy Conservation, Mechanical Refrigeration, Chiller Systems, and Temperature Control and Air Balance.) The new arrangement has allowed our staff to focus more effectively on responsibilities within their respective functional areas, rather than being pulled in many different directions throughout the day. Through this increased efficiency, we have been able to accomplish more work overall than we could previously. Paradoxically, this has resulted in increased expenditures for parts and materials by staff fixing more stuff.

FY 2007 saw an acceleration of personnel changeover. After many years of relatively few personnel changes, particularly in the AC shops, several long-time employees retired or left, including the General Foreman, Gary Ernst. Gary’s was a long and distinguished record of service to the University Community, and meeting the standard he set will be a considerable challenge for his successor.

FY 2007, like FY 2006, was a very challenging year. General Fund resources continued to diminish, and required general fund maintenance demands continued to grow. Customer performance expectations are higher than ever. Many new facilities have been brought online, and with these new startups have come glitches and surprise design problems which Mechanical Systems shops have had to address. Nevertheless, the staff of the Mechanical Systems department is as capable a group of facilities management professionals as can be found anywhere. The challenge is great, but so long as we continue to improve our tools, skills, and methods, we will meet it.

Craig Butcher, General Foreman

MECHANICAL SYSTEMS ACCOMPLISHMENTS FY 2007

- Selection of Craig Butcher as new General Foreman
- Improved communications (shutdown notification system) with LSI customers regarding actual and potential system problems.
- Implemented needs reporting process within the AC shop to identify physical system issues and concerns (WRQ, Engineering, repair, FCA).
- Expanded tracking of systems costs to identify labor and material costs required to winterize equipment.
- Implemented Chiller system improvement teams to identify and resolve system performance problems (improve efficiencies and reliability).
- Reorganization of shops and function (Temperature Controls, Chiller Systems, and Mechanical Refrigeration) continues to improve our focus and efficiency.
- Improved monitoring and reporting of actual energy usage by chiller plants. This will alert staff to impending chiller problems, improve shop accountability to customers and identify opportunities for improvements.
- Hangtag system implemented for M3700 to improve communication with customers.
- Improved Test and Balance (T&B) services:
  - Data collection, report generation, storage and publication have been streamlined and time from test to report has been reduced. Customers can now review their data online.
  - Response process has changed to work T&B work requests.
  - Fume hood service backlog has been eliminated. Shop now responds to all fume hood requests within 24 hours.
- Training and software installed to improve communication with fan coil equipment at 300 N.I.B.
- Vacuum systems are being replaced with more efficient and effective equipment. DCW fed lab vacuum sources are being replaced with electrically driven pump and steam condensate is used for vacuum steam heating system instead of DCW.

Section II: Mechanical Systems Organization Chart

- **MECHANICAL SYSTEMS**
  - **TEMPERATURE CONTROL & AIR BALANCE** (UNIT M3700)
  - **HVAC CONTROLS & ENERGY CONSERVATION** (UNIT M3600)
  - **MECHANICAL REFRIGERATION & AC** (UNIT M3500)
  - **PLUMBING SYSTEMS** (UNIT M3100)
  - **STEAMFITTING & PUMPS** (UNIT M3200)
  - **INSULATION & ASBESTOS ABATEMENT** (UNIT M3300)
  - **CHILLER SYSTEMS** (UNIT M3400)
### General Fund

#### Mechanical Systems

**General Fund Expenditures vs. Budget FY 2007**

<table>
<thead>
<tr>
<th></th>
<th>Beginning Budget</th>
<th>Final Totals</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor</td>
<td>$ 6,002,844</td>
<td>$ 6,725,141</td>
<td>$ 722,297</td>
</tr>
<tr>
<td>Material</td>
<td>$ 2,451,278</td>
<td>$ 2,175,866</td>
<td>$ (275,412)</td>
</tr>
<tr>
<td>Total</td>
<td>$ 8,454,122</td>
<td>$8,901,007</td>
<td>$ 446,885</td>
</tr>
</tbody>
</table>

Variance of actual over budgeted expenditures 5.3%

#### FY 2007 MGF EXPENDITURE BY SHOP

<table>
<thead>
<tr>
<th>Shop</th>
<th>Amount</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Systems</td>
<td>$376,386</td>
<td>4%</td>
</tr>
<tr>
<td>Mechanical AC &amp; Refrigeration</td>
<td>$1,730,976</td>
<td>19%</td>
</tr>
<tr>
<td>Chiller Systems</td>
<td>$2,045,775</td>
<td>23%</td>
</tr>
<tr>
<td>Plumbing Systems</td>
<td>$974,274</td>
<td>11%</td>
</tr>
<tr>
<td>Steamfitting &amp; Pumps</td>
<td>$2,141,410</td>
<td>25%</td>
</tr>
<tr>
<td>Insulation &amp; Abatement</td>
<td>$386,315</td>
<td>4%</td>
</tr>
</tbody>
</table>

Total: $8,901,007

The primary mission of Mechanical Systems is to serve general fund buildings and equipment on the Ann Arbor campus. Our general fund expenditures amount to 53% of our total program. This reflects continuing pressure in recent years to minimize general fund budgets, and also reflects a deliberate effort to direct more resources to targeted projects. In particular, the University has sought to maximize the bang from its infrastructure buck by identifying maintenance—whether deferred or otherwise—which can be addressed by renovation or capital replacement. Our shops have taken on considerable portions of this work. Mechanical Systems MGF expenditures exceeded our allocation by 5.3% in FY 2007. The overdraft was largely due to:

- Continuing problems with new chillers which consumed more overtime than was budgeted.
- Cost of repairs due to “value engineering” decisions that produced first cost savings at the expense of long-term maintenance affordability.
Continuing replacement of vital system components in the $2,000 to $20,000 range. These replacements were urgent, occasioned by existing capital equipment having exceeded its service life, but for which no capital replacement project or funding was available. Examples include isolation valves for chiller systems, patching cooling tower leaks, and replacing fan drives.

Significant service time and material expended giving advanced life support to used up systems in such buildings as Kresge I. A stopgap winter project to clean evaporators in two obsolete chillers cost over $18,000.

Diversion of MGF time to assisting contractors and construction projects. Even where some of these labor costs are borne by the projects, the labor hours displaced must often be made up on overtime.

Urgent general fund work made it difficult to shift labor to customer pay work.

Significantly increased material prices, especially for items like copper pipe and wire.

Increased personnel costs.

Increased acquisition of materials due to more work being done.

Significant increase in mission scope for MGF funded programs and services, such as the High Purity Water program, which has expanded to the point that it is now both qualitatively and quantitatively different. The program cost $390,000 this last FY; in FY 2004 it cost $210,000.

Condenser water conservation program resulting in increased maintenance expenditure for heat transfer surfaces, because the existing water treatment control infrastructure is not fully adequate to the demands of operating with increased condenser water cycles. These additional costs amounting to more than $85,000.

Increased focus and attention upon maintaining a balanced general fund budget for FY 08 will have to be a top priority. Continuing effects of previous budget cuts will limit our ability to respond as we would wish to customer concerns, and to maintain and replace failed or degraded system components. As the University’s older mechanical systems become less reliable and as failures do occur, down time will increase. The concern, of course, is the impact of less reliable mechanical systems on the University.

We continue to develop methods and systems for identifying and prioritizing these needs further and further ahead of time. This allows more of them to be planned for and addressed outside of the MGF operational budget.

**Enterprise**

<table>
<thead>
<tr>
<th>Mechanical Systems</th>
<th>Comparative Enterprise Expenditures and Revenues for FY 2007 and FY 2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>FY 2007</td>
</tr>
<tr>
<td></td>
<td>$ 16,495,389</td>
</tr>
<tr>
<td>Expenditures</td>
<td>$ 16,419,038</td>
</tr>
<tr>
<td>Net Income Variance$^{[1]}</td>
<td>$ (87,789)</td>
</tr>
<tr>
<td>Net Income Percent Variance$^{[2]}</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

$^{[1]}$ Actual Net Income less budgeted Net Income  
$^{[2]}$ Net Income Variance as a percentage of budgeted expenditure.
Total revenue and total expenditures ("Enterprise") grew from FY 2006 to FY 2007. Revenue was 6.1% higher and expenditures were up 6.3%. This represents a continuing trend in which our units take on projects funded by other revenue sources than the general fund allocation. The net income variance (difference between actual and budgeted net income) was one half of one percent of budgeted expenditures.

Section IV:  Highlights, Accomplishments, Improvements FY 2007

Craig Butcher, foreman of the Chiller group, moved over to become the Mechanical Systems General Foreman.

We worked with customers at LSI to improve the channels of communication regarding not only actual system problems, but potential problems. This was a combined effort with Plant AC, Plant Maintenance Engineering, and Work Control. We focused on using some of the systems already in place, particularly the shutdown notification system, and refining it to help us give our customers advance warning.

We have started a needs reporting process within the AC shop, to identify physical system issues and concerns. Our "Needs Form" gathers information which is brought either to WRQ directly, to Engineering as a concern, or as an FCA need. This reporting process will be improved and fine tuned.

We began an analysis of the costs of winterization. Systems to be winterized in the fall, and de-winterized in the Spring, consume labor. It is important equipment be designed so it need not be winterized. This year we spent about $70K in three shops alone on winterizing activities. If this can point the way to avoiding some of these costs, it will start to make a difference.
We are partnering with utilities and PME to drive real time utility consumption data down to the level of the individual chillers in our chiller plants. This means more comprehensive monitoring and reporting of actual energy use in a usable form that will help alert staff to impending chiller problems. Another benefit will be better data on the actual achievable performance capabilities of various systems, which will improve our accountability to our customers and help us identify opportunities for improvement.

We implemented Chiller system improvement teams: staff from PME, Chiller Systems, and DDC Shop are working together to co-ordinate their efforts. This has already resulted in identification of several problems which are being addressed to improve system efficiencies and provide greater system reliability.

An analysis of how work divides between MGF and non-MGF funding sources has made it clear significantly improved project planning and scheduling will be a key factor in determining whether Mechanical Systems can meet the University’s needs. We are exploring ways to meet this challenge. Approaches include a program of project management training, as well as re-assigning some staff to emphasize project planning and scheduling.

Section V: Mechanical Systems Shops

Plumbing Systems (M3100)  Ivory Sims, Foreman

Overview
The Plumbing Shop is comprised of one Foreman, one Steamfitter, one Apprentice Plumber three Sanitary & Storm Water Systems Specialists and seven Plumbers. Ivory Sims, plumbing foreman, holds the master plumbing license of record for the University.

The Plumbing Systems shop is responsible for:
- The maintenance and repair of the underground water mains, storm and sanitary sewers.
- The management of the high purity water vendor contract.
- The cleaning of obstructed sanitary drains in all MGF Buildings.
- The operation of the Vactor Truck.
- The installation and repair backflow preventers located on the main water supply to each building.
- The installation, repair of and maintenance of plumbing systems, as needed, in all University buildings.
- The response to after hours plumbing and service repair calls.
- Emergency response and repair to critical buried water infrastructure, especially water mains, but also sanitary and storm sewers.

Accomplishments, Highlights, and Areas of Improvement
In FY 07 as in FY 06, many defective underground isolation valves were replaced as a normal maintenance activity, forestalling need to replace them under emergency conditions. This will be an area of continuing improvement in FY 08 and 09.

We are implementing a GPS locator database for these buried valves, as well as for other critical buried locations such as vaults and catchments.

Our Backflow Preventer replacement and upgrade program continues to make progress. At the present time, servicing the primary building backflow preventer necessitates a complete shutdown
of water service. This is a costly, involved, and highly disruptive process, particularly in large research facilities. We are now working to install bypass lines in critical buildings, so that routine backflow preventer maintenance will not adversely affect research or other activities.

As in past years, we responded quickly and effectively to many main water line breaks. One area of improvement has been the acquisition of a hydraulically actuated guillotine cutter which significantly reduces the time and hazard involved in these repairs.

Challenges

• Constantly meeting the challenge of upgrading and replacing failed and broken valves.
• Meeting upgraded schedule of servicing sewers and catchments.
• Increasing rates of failure for aging buried water mains and sewers. Some of the buried water mains are over 60 years old. Much of it was not laid properly in engineered backfill, making it more and more vulnerable to failure as the piping ages and weakens.

Steamfitting and Pump Systems (M3200)

Overview

The Steamfitting and Pump Shop is comprised of one Foreman, fourteen Journeyman Steamfitters, and four Apprentice Steamfitters. The Shop’s Steamfitters are divided into two working groups: Steamfitting and Pump maintenance.

Steamfitters

• Installation and maintenance of radiators, fan coils, steam traps, steam valves, and high and low pressure steam systems.
• Steam heating coils, chilled water coils and condensate receivers (air and steam).
• Installation of steam ovens, autoclaves, steam tables, and other steam equipment.
• Maintain and install gas lines, air lines, steam and condensate mains and branch lines, etc.
• Installing condensate receivers (air and steam).
• The Steamfitting and Pump shop maintains three fitters certified to perform high-pressure steam and condensate system welds. Certification must be repeated every five years.

Pumps

• Installation, repair, and replace vacuum pumps, chilled water pumps, sump pumps, sewage ejector pumps, hot water heating pumps, all circulating pumps, DI system pumps.
• Install and repair air compressors.
• Repair steam condensate pumps including air drives.
• Repair of pump seals, flanges, and gaskets.

Accomplishments, Highlights, and Areas of Improvement

Vendor training: we conducted two in-house vendor provided steam system component training seminars to maintain steamfitter skills at a high level. Training covered steam traps and pressure reducing valves and reducing stations.

We conducted a pro-press training seminar. This is a new pipe joining technology which has significant cost and labor savings over other methods and is well suited to certain piping applications.

We commenced a review of PM work, particularly pump and compressor work, to identify problem areas and opportunities to accomplish more necessary work with the resources available.
This review continues in the next FY, and will allow us to significantly increase the percentage of PM work completed. This in turn will improve equipment reliability and consequently should reduce corrective repairs.

The Steamfitting and Pump shop performed extensive urgent and crucial replacements of isolation valves, check valves, and other pump system fittings in the Med School chiller plants. This was long-deferred essential work for which funding had been delayed due to the overwhelming number of other critical replacement needs. Had this work not been done, the result would have been an 80% or higher likelihood of one or more total cooling system shutdowns in a vital research complex. Although the work increased strain on the MGF budget, and presented a significant scheduling challenge for the Steamfitting shop, the crew rose to the occasion, and the result was an unusually trouble-free cooling season for the chiller plants in question.

**Challenges**

The time available to perform important PM work on critical equipment is hard to come by, especially since PM work is almost entirely MGF funded. We will continue to work on maximizing the effectiveness of the PM work scheduled and performed. One element will be to ensure that the level of expertise required for any given PM task is matched to the skill level of the staff to which the work is assigned. Another element will be to identify areas where labor can be reduced or eliminated, such as by installing automatic lubricators.

One critical challenge area is finding the time and money needed to continue and improve staff training. We continue to maximize training value by seeking out vendors who can provide training on our site and by spreading expertise within the shop by staff-to-staff interaction.

Significant improvements in planning and scheduling effectiveness are necessary if we are to successfully complete the large number of MGF and customer pay projects we are responsible to perform. We are engaged in a project management training program and are working to improve communications with engineering and customers.

**Insulation and Asbestos Abatement (M3300)  Fred Riecks, Foreman**

**Overview**

The Insulation and Asbestos Abatement Shop is comprised of one Foreman and ten Pipecoverers.

The Foreman has professional certifications and accreditations related to the management of Asbestos in the following areas:

- Building Inspector
- Management Planner
- Project Designer
- Contractor Supervisor

All of the Journeymen Pipecoverers have extensive training and certification in proper work methods of asbestos abatement. They are Contractor/Supervisor certified, which qualifies them to do all aspects of asbestos abatement. The certification requires yearly training by a recognized State Certified Trainer.

The Insulation and Asbestos Abatement Shop provides the following services:

*Insulation:*
• Ensures constant chilled water, hot and cold water, and steam piping temperatures.
• Ensures constant air temperatures in heating, ventilating, and air conditioning ductwork.
• Provides burn protection from hot pipes, ducts, and boilers.
• Eliminates condensation from chilled water and cold water piping and from air conditioning units and their ductwork.
• Provides high temperature insulation blankets for the University’s powerhouse turbines generators.

Asbestos Containment and Control:
• Removal and disposal of asbestos containing materials i.e.: Floor tile, pipe insulation, ductwork, boilers, plaster, etc.
• Clean up of debris and encapsulation of damaged asbestos.
• Drilling of holes in transite fume hoods, asbestos containing laboratory table tops, floor tile, etc.
• Test samples of suspect materials for asbestos content.

Accomplishments, Highlights, and Areas of Improvement
We are meeting on a regular basis with OSEH to identify, address, and review regulatory compliance concerns such as abatement notifications. This process has already borne fruit by reducing the notification time and allowing us greater flexibility in accomplishing urgent abatement work while maintaining and improving accountability.

Aside from regular abatement and insulation activity, the insulation shop performed a number of significant projects, including 5000 ft² remodel of asbestos tile in the Music School Library, a replacement project for chilled water piping insulation and PVC re-jacketing at the North Campus Chiller Plant, removal and replacement of insulation on heating water piping for the North Hatcher VAV box replacement project, and re-insulation of the new pumping and piping system in Lorch Hall. In addition, the insulation shop worked on the Henry Ford Estate heating and cooling renovation project.

The Insulation shop has acquired a new spray-on insulation technology. Staff was trained in this technology, and it has been employed successfully in such problem areas as the Lorch Hall elevator hoistway.

Challenges
Like all parts of Plant Operations, the Insulation shop faces the challenge of accomplishing more each year with increasingly limited resources. The percentage of our effort funded from MGF sources is now less than 25%, yet a primary part of our mission remains to respond to maintenance and repair abatement and insulation needs.

The challenge of meeting and exceeding regulatory compliance standards with respect to asbestos management continues. We are working closely with UM-OSEH in this area and will continue to do so in the years ahead.

Improved planning and scheduling expertise will be necessary for both foreman and staff if insulation and abatement projects are to continue to be brought in within budget and on schedule. Increased attention to regulatory detail means the highest quality planning is needed to provide regulatory notifications with the required lead times.
Chiller Systems (M3400)  
Judd Nearhood, Foreman

Overview
The HVAC Chiller Systems unit is comprised of one Foreman, 12 Air Conditioning and Refrigeration Mechanics, and two Mechanical Systems Field Service Specialists. In addition, HVAC apprentices are assigned to Chiller Systems during portions of their 5 year apprenticeship training.

Chiller Systems operates, services, and maintains large scale chiller systems that provide cooling to general funded buildings throughout the University of Michigan’s Ann Arbor campuses. Chilled water systems differ from other systems, such as direct expansion systems, in that they cool using a circulating heat transfer fluid, serve larger building or complexes of buildings, and require management and operation of relatively complex interactions between multiple subsystems of controls and equipment, including chillers, heat exchangers, cooling towers, coils, strainers, pumps, valves, sensors, meters, and other system components. A chilled water system can consist of one chiller and one building, but increasingly our systems are chilled water plants, in which multiple chillers are tied together to serve at least one but usually two or more buildings.

For our purposes, a “large scale” system is capable of transferring 1.2 million Btu or more of heat energy per hour. Incessant construction and renovation at the UM makes determination of exact numbers more a matter of definition than of arithmetic, but at last count, Chiller Systems is responsible for 48 absorption chillers and 36 centrifugal chillers. The average cooling capacity of our absorption chillers is 625 tons, and that of our centrifugal chillers is 545 tons. Our largest system can remove over 48 million Btu per hour from the buildings it serves, in the process pumping enough chilled water to fill a large public swimming pool in 15 minutes, and evaporating more than 5000 gallons of cooling tower water each hour.

To operate and service these plants, HVAC personnel must work closely on a day-to-day basis with the Plant Steamfitter shop, Plant Plumbing shop, the Electric Shop, Machine Repair, the Sheet Metal shop, Plant Engineering, Plant Utilities, Zone Maintenance, and Work Control.

An important part of the Chiller Systems group is the Water Treatment team. This team currently consists of two full-time skilled trades water treatment technicians, who work closely with other staff and with our water treatment consultants to monitor and maintain the water condition of open and closed loop systems.

Accomplishments, Highlights, and Areas of Improvement
Judd Nearhood, an AC & Refrigeration mechanic in the Chiller Shop, was promoted to Foreman.

Several years’ effort and expenditure upgrading pumps, valves, and other components in the Medical Sciences chiller plant paid off in the highest output and greatest CHW efficiency since the plant was first placed in service.

Challenges
Treatment of open and closed heating and cooling water loops has come to the forefront as a critical need. An effort to decrease cooling tower water blowdown rates, instituted three years ago, has resulted in increased fouling of heat exchange surfaces, and added significantly to winter maintenance costs for tube de-scaling. This is because the cooling tower water treatment control systems as originally designed and installed are not adequate to maintain the tight dissolved solids
control margins necessary to prevent tube fouling with the reduced blowdown rates. We are working to bring these treatment control systems up to the necessary functional capability, but this will cost money and will take some time.

The move to combined chiller plants has also made more sophisticated closed loop (chilled water and heating water) treatment practices absolutely critical. This means upgrading loops to add corrosion monitoring devices, and increase monitoring rates for inhibitor levels and for makeup quantities. We are working with Plant Maintenance Engineering to plan and implement these upgrades. In the long run, these expenditures will result in significantly improved system performance, reduced energy consumption, and lower maintenance costs. In the next two or three years, however, costs will increase.

Similarly, increased energy costs have made it imperative that improved steam and energy consumption monitoring capability, particularly for steam absorption chillers, be upgraded. In the short run, this means increased cost for measurement equipment and monitoring. In the long run, improved chiller performance, increased cooling capacity, and reduced operating costs will ensue.

**Mechanical A/C and Refrigeration (M3500) Frank Hilberer, Foreman**

**Overview**

The Mechanical Air Conditioning and Refrigeration Shop (MACRS) is comprised of one Foreman and sixteen Air Conditioning and Refrigeration mechanics. All staff are EPA certified to install, remove, and handle all refrigerants.

The MACRS is responsible for all refrigeration equipment in GF buildings on U of M’s Ann Arbor campus and for a great deal of the equipment in non general fund buildings. Examples of refrigeration equipment serviced:

- Cold rooms, ultra-low temperature freezers
- Compressed air dryers
- Ice machines, salad bars, pop machines, etc.
- Controlled environment chambers
- Walk-in and reach-in coolers & freezers
- Self contained A/C units
- Small package chillers

The MACRS is also responsible for:

- Maintenance and operation of the reciprocating and screw chillers on campus.
- Management of the U of M’s Refrigerant Compliance data base.
- Computer server rooms.
- Direct expansion air conditioning systems through out Campus.

The MACRS has service level agreements with Dining Services, Yost Ice Arena, Ford Library, and MACC, and with Property Disposition to repair, maintain and dispose of their refrigeration and air conditioning equipment.

**Accomplishments, Highlights, and Areas of Improvement**

- We continue to maintain and service Dining Services refrigeration and air conditioning equipment. The number of corrective work requests we receive from Dining Services continues to decline, primarily due to the properly funded preventive maintenance program we implemented for them.
• Dining Service also continues to contract with us to install new refrigeration equipment.
• OSEH has made a commitment to fund refrigerant and oil removal from appliances in general fund buildings. The intent is to encourage recycling of older equipment. The procedures have been streamlined to reduce administrative time. We will continue to look for ways to improve this process in the next year.
• Employees Working Out of Classification (EWOCS) were used to clean condenser coils on A/C units and to assist wherever necessary. This has proven to be an effective and cost saving use of manpower. Unfortunately, General Fund budget constraints made it necessary to curtail this program for the time being.
• Both AC Apprentices worked their first Mechanical Refrigeration rotations in shop M3500.
• Yost ice making equipment annual overhaul was completed again this year without any problems. Ice was made and Yost was up and running by July 4, 2007.
• We continue to work with OSEH and Property Disposition to formulate the best plan and procedures for the removal of refrigerant and oil from appliances that contain these products. This work is done at our Refrigerant Recovery Center. The refrigerant and refrigerant oil are recovered and sent to a recycling facility. This program is necessary due to provisions within the Federal Clean Air Act dated July 1, 1992.
• The Air Conditioning Shop reorganization and formation of a new Temperature Control and Air Balance Shop has put a new focus on the way HVA/C work is done now. The new shop organization is allowing our mechanics to focus closer on specific tasks rather than being pulled in all directions.
• The new MACC Data center located at UM/MITC is now on line and being maintained by us. We had some basic training on the equipment. Further, more specific, equipment training (Liebert A/C units) is one of our planned focus areas for the upcoming year.
• The continuation of Arbor Lakes building #2 Parallel Computing Center maintenance and repair is being done by this shop. A basic service contract with Johnson Control was initiated to assist us with these tasks. Meetings were held with the customer to address and focus on issues as they present themselves.
• Ford Library received a new energy management control system that was installed by Johnson Control. We are working closely with Johnson Control to maximize energy savings through the use of this new system. This year, one of our tradesmen went to Indianapolis IN for factory training on this new system.

Challenges
• MGF budget limitations constrain our ability to accomplish MGF work as rapidly and flexibly as we would wish to do.
• To reduce MGF costs for unanticipated repairs, we are working to focus greater effort on preventative maintenance. In particular, we are engaged in a PM work review to identify the highest value PM work, and work which will have the greatest return in the form of reduced operation and maintenance costs.
• Continuing to provide highest quality service to MGF customers, while taking on additional service responsibilities for other units, without increasing staff and without additional funding.
Overview
The HVAC Controls and Energy Conservation Shop is comprised of one Foreman, four Steamfitters, and fifteen HVAC Control Specialists.

The Controls Shop installs and maintains the Direct Digital Control (DDC) systems in all of the general fund buildings on the Ann Arbor Campus and in most of the non general fund buildings that have DDC systems. The Shop is responsible for the wiring connections, Programming, and start up of all the DDC cabinets for all new construction projects on Campus.

The Energy Conservation Outreach (ECO) program is a large part of the Control Shop’s responsibilities. The Control Shop is responsible for the building tune-up portion of the program:

- Complete tune-up of building HVAC systems which includes operational testing of:
  - Pneumatic, DDC, electric, and electronic controls.
  - Dampers, humidifiers, heating and cooling valves, heating and cooling coils, heat exchangers, supply fans, return fans, exhaust fans.
  - Room controls.
- Testing and maintenance of the steam, hot water and chilled water distribution systems which includes the following:
  - Testing of valves and steam traps.
  - Repair or replacement of the valves and traps depending on the results of the testing.

The shop is responsible for the maintenance and reading of the condensate and water meters, which is vital for proper billing of utility charges to University Buildings:

- Accurate reading of 200 steam condensate meters throughout the central, athletic and medical campuses.
- Accurate reading of water meters.
- Analysis of monthly readouts to determine proper functioning of metering systems.
- Preventive maintenance and repair of metering systems.
- Testing and research into new technologies of steam metering devices.
- Preparation of monthly reports for the Utilities Department as an aid in the billing process.

Accomplishments, Highlights, and Areas of Improvement
Retirement of three highly experienced technicians created an opportunity for reallocation of staff to fine tune the service responsibilities between DDC and Temperature Control shops.

M3600 again successfully completed an ambitious program of ECO (Energy Conservation Outreach) building tune-up work, while also performing DDC building automation work on more than 21 fixed price projects.

The HVAC Controls and Energy Conservation shop worked closely with Plant Maintenance Engineering to produce programming and instrumentation upgrades to improve chilled water loop performance, and improve the ability of the BAS (Building Automation Systems) department to identify and respond to system problems.

Challenges
An increased pace of ECO work, spurred by the formation of the Wolverine Teams, will challenge the HVAC Controls shop to more than double the number of buildings completed each year.

A new DDC controls specialist will be brought on board. Training this person, and maintaining the necessary high level of training for all staff, will be a continuing challenge.

**Temperature Control and Air Balance (M3700)  Randy Fox, Foreman**

**Overview**

The Temperature Control and Air Balance Shop (M3700) is comprised of one Foreman, one HVAC Controls Specialist and eleven Air Conditioning and Refrigeration Mechanics.

The M3700 mechanics primarily respond to work requests for comfort complaints. We service pneumatically and digitally controlled variable air volume box controls, fan coil unit controls and pneumatic air handling unit controls. We make controls adjustments for animal rooms, lab pressurization and ventilation noise complaints. We provide water and air balance services, service and maintain building exhaust systems and their associated fume hoods and also service humidifiers.

In addition, we now also perform calibration and maintenance on sophisticated electronic CHW loop sensors to maintain efficient and effective system control performance. This includes both temperature and flow sensors

**Accomplishments, Highlights, and Areas of Improvement**

We hired a new staff person with Test & Balance experience to bring the T&B capability up to full complement.

AC Shop apprentices rotated through this unit as part of their 5 year training program. Apprentice Jason Hackbarth devised and assembled a DDC controls training station which will be used in future controls instruction sessions.

We commenced a temperature sensor calibration initiative for Energy savings and improved control loop performance.

M3700 has implemented a hang tag system which helps our customers know when something has happened in response to their call. Even where we do contact people, the hang tag helps us communicate with people who were not available when the response occurred, and is tangible evidence of our dedication to serving our customers' needs.

Several improvements in how we direct and manage the Test and Balance services:

- We redesigned our data collection forms to simplify the way we record measurements and improve the accuracy of our reporting. We modernized the report generation process. The technician now enters much of the data directly in electronic form. Report storage and publication has been improved. A new file scheme allows us better access to our results. In addition, our customers, particularly PME, can now look at our data electronically through the BF network. Time from test to report has been reduced.
- We have made some business process changes also in how T&B WRQ are responded to. We have eliminated the fume hood service backlog and are now responding to virtually all fume hood requests within 24 hours.
- Training and software were implemented to upgrade communication with some troublesome fan coil equipment at 300 N.I.
**Challenges**

The Temperature Control shop has a very high level of responsibility for MGF funded work, but needs to also devote effort to non-MGF projects in order to meet budgetary constraints. This includes working with Shop M3600 on Energy Star projects.

The increasing number and critical nature of CHW loop flow sensors will require increased T&B staff training. This expensive, complicated equipment exhibits significant vendor-to-vendor differences, complicating the training problem.

New staff will also have to receive training in installing and servicing DDC equipment, Phoenix lab pressurization and ventilation control equipment, various flow and temperature sensors, and other equipment which is more or less unique to the University.
Section I: Introduction

Healthcare facilities are expected to establish measurable standards of performance and ensure internal business processes are designed to achieve desirable outcomes where undesired outcomes are avoided through application of technology for patients and the patient care environment. It is expected for Healthcare organizations to demonstrate their capacity to provide high-quality care and to continuously improve their performance of such care. The Plant-Hospital Maintenance Department support these efforts by acting as a direct resource for the seven (7) management plans supporting the Environment of Care: Fire/Life Safety, Emergency Management, Security Management, Hazardous Materials Management, Equipment Management, Utilities Management, and Safety Management. The goal of the Environment of Care management plans are to provide a safe, functional, supportive, and effective environment for patients, staff, and others who come to our hospital facilities. Plant-Hospital Maintenance is Plant’s largest Service Level Agreement (SLA) with over 100 employees, and receives collaborative support from several other Plant Departments, e.g., Engineering Services group, Construction Services group, and various Plant Shops. The Department’s primary charge is to maintain the physical environment and provide related services to support the Hospital in reaching its goal of excellence in delivering quality healthcare and public service.

Plant-Hospital Maintenance Mission Statement
The Hospital Maintenance Department, a member of the University Community, maintains the physical environment and provides related services to support the Hospital in reaching its goal of excellence in delivering quality healthcare and public service.

Vision
- To be a department where continuous and measurable improvement in services is the standard.
- To be recognized by the Hospital and University community for excellence in service, as a partner in solving our customers' problems, and as the provider of choice.
- To be an innovative leader in facilities management. To be an organization where all employees are treated equitably and honestly.
- To be an effective, diverse work community.
- To be a learning organization, where all staff members are empowered and supported in reaching their full potential.
- To be a workplace where the atmosphere of trust encourages creativity and innovation.

Guiding Principles
Our vision can only become reality through the efforts of all members of the Plant Operations team. This requires that everyone identify processes that need to be improved and the milestones that must be achieved as we seek to be the provider of choice for those we serve. While keeping the vision before us, it will serve to remind us what we are to do. It is critical that we also give attention to how we do it. We will be guided by these principles:

Focus
We exist to serve the needs of the Hospital through partnerships and mutual understanding.

Integrity
How we do our work and how we relate to each other are of paramount importance. Our conduct must conform to the highest, uncompromising standards of trustworthiness and character. We will never knowingly make decisions that harm people or that is not in the best interest of the Hospital community.

Respect for People
Respect for people and their intrinsic worth is the cornerstone of our relationships with one another, our customers, and our suppliers. We appreciate the diversity of the human family and recognize our differences as sources of collective strength and wisdom.

Empowerment
We are a team. Team members are stakeholders in the success of the enterprise, and must be involved in the decisions that affect their work lives. "Empowerment", with its freedoms, responsibilities and boundaries, describes the intended work culture. Empowerment requires competence, sharing of information and ongoing learning. We are dedicated to becoming the best workforce in our industry. A person seeking to improve service to a customer will not be blamed for taking reasonable risks or for trying something new that does not quite work out.

Innovation
- We are a learning organization.
- We recognize that improvement of our work processes, our methods, and ourselves is essential to our success.
- We must be creative.
- We must challenge our own thinking. We must seek to learn from our mistakes.
Guiding Principles
- Service
- Integrity
- Respect for People
- Empowerment
- Innovation
- Responsibility to the Environment

Plant Operations – Mission
Plant Operations, a member of the University community, maintains the physical environment and provides related services to support the university in reaching its goal of excellence in education, research, and public service.

UMHS – Mission
To achieve excellence and leadership in Patient Care/Service, research, and education.

Facilities Maintenance Strategic Direction:
Four Way Focus

Plant - Hospital Maintenance Goals

**Bold** items are strategic initiatives developed from the B&F Employee Satisfaction Survey for Plant-Hospital Maintenance
HHC Employee Engagement Survey
Plant Hospital Maintenance was identified as being one of the top ten most improved HHC units in response to the Employee Engagement Survey question: *Willingness to recommend work area to someone looking for a good place to work.* KUDOS to PHM!!

B & F Employee Survey
The Matrix below provides an accurate “picture” of the Department challenges and successes based on employee survey participation. Strategic planning efforts have already begun to address the “Priority” items identified within the matrix. Two (2) items identified within “areas of concern”, Workload, Training and Development are ongoing. Hospital Administration has approved proposed recommendation to remedy the workload concern by agreeing to fund a Scheduler/Planner position. Discussions have also started addressing Foreman to staff ratios. Equally, the LearnerWeb Training Program is becoming more “fine tuned” in developing and maintaining staff skills levels.
### Dimension Summary

1/25/2007

#### University of Michigan - Business and Finance -
Employee Satisfaction Survey

#### Plant Operations
Facilities Maintenance

<table>
<thead>
<tr>
<th>Plant Operations</th>
<th>Facilities Maintenance</th>
<th>Plant-Hospital Maintenance</th>
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<tr>
<td></td>
<td>T2 10/06</td>
<td>T1 02/05</td>
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<tr>
<td>Participating Employees</td>
<td>57</td>
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<td>Department Employees</td>
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<td>Percentage of Employees who Participated</td>
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<tr>
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<th>Sig Diff</th>
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<tr>
<td>Recognition</td>
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<td>60</td>
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<tr>
<td>Upper Management</td>
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#### Satisfaction

| Job Satisfaction | 76 | 81 | 86 | -5 | |

#### Outcomes

| Unit/Dept. Commitment | 82 | 1.6 | 82 | 0 | |
| Unit/Dept. Loyalty    | 78 | 3.0 | 78 | 0 | |
| Unit/Dept. Recommend  | 79 | 2.4 | 79 | 0 | |
| U of M Commitment     | 86 | 1.6 | 86 | 0 | |
| U of M Loyalty        | 82 | 1.3 | 82 | 0 | |
| U of M Recommendation | 83 | 1.7 | 83 | 0 | |
| Customer Focus        | 82 | 1.2 | 81 | 86 | -5 | |

#### Priority Matrix

**Diff.** Comp Index T2 compared to Index T1 (when possible).

**Sig Diff.** p < .1. (9 in 10 chance that outcome can be replicated.)
Customer Survey Results

The Department has implemented a “web-based” survey process to solicit comments from our customers. This activity is performed twice per year. For the past three (3) years, Plant-Hospital Maintenance has met or exceeded survey target scores. The next Survey is scheduled during September 2007. Historical results are shown below:

Customer Survey Overall Score Results
(Hospital and Off-Sites)
Section II: Hospital Maintenance Organization Chart – June 2007
Section III: FY 07 Financial Summary

Total revenue received under the Plant-Hospital Maintenance contract for FY07 was $12,127,965. Once again, this year’s financial performance supported successful implementation of several internal business processes. The introduction of an “encumbrance” process and continued alignment with Plant’s own internal business systems and the Hospital’s internal business systems has produced success. Equally, several operational strategies were implemented which better aligned our staff resources with environment demand resulting in OT reductions. We have experienced a 48.5% reduction from FY05. “Kudos” to all who embraced the new internal business processes and operational changes! Special thanks and recognition to Admin Assistant, Melissa Berry who played an important role in helping to achieve this level of success. Once again, we have met or surpassed our financial performance indicators while providing quality service to our customers.

FY07 Total Program – Hospital Plant Maintenance 681670

<table>
<thead>
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<th>Plant Hospital Maintenance</th>
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<tbody>
<tr>
<td>Dept Id</td>
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<tr>
<td>Fund</td>
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<tr>
<td>Program</td>
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<tr>
<td>Project</td>
<td>TOTAL PROJECTS</td>
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<tr>
<td>Total Revenue</td>
<td>$12,127,965</td>
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### Compensation & Benefits

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<tr>
<td>Flex Bene</td>
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<tr>
<td>Var Bene</td>
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<td>Total Benefits</td>
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### Subtotal Funds

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<tr>
<td>Balance</td>
<td>$-282,971.58</td>
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### Total Program Income

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<tbody>
<tr>
<td>Total Revenue</td>
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<tr>
<td>Subtotal Funds</td>
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<tr>
<td>Total Program Income</td>
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### Line Items

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<td>Balance</td>
<td>$-282,971.58</td>
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</tbody>
</table>
Section IV: Year-End Operational Highlights

CMS 2007

The Centers for Medicare & Medicaid Services (CMS) is a Federal agency within the U.S. Department of Health and Human Services whose purpose is to assess the Hospital’s compliance with the CoP (Conditions of Participation) for all services and areas in which the provider receives reimbursement for patient care services. The goal of the inspection is to determine if the Hospital is in compliance set forth within 42 CFR Part 482. Certification of Hospital compliance with the CoP is accomplished through a series of observations, interviews, and document/record reviews and is used to assess compliance with Federal health, safety, and quality standards that will insure the beneficiary receives safe, quality care and services. Hospitals who participate are required to be in compliance with the Federal requirements set forth in order to receive Medicare/Medicaid payment/reimbursement. In short, this is approximately $1 million per day for UMHHC. On April 23, 2007, CMS arrived on the premises to evaluate and ensure beneficiaries receive safe, quality care and service. Over 300 hundred Fire Marshall related work orders were identified for Plant Hospital Maintenance to provide action for compliance. By July 19, 2007, eighty-seven percent (87%) of these work orders were complete.

Utility Management

In compliance with the Joint Commission Environment of Care Standard EC 1.9 and UMHS Utility Management Plan, the following graphs summarize utility system failure activity and elevator entrapments. The Hospital’s on-going performance improvement activity for utilities is to maintain an average of one (1) utility incident/failure per month and achieve a monthly PM completion rating of 95% or above on Priority 4 utility rated equipment. Elevator entrapment performance targets are not to exceed 18 occurrences within one year.

PM Completion Summary: July 2006 – June 2007

![PM Completion Summary Graph]

Elevator Entrapment Summary: July 2006 – June 2007

![Elevator Entrapment Summary Graph]

Additional Highlights FY07

- Construction is now complete for UMHHC’s new 49,000 square foot out-patient diagnostic and treatment facility located at the East Ann Arbor Health Center. A collaborative effort between the Medical School and UMHHC, this $30 million state-of-the-art facility for off-site out-patient
surgery and medical procedures is expected to accommodate over 7000 surgical cases and approximately 2000 medical procedures per year.

- The Rachel Upjohn Building opened in October 2006 and is also located at the East Medical Campus. The $41-million facility is the new home of the U-M Depression Center, and most outpatient clinics in adult and child/adolescent psychiatry.

- On June 11, 2007, the new $215 million, six-story clinical heart and vascular care facility (CVC) opened. The 350,000 sq ft clinical building and adjoining 465 space parking deck is the new home for much of U-M's care for adults with heart disease and blood vessel conditions. The CVC building has 8 operating rooms, 11 interventional procedure rooms, 48 inpatient rooms, dozens of clinic rooms, a state-of-the-art non-invasive diagnostic facility, classrooms and offices.

- On October 6, 2006, the groundbreaking ceremony took place for the new state-of-the-art UM C.S. Mott Children's Hospital and Women's Hospital. This new construction is the 2nd largest construction project in Michigan and the 15th largest hospital project currently being planned in the country. Plans for the new children’s and women’s facility will include 16 pediatric operating rooms, 4 pediatric surgical procedure rooms, 4 Caesarean section suites, and 264 private inpatient beds upon opening, including 50 single room maternity care beds, with capacity for an additional 84 beds in the future.

- In progress as well is the construction for the new Kellogg Eye Center expansion. This 220,000 square foot, eight-story, $221 million building will provide a home for the researchers of the Brehm Center for Type 1 Diabetes Research and Analysis. When completed in 2010, Kellogg will become the largest and most comprehensive eye center in the Midwest. The Brehm Center will occupy two floors of open laboratories designed to accelerate the search for a cure for Type 1 diabetes.

- Construction of a new primary Medical Center Info Tech (MCIT) Machine Room to replace the existing machine room located within the Taubman Center has been approved. The 46,825 sq ft structure will exist as a standalone two-story building containing its own machine room and utilities.

- The PHMP/A group completed “StrengthFinder” and Myers-Briggs Type Indicator (MBTI) assessments to help align individual strengths into team strength in an effort to support and sustain team philosophy concepts.

- The newly added Scheduler/Planner position continue to produce positive results by appropriately aligning available staff resources with environment demand using planning and/or scheduling techniques. Centralizing the “shut-down” process using the Scheduler/Planner position has allowed increased communication with Building Managers and has allowed scheduling of multiple “shut-down” requests into single events. This position has also provided quantitative info supporting changes in shifts with current maintenance staff which increased PM activity efforts to off-hours resulting in less disruption to medical staff and patient care areas. ROI for this position is already greater than 50%.

- Efforts to address current Foreman to staff ratios are in progress. Org re-structure to occur prior to occupying C&W around FY2012. Successfully addressing this issue will have a positive impact on Employee Satisfaction scores (reference B&F Employee Survey on page 4).

- Our system logged 116,171 work orders for FY07.

- Over 205,000 hrs of available man hrs were logged for FY07.

- There has been a 15% increase in Corrective Maintenance (CM) hrs over the last five years.

- $63,626,598 total contract revenue received in the last six years.
Recommendations/Future Opportunities

Hospital Facility Condition Assessment (FCA) Program

The Environment of Care (EC) goal, as defined within the Comprehensive Accreditation Manual for Hospitals, is to provide a safe, functional, supportive, and effective environment for patients, staff, and other individuals within the hospital. Achieving this goal depends on positive outcomes stemming from processes which involve:

- strategic and on-going master-planning
- consistently planning and designing the environment through careful consideration while linking mission and vision, patient physical condition/health, cultural backgrounds, age of the population served, and their cognitive abilities
- educating staff and the processes used for monitoring, maintaining, and reporting the related results to the EC
- developing standards to measure staff and hospital performance in managing and improving the EC
- implementing plans to create and manage the hospital's EC

The EC consist of three (3) basic components: building, equipment, and people. Under these three (3) components a variety of key elements and issues contribute in impacting the way the space feels and works for patients, families, staff and visitors experiencing the delivery of healthcare. There are “key” elements which significantly influence positive patient outcomes, patient satisfaction, and patient safety. When effectively designed and managed, as part of the physical environment, these elements create a safe, and comfortable environment that supports the EC goal. Achieving the EC goal requires effective management of the UMHHC Environment of Care Plans and Policies which involve processes whose outcome will:

- reduce and control environmental hazards
- prevent accidents and hazards
- maintain safe conditions for patients, staff, and others coming to healthcare facilities
- maintain an environment that is sensitive to patient needs for comfort
- maintain an environment that minimizes unnecessary environmental stresses for patients, staff, and others.

One method of assuring this goal is achieved within a Healthcare environment is to implement and sustain a Facility Condition Assessment (FCA) Program. This program relates directly to the overall success of the EC initiative and directly supports the Utilities Management Program by:

- Prioritizing deferred maintenance backlog for short & long term goals
- Planning for long term major building component replacements or actual building replacement
- Complimenting Capital planning of major Hospital facility renovations and/or system replacements

The FCA program will serve as a valuable and effective process tool used to manage hospital facility related assets which can be used to effectively support the Hospital’s Mission and Vision. It will focus on identifying Hospital facility needs, project scope development and budget, prioritization of identified projects, and funding of projects that have been identified as critical to Hospital operations when delivering positive healthcare outcomes. By focusing funds on the most critical needs we can address the deferred maintenance backlog systematically. Equally, by including FCA data in the capital planning process, a method to identify which systems and/or Hospital buildings should receive major renovations or replacement is now attainable.
By taking the total FCA backlog (deferred maintenance) and dividing by the Hospital’s current facility replacement value (CRV), the Facility Condition Needs Index (FCNI) is derived. In theory and practice, the lower the value of this number, the closer the Hospital is to meeting the desired goals of the EC management plan. When used in this fashion, the FCNI now becomes a financial indicator which can be used to support the overall FCA program while directly aligning efforts with the EC goal. Tracking the FCNI over time will provide trending capabilities representing the overall healthiness of the Hospital’s facility condition.

By adopting this effort, FCA data can be used to develop long term replacement models for major components and related sub-components and systems within the Hospital environment which would include: chillers, roof-top units, medical air/vacuum, domestic hot/cold water systems, RO systems, roofs, elevators, escalators, and electrical systems, including emergency generators. It is highly recommended for Hospital Administration to address aging facilities as part of their capital plan and address infrastructure as part of major renovations when building new hospital facilities. The FCA Program will serve as a valuable tool to accomplish this desired goal when aligned with EC management plans. This effort is recognized as a “Best Practice” since it fosters effective and practical steps in supporting the basic components identified under the EC goal and is achievable by considering:

- Multi-level team approaches for validating, estimating and prioritizing maintenance deferred related projects
- Processes to maintain FCA database
- Prioritization process of deferred maintenance projects
- Reporting tools complimenting planning & budgeting activities.

Supplementary Commissioning Efforts Involving Equipment Tagging, Inventory, and Job Planning

It is recommended to exercise supplementary practices aligned with the Building Commissioning Documents identified in Division 01 General Requirements for Facilities Commissioning under Section 01715 and Section 01710 Execution Part 3. The "Facilities Commissioning Specification" (Section 01715) and the "Facilities Commissioning for Small Projects Specification" (Section 01710) are generic specification sections that outline Contractor requirements related to the commissioning process. It is strongly recommended that these supplementary practices include the following:

1) Identification of required Preventative Maintenance (PM) activity of Fixed Utility Systems with an APMI Rating of 12 or Greater. This will include written additional or new processes/procedures (job plans) for all fixed utility systems or components requiring Priority 4 PM actions.

2) Systems/components of interest include: Plumbing, Pumps, Electrical, Fire Systems, Elevators, Escalators, and electric Door Closers. Chilled & process water systems, water towers, condensers, pumps, chemical treatment systems, heating systems, air handling, and HVAC/building & Fire alarm controls. Point to Point data should be included as well.

3) The overall effort will support the PM Program as identified under the Utilities Management Plan and the data gathered will help to sustain an effective Preventive Program and begin implementation of Predictive Maintenance practices.

4) Bar-code tags will be used to tag and label all Priority 4 PM (APMI greater than 12) equipment identified for inclusion into the PM program.

The minimum suggested manufacturer’s PM Job plans/actions of these identified pieces of equipment/systems should match the labor resources required to properly maintain the Priority 4 equipment/systems. This condition will support efforts to achieve the anticipated life expectancies
and ensure the safe delivery of the system designed function. Successful development of this action will help significantly improve the “hand-off” process to Maintenance with newly installed systems/equipment stemming from approved major capital projects, thus aligning the Utilities & Life Safety Management Plans with the overall EC goal.

**Facility/Construction Design Process**

Day-to-day operations, maintenance procedures, repair processes, and capital renewal practices will experience a large negative impact on long-term maintenance practices if proper facility planning/design prior to building construction is not performed. The Hospital has invested heavily in hiring personnel and structuring processes to lessen these identified negative impacts. Recognizing the benefits of “fine tuning” the design and programming processes before actual construction takes place is invaluable in supporting positive healthcare delivery practices. Initiating the Hospital Construction Department Process Improvement Team (HCDPIT) is a solid example of exercising and achieving a “best practice” in this area, if sustained.

**Interoperability**

It is prudent to develop protocol and identification of technology the Hospital intends to use for future equipment (HVAC), building (fire, security) controls, and systems monitoring. Implementing and adopting a strategic planning process in this area will result in the ownership of a “seamless” controls operating environment. This is attainable by combining synergetic efforts from Plant and Hospital resources. Identifying the “champion/s” to lead this effort by Committee will achieve the desired results. This action fosters “best practices” in regards to building automated systems.

**Increase Communication of Maintenance Request Status to Customers**

Customer Survey results over the past three (3) years have shown there is a great opportunity to improve results and improve service to our customers if “timely feedback and detailed explanations are provided on long standing service requests”. Structuring available staff support and the use of technology are the primary means to improve feedback to customers and will increase communication of maintenance requests to customers. Combining Call Center response initiatives and automatic “on line” responses via web-based MAXIMO are examples of how to accomplish this initiative. Moving forward to structure efforts to attain this goal is desired and will require resources from Plant and Hospital.
Section I: Introduction

Fiscal year 2007 was tremendously challenging due to continuing budget decreases. Additional funding was received to pay for maintenance and repairs in new facility space. Campus facilities continue to grow as our customers desire increased levels of service while the total budget remained relatively neutral. Educating the University community as to our goals and limitations is part of our improved communication responsibilities. Informational classes at Plant Academy educate facility managers and other participants as to Plant Operations’ goals, limitations and challenges.

The Roofs, Metal Shops & Elevators enterprise consists of the Roofing Shop, Sheetmetal Shop, Weld Shop, Machine Shop, Millwright Shop and the Elevator Shop. We are a team within Facilities Maintenance in Plant Operations working together to support the mission of the University.

The U-M Elevator Shop is one of the largest private elevator service shops in the country, with eleven licensed mechanics and is responsible for over 500 pieces of vertical transportation.
equipment across campus. The shop administrator manages the Hospital elevator maintenance contract using an external vendor. Staff performs construction plan and specification review for all of the Ann Arbor campus projects, acting as the in-house consultant for the University. Flint and Dearborn campuses receive similar consultation services on a customer-pay basis.

The **Roofing Shop** manages over 4 million square feet of general fund roofing surface in addition to many other auxiliary building roofs on campus. Housing, Athletics, the Hospital and other auxiliary departments obtain roofing services on a limited basis. Much of this “customer-pay” repair work is sent to outside contractors although the Roofing Shop usually oversees the work. All new roof and reroof projects are handled by outside contractors with the Roofing Shop inspecting the work for conformance to codes, regulations, and University specifications. This shop also does customer-pay roof plan and specification review for Flint and Dearborn campus projects.

The **Sheetmetal Shop, Weld Shop** and **Machine Shop** all work to maintain, repair, or fabricate almost anything imaginable from metals. Work includes metal roof repairs, gutters, ductwork, hand rails and cat walks. Occasionally prototype parts are made for a researcher with an idea, hospital surgery tools are repaired, or obsolete parts are replicated for elevator component repairs.

The **Millwright Shop** repairs and assembles all sorts of equipment and components from fans to key board trays to office partitions. This shop was part sponsor of the **Employees Working Out of Classification** (EWOC) program. Our portion of the EWOC program was put on hold this year due to budget reductions.

Each shop has their own mission statement and strategic plan in relation to Plant Operations’ goals and the University mission. All shops’ goals of additional technical training were met this year and will be discussed later under individual shop highlights. New goals will be addressed next year following the outcome of the B & F customer survey.

Work load evaluations for all shops were performed in the spring and will be done again in the fall. The late January to mid March time frame tends to be the slowest time of year for work load in these shops. The fall time frame tends to have the most work backlog. A major goal of management is to right size each shop to effectively handle their respective work loads to meet customer expectations.

A common communication goal of the Sheetmetal Shop, Welding & Machine Shop and Millwright Shop involved meeting with Plant Engineering to discuss common communication issues and ways to improve the process. The initial meeting was very beneficial and the process is ongoing.

*Dennis Krieg*  
*General Foreman*
Section II: Roofs, Metal Shops & Elevators Organization Chart

Section III: FY 07 Financial Summary

General Fund

<table>
<thead>
<tr>
<th></th>
<th>Beginning Budget</th>
<th>Ending Totals</th>
<th>Remaining Balance</th>
<th>Under/Over</th>
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<tr>
<td><strong>Labor</strong></td>
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<td>$498,868</td>
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</table>

The Roofs, Metal Shops & Elevators general fund enterprise finished the budget year with a surplus, as requested, of $437,173. A deficit of $61,695 was carried over from FY 2006. $498,868 - $61,695 = $437,173.
Total revenue for all shops decreased from $8,184,085 to $7,870,500, partially due to staff retirements who were not immediately replaced.

The Fixed Price account finished with a small deficit of $193 only because revenue owed of $36,500 was not received before the end of the fiscal year.

Overtime worked this year by all shops combined was 4154 hours compared to 5453 hours for last year. Customer-pay overtime accounted for 2112 hours, or about half of all overtime worked. The reduction in overtime hours also contributed to the reduced revenue.

**Section IV: Year-End Operational Highlights**

**Elevator Shop**

David Flint, Foreman

Mission statement: The Elevator Shop strives to maintain and repair vertical transportation equipment, while providing immediate response to community requests in order to maintain safe and reliable operation for the students, faculty, staff and guests of the University of Michigan.

We support our mission by:
- Providing top-notch preventive maintenance on the equipment for which we are responsible.
- Performing repairs in a proficient, expedient manner.
- Responding IMMEDIATELY to any emergency situation.
- Addressing customer concerns in a professional, timely manner.
- Adhering to the rules and codes promulgated by our governing authorities.
- Being a resource of elevator and escalator information with Plant Department and the University community.

The continuous construction of new facilities with additional elevators and dock lifts pushed the need to revise the “route” structure for each mechanic. This added work to the Work Control Preventive Maintenance staff by changing which elevator mechanic gets assigned to each work request.

**Vertical Transportation Conference for Colleges & Universities:**

Representatives from the Elevator Shop attended the Vertical Transportation Conference for Colleges and Universities, VTCCU, held June 18-21, 2006, at the University of Maryland and co-hosted by the Smithsonian Institute. In addition to the Educational Sessions and the mini Elevator Product Trade Show, Elevator U has incorporated as a professional organization in the State of Georgia. The By-Laws are under review at the present time and will be forwarded to the Current Mailing List of the VTCCU. Our own Ms. Terri Emmons, Administrative Associate for the Elevator Shop was elected President of this new organization. The purpose of Elevator U will be to support and encourage the exchange of ideas and information relative to vertical transportation in academic, municipal and governmental facilities.

There is discussion and planning on how to bring more technical training to groups instead of sending individuals around the country to receive the same technical training and code updates.
This could save significant travel and lodging expenses while expanding the educational opportunity for more participants.

Fiscal year 2007 included the following highlights:

- A renewal of the hospital escalator maintenance contract is currently being negotiated with Kone Elevator Company. Additional performance measures are being added to improve equipment reliability and increase customer satisfaction.
- Additional funding was provided this year for elevator replacements in Hutchins Hall, Dental & Kellogg Institute, Taubman Medical Library, and the College of Pharmacy.

Areas of Improvement

More comprehensive construction inspections are now in place for elevators, dock lifts, dock levelers and other vertical transportation devices during installation and commissioning.

Although the Elevator Shop prides itself in keeping old equipment running, there may come a point when some obsolete parts can no longer be obtained or fabricated, even in our own machine shop.

Reducing construction costs for new and renovated elevator systems is a continuous challenge. General contractors tend to select an elevator installer without soliciting competitive bids from all of our approved installers. The Wolverine Tower elevator replacement project was the first to break the mold. The elevator portion of work was bid to elevator installers while the other electrical, hvac, etc. was bid separately to general contractors. This way we know who is doing the elevator work and at what cost.

Construction cost and life cycle analysis completed for new installation (S. Thayer) and renovation/upgrade (Wolverine Tower) shows the University specified non-proprietary equipment significantly less overall cost than proprietary, manufacturers’ standard equipment. A complete performance based maintenance program was developed for competitive bidding, as has been successfully in use at the Hospital for several years.

**Millwright Shop**

Mission Statement: To maintain comfortable and efficient environment/facilities for the students, faculty, staff and researchers of The University of Michigan.

The Millwright Shop provides the following services to the University community:

- Maintain and repair all types of fans
  - Supply fans.
  - Exhaust fans.
  - Return fans.
  - Fume hoods.
  - Cooling tower fans.
- Troubleshoot, repair and replace electric motors.
- Repair cooling towers.
- Office furniture and equipment installation & repair.
• Repair auditorium and classroom seating.
• Repair window springs, latches, and handles, etc.
• Repair and replace loading docks.
• Lockers repaired.
• Mechanical blackboards and projection screens repaired.
• Window air conditioner maintenance program.

The Millwright staff is now performing preventive maintenance on dock lifts and dock levelers. Occasional greasing and oiling was performed, but not tracked. The Facilities Maintenance PM crew inventories the lifts and levelers while assigning equipment numbers to those without identification. A preventive maintenance schedule is formed in our FMS to be assigned at predetermined intervals.

One area of little notoriety is the Millwrights’ responsibility for maintaining the flags and poles on the central campus Diag and outside the Plant Director’s office. The flags were lowered to half-staff and raised 62 times this past year to honor our country’s deceased by order of the Governor or President.

The truck (ball and pulleys) at the top of the DIAG flag pole was replaced along with the cables this year. The entire flag pole was repainted, too. (front page photo)

Areas of Improvement
The staff survey indicated most hourly staff do not have access to email. We are implementing a pilot program to provide email access to staff before and after work hours, during breaks and during lunch hour just as with the Sheetmetal, Welding and Machine Shop staff.

Roofing Shop

Roofing Shop Sam Hess, Foreman
The mission of the Roofing Shop is to repair, maintain and replace roofing systems to provide a watertight environment for safety and comfort of the students, faculty and staff of the University of Michigan.

We provide complete roofing services consisting of:
• Repairs to any type of roof system.
• Re-roofs from tear-offs to recover.
• New roofs of any type (shingles, slate, tile, rubber, metal, built up, single ply’s of any type, etc.).
• Inspection service for existing roof condition, survey included, during construction inspection of new work and re-roofs.
• Survey includes present condition, test cut information of the system, deck type and building roofing history.
• Water proofing above or below grade as well as inside building.
• Installation of new mechanical units on existing roofs.
• Cleaning of roof drains, roof gutters, and downspouts prior to the winter season.
Bob Brabo, roofer, retired in December of 2006 with over 32 years of service to the University. Ron Hansen, roofer, retired in May, 2007, with over 31 years of service to the University. John McCallum, roofing foreman, retired in April, 2007, with over 24 years of service. Sam Hess was promoted to Roofing Foreman after 14 years of service as a Plant Ops Roofer. The roofing shop continues to increase business to outside contractors to supplement the work load. Outside contractor repairs leveled off the last couple of years from previous years due to the administrative work load necessary to put such work into place.

Many water infiltration issues are related to walls, windows, skylights, and plumbing for roof drains. This work must also be investigated and sent off to the appropriate shop or contractor for correction.

**Areas of Improvement**

Roofing staff performed 773 hours of overtime this year compared with 725 hours last year. Roof inspection work requests are increasing as the struggle between being proactive with inspections and responding to problem leak calls overfills the work schedule.

$6.3 million was allotted for roof replacements at several buildings this year. This is over $5 million more than usual.

The staff survey indicated most hourly staff does not have access to email. We are implementing a pilot program to provide email access to staff before and after work hours, during breaks and during lunch hour just as with the Sheetmetal, Welding and Machine Shop staff.

### Sheetmetal Shop  
**Ralph Rose, Foreman**

Mission Statement: The Sheetmetal Shop supports Facilities Maintenance and Plant Operations in providing the University community with the highest quality customer service and superior craftsmanship to maintain a safe and comfortable physical environment.

**Heating Service**
- Install and service gas fired forced air furnaces and heating units.
- Install and service gas fired water heaters

**Sheetmetal Shop**
- Precision CAD-CAM sheetmetal fabrication and installation
- Fabricate, install or repair architectural, structural or ornamental ferrous and non-ferrous metals such as: duct work, grills, louvers, dampers, machine guards, gutters, flashing, tanks, cabinets, boxes, ventilators, window air conditioners, filter housings, roof vents, sinks, lab hoods, shelving, light fixtures, specialty medical equipment or anything made out of metal.

We are particularly proud of Apprentice Clint Fink who completed his apprenticeship in Fall 2006. Clint did very well with the schooling and his workmanship is outstanding.

**Areas of Improvement**
A common communication goal of the Sheetmetal Shop, Welding & Machine Shop and Millwright Shop involved meeting with Plant Engineering to discuss common communication issues and ways to improve the process. The initial meeting was very beneficial and the process is ongoing.

Heating Service and Hot Water Heater preventive maintenance is being concentrated on this year. The PM has always been performed on heating units, but now preventive maintenance work requests are added to the FMS system for improved tracking and reporting. The increase in rooftop heating units on campus has created a work load and training issue for the sheetmetal shop as a “right-sizing” exercise is performed to validate staffing requirements.

The staff survey indicated most hourly staff do not have access to email. We are implementing a pilot program to provide email access to staff before and after work hours, during breaks and during lunch hour just as the Roofing and Millwright Shop staff.

**Weld & Machine Shop**

**Randy Ramsey, Foreman**

Mission Statement: The Weld Shop’s mission is to maintain and improve a safe and efficient environment for the campus community area through specialized projects and needs in all aspects of metal fabrication.

**Weld Shop**

- Provide assistance in design and fabrication for prototype or research projects and specialty items
- Repair or replace all interior and exterior metals as needed due to damage, weather or wear
- Repair, reconstruct or fabricate kitchen or medical equipment
- Install rigging beams and walkways to aid in gaining or improving access

**Machine Shop**

- Design and fabricate metal and plastic precision and specialty parts and machinery components such as:
  - Student solar car project
  - Student future car project
  - Historical or obsolete components as in the Burton Bell Tower clock mechanisms and the Observatory telescope restoration

**Areas of Improvement**

The Weld Shop received a new steel storage rack for incoming materials. The current receiving and shipping area has been redesigned for a more efficient material flow. Now completed, the area will promote more efficient material handling while more fully utilizing the existing chainfall/hoist system. The ergonomic advantages of this improvement should also reduce staff injuries.

The staff survey indicated most hourly staff do not have access to email. We are implementing a pilot program to provide email access to staff before and after work hours, during breaks and during lunch hour just as the Roofing and Millwright Shop staff.
ACCOMPLISHMENTS FY 2007

- Established new/additional strategic planning goals in all shops based upon B & F and Dennison survey results & incorporated them into existing Shop Business Plans. All shops have "hang tags" for customer service communications.
- Weld Shop Material Rack for structural metals installed to improve material handling ergonomics.
- Performance Plans developed for non-supervisory office staff.
- Work load and backlog analysis completed for all shops.
- Negotiations completed for renewal of hospital elevator contract.
- Negotiations underway to service Hospital escalators in-house.
- Funding established for elevator replacements in Hutchins Hall, Dental and WK Kellogg Institute, Taubman Medical Library and College of Pharmacy. Design and planning underway.
- Funding established for roof replacements in Health Services, Med Sci I and SPH II. Design and planning underway.
- All RMSE shops have been involved with new space and major renovations: Weill Hall, Thayer Building, Walgreen Drama Center, Computer Science Engineering Building
- Roof inspections during construction
- Elevators, dock lifts, dock levelers, other vertical transportation devices during installation and commissioning
- Handle contractor punch list issues on a customer pay basis
- Millwright support of cooling tower issues, non-electrical dock lifts and dock leveler issues.
- Ross School of Business did purchase Proprietary elevator equipment during discussions with an elevator installer even though the installer did not offer a bid for the base required package.
- The Museum of Art addition project contains two new elevators with the normal warranty service removed from the elevator installer’s contract.
- Additional funding of approximately $5 million to replace existing elevator equipment.
Section I: Introduction

The Facilities Maintenance Training & Apprenticeship unit continues to provide for the training needs of the department; coordinating all aspects of the Skilled Trades Apprenticeship program; and collaborating with Plant Academy in diverse ongoing efforts such as the Plant Academy Coordinators (PAC) Team, the Plant Operations Orientation program, the Practical Supervisor Program, and the Institute for Facilities Management program.

This year we addressed changing training demands with new programs, most noteworthy of which was the Customer First! program, assembled by a team of General Foremen, work control coordinators and other staff; a Zero-Based Budgeting seminar, developed with the assistance of the Manager of Plant Administrative Services and an accounting professor from Eastern Michigan University; and training on Coaching, Positive Discipline, and Grievance Handling developed for Plant Academy.

The Training Assistant Associate became full-time in October, 2006, enabling our department to give one person primary responsibility coordinating travel and accommodations to promote consistency and cost efficiencies. Additional new responsibilities this year included support for the Business Continuity / Pandemic Planning Committee, and acquisition and storage of the necessary pandemic supplies.

FM has continued to play an active role in developing a comprehensive Training Administration Compliance System (TACS) for all of Plant Operations. The TACS team has customized and populated a web-based, computerized learning management system called LearnerWeb, which was rolled out in FY 2006. Major progress was made this year in the development of learning tracks for Plant Operations staff.

The Skilled Trades Apprenticeship program remains robust. Four new apprentices were added to the program, bringing us to a total of twenty-two apprentices by year’s end. Looking ahead, tight budgets and external labor market conditions are expected to slow down our hiring of new apprentices and we will experience a modest drop-off in the level of participation in the coming fiscal year.

Tom Sullivan, Training Specialist Senior
Section II: Facilities Maintenance Training

Training & Apprenticeships

Tom Sullivan, Training Specialist Senior
Christine Nedrow, Training Assistant Associate

Section III: Year-End Operational Highlights

Customer Service and Communication

This November, the Facilities Maintenance department unveiled an ambitious new customer communications training initiative entitled Customer First! This highly interactive course was designed to help our point-of-contact maintenance service providers to better serve their customers and to be sensitive and responsive to their needs. The class was developed in response to the results of the Business and Finance Customer Survey and addresses some of the concerns raised in subsequent facility manager focus groups. Approximately 20 sessions of the class were held November through March in order to accommodate 480 key service providers - tradespersons, mechanics, foremen, work control coordinators, and call center staff.

Figure 1 - Lowell Hanson, Dennis Krieg, and Sam Hess discussing how to improve communications with the customer
Staff members exchanged views and received advice on how to maintain relationships with customers, better understand their position, and to communicate positive and helpful information to the customers and to each other. The participants reviewed the importance of providing feedback on work progress, either in face-to-face communications, via email or hangtags, or by updates to POCC. There was a particular emphasis on the critical role of the POCC as the central communications hub, vital to coordinating the work between shops and updating the customers on work progress.

The course included interactive use of case studies taken from actual U-M experiences, with a view towards identifying what excellent customer service looks like, targeting areas for improvement, and outlining a communications protocol expected of all employees.

As a testament to the effectiveness of this training, the Facilities Maintenance Department attained a 10% reduction in customer dissatisfaction from the previous iteration of the Business & Finance Customer Service survey. The Plant Academy Director was so impressed with the class she decided to adapt it for wider use for all Plant Operations units in the coming academic year.

Zero-based Budgeting
With budgets becoming leaner year after year, managers increasingly need financial training to help them analyze and prioritize operational programs when drawing up their budgets. Facilities Maintenance led the way in organizing training on the Zero-based Budgeting (ZBB) Model. This six-hour course, arranged in conjunction with Washtenaw Community College, provided an opportunity for Plant Operations Managers to review the budgeting process, learn about the ZBB model, and apply the concepts to their own budgets. Through this process of discovery and evaluation, the participants obtained a feel for a modified Zero-based model which can be used in the future to analyze budgets or build programs from the ground up.

Coaching, Positive Discipline, and Grievance Handling
The Practical Supervisor series is a certification program sponsored by Plant Academy on the “nuts and bolts” of critical performance areas for Plant Operations Supervisors. Facilities Maintenance Training has collaborated on a module entitled A Supervisor’s Guide to Coaching, Positive Discipline, and Grievance Handling. This module centers on how to use a positive, productive approach encouraging employees to take ownership of performance problems and to participate in their solutions. It serves as both a guideline for new supervisors and a refresher and information exchange for experienced ones.

Plant Operations foremen & supervisors attended six sessions of this training held between October and March, and the course will be repeated twice a year for new supervisors.

Apprenticeship Program
This year three apprentices received promotions to Journeyperson status. These highly-skilled tradespersons have proven their abilities during the course of their apprenticeships, and we expect they will make great contributions in their respective crafts over the course of their careers. The apprentice graduates are:
Four new apprentices were added to the program in FY 2007, bringing the number of active apprentices to twenty-two as we start the new fiscal year. The new apprentices are:

<table>
<thead>
<tr>
<th>New Apprentice</th>
<th>Trade</th>
<th>Department</th>
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</thead>
<tbody>
<tr>
<td>Kevin Kelley</td>
<td>Carpenter</td>
<td>Construction Services</td>
</tr>
<tr>
<td>Brian Morse</td>
<td>Electrician</td>
<td>Construction Services</td>
</tr>
<tr>
<td>Mark Leighton</td>
<td>Electrician</td>
<td>Facilities Maintenance/ UPE</td>
</tr>
<tr>
<td>Ted Dwornick</td>
<td>AC and Refrigeration</td>
<td>Facilities Maintenance</td>
</tr>
</tbody>
</table>

Due to current labor market conditions, the IBEW Local 252 Apprenticeship Training Program recently decided not to take in a first year class in 2007, thus putting our plans for hiring two new Electrical Apprentices on hold. A new Elevator Mechanic apprentice is due to start in the 1st quarter FY 2008, but this will not be sufficient to offset the anticipated four apprentices that will complete the program during the fiscal year. Nonetheless, there are nearly twice as many active apprentices than were in the program at the end of FY 2002.
The Joint Apprenticeship Committee (JAC) continued with our streamlined selection process and interviewed 27 candidates for apprenticeships. We are reaping significant savings in time and costs for the selection committee having one annual posting period rather than separate postings for each opening.

Safety Training
Facilities Maintenance continued with robust safety training this year, including the Annual Safety Refresher training; New Employee Safety Orientation; Fall Protection / Scaffold Safety; Confined Space Entry Initial and Refresher Training; as well as others listed below in more detail.

High Voltage Safety Training
A major safety training initiative for the Electrical Shops, initiated in FY 2006, continued this year with the provision of a 30 hour Electrical Safety for Industrial Facilities training class for high-voltage electricians, foremen, and electricians in the high-voltage cross training program. The objectives of this course, presented by an AVO Training Institute trainer over three and one-half days, are to enable the participants to work safely around metal-clad switchgear, industrial substations, motor control centers and facility electrical systems; use safe practices for working on or near energized and de-energized electrical systems; and to properly install temporary grounding for personal protection.

The presentation of a course of this length and level of detail reaffirms Plant Operations’ steadfast commitment to worker safety. By combining efforts with IBEW Local 252 in scheduling multiple sessions of this class, our department was able to provide this training for 32 Facilities Maintenance, Hospital Maintenance, and UPE electricians and foremen at a per person savings of over 50% of the cost of having the training onsite, and without interruption of service to the campus.

Trenching & Underground Safety
Employees from a variety of shops attended a four-hour workshop on Excavations, Trenching & Underground Safety co-sponsored by Washtenaw Community College and MIOSHA Consultation Education & Training Division.

Confined Space Entry Safety Training
Sixteen Plant Operations employees received the full Confined Space Entry Certification training in two sessions held this year, bringing the total of active employees with this training to 212. An additional four employees received refresher training on this topic.

Technical Training Programs
Because of ever-changing technology and the increased complexity of building systems, technical training sessions are frequent and too numerous to mention here. Our aim is to target training to meet priorities established by the employees’ skills assessments. Classes that can be provided to employees from a variety of shops and classifications are an efficient way to meet these needs. A noteworthy example is the Bearings, Belts, and Sheaves 101 class provided to a wide audience of Maintenance and Trades Mechanics held on-site in May and to be repeated in
August. Other more specialized training efforts this year include NFPA 72 Fire Alarm Systems, Portable Generator Operator training and field testing; Microprocessor Fire Pump Control Panels; Kitchen Fire Suppression System Servicing; and DOT Hazmat & Fire Extinguisher Maintenance and Hydrotesting.

A wide variety of Maintenance and Trades Mechanics attended the Bearings, Belts, & Sheaves 101 seminars provided on-site by bearing & belts industry experts.

**BOMI Certification**

At this writing, we have completed the third of the five semesters of *BOMI Systems Maintenance Technician Certification* courses. These courses are sanctioned by the Building Owners and Managers Institute (BOMI), an internationally recognized leader in commercial property education, and will run through April 2008. More than 20 employees each semester are studying Electrical Systems and Illumination; Air Handling, Water Treatment, and Plumbing Systems; Boilers, Heating Systems, and Applied Mathematics; Refrigeration Systems and Accessories; Energy Management and Controls; learning how to maintain energy-efficient and cost-effective building systems. Successful participants in these programs will receive 10 college credits in addition to the SMT certification as maintenance professionals.

**Building Systems Owner Training for New Construction**

Extensive new construction on the campus continues unabated and provides us with opportunities to provide owner operation and maintenance training on new building mechanical, electrical, and architectural systems. This system training gives our service technicians an opportunity to stay abreast of new technology. The cost of providing this training is included in the construction project. Noteworthy projects this year included the School of Public Health; Weill Hall; Church Street Parking Structure; Walgreen Drama Center; EECS; Arbor Lakes, and the Michigan Academic Computing Center.

**Training Administration & Compliance System Project**

The Facilities Maintenance Training function serves an essential role in the Training Administration & Compliance System (TACS) project. The Training & Apprenticeship Coordinator and the Training Assistant are serving as the TACS representatives for Facilities Maintenance, Hospital Maintenance, Work Control, and U&PE electrical & engineering units.
This project has been tasked with developing a web-based learning management system for Plant Operations Employees to help supervisors identify and prioritize training needs in order to more effectively allocate training resources and ensure compliance with regulatory training requirements. The end product will allow training to be targeted to the knowledge and skills required for competent job performance.

Our major accomplishment this year was the development of employee learning tracks - a challenging task due to the large number of distinct job classifications and the relative complexity of the Facilities Maintenance skilled trades and service maintenance staff training needs.

Learner Web is being used to track compliance with Safety training requirements, including orientations, annual refreshers, and monthly safety meetings. This data will be used to determine which departments qualify for awards under the standards of the newly-revised, proactive Safety Incentive Awards Program adopted for FY 2008.

Looking Ahead to FY 2008
Beginning with a repeat for the afternoon shift of the *Bearings, Belts, and Sheaves 101* workshop, we will hit the ground running in FY 2008. In August, we will see the introduction of another major, multi-trade seminar on *Rigging & Load Distribution* workshops, as well as the start of the fourth of five *BOMI Certification* courses.

Shortly afterwards, we will introduce a *360 Degree Evaluation* tool for all Facilities Maintenance supervisors, in an effort to improve communications between employees and supervisors. FM Training will coordinate training for the new *Facility Max* HR software as it is introduced in the Fall.

Other major training campaigns this year will include an *Electrical Safety & Arc Flash* training seminar for nearly 400 electricians and mechanics. And finally, with the adoption of the 2005 National Electric Code in November, 2007, we will be holding the *NEC Code Update* training throughout 2008.
Section I: Introduction

As a whole, 2007 was a year of transition for the Zone Shops. We lost two foremen from Zone Shops and went for extended periods of time with interim supervisors in place. In January, the Business Manager, Jim Almashy, took a position in the College of Literature, Science & Arts. Under Jim’s leadership, many good things happened within the Zones and when he departed, we were in better shape than when he came.

Lee Lambarth, South Zone Shop returned to lead the High Voltage Electrical Shop. We know he returned to the area he will likely have the biggest impact for Plant Operations. Since Lee’s departure, we’ve used the South Zone foreman position as the testing ground for a potential “foreman-in-training” program. We’re anticipating potential retirements in various areas in Facilities Maintenance. To be ready, we hope to have a few potential supervisors prepared, ready to go when the need arises. Andrew Strobl was designated as the latest interim to fill the supervisor role in the South Zone finding the role of a supervisor to have many challenges.

Jim Vibbart came on board with the Zones after heading up Work Control for several years. His past experiences with the Zones allowed him a quick start. We spent April through June looking at a variety of practices and processes working hard to reduce the projected budget deficit. Zones ended the fiscal year $400,000 over budget. We’ll be using the 2008 fiscal year to bring our budget back in line.

Organizationally, the Key Office and Door Closer Shop (M8XXX) moved to the Zone Maintenance Group in April. This move has brought a closer relationship between the Key Office and the Zone Maintenance groups and should allow us some synergistic opportunities in the future.

Jim Vibbart
Business Manager
Zone Maintenance Organization Chart

Zone Maintenance

Chemistry Zone

Fire Extinguisher Shop

LS&A Zone

North Campus Zone

Off Site Zone

Dental School Zone

Electrical Alarms & Radio Shops

Life Science Zone

Medical Zone

North Campus Zone II

South Campus Zone

Key Office
Section III: FY 07 Financial Summary

The Zone Maintenance group ended FY07 4.5% over budget ($402,798). It is difficult to single out any one area as the cause of this problem, rather, nearly every shop finished either over budget or very close to it. In reviewing the budget information provided below, it is obvious that excessive labor expenditures were the reason the Zones went over budget. Each Zone Shop made a valiant effort to reduce spending (eliminated temporary workers, reduced or delayed purchases, deferred work, etc.) in the last three months of the fiscal year and we finished the year somewhat below the overdraft that had been projected.

In early FY 07, Zone Maintenance underwent a rigorous University audit. This audit revealed inadequate financial training among supervisors and inappropriate purchasing activities which have since been addressed. Since April 2007, the Zone Shops have initiated additional financial training for the foremen and implemented new business processes to improve the Zones’ financial performance for FY 08. In FY 08, the Zones will closely monitor the labor charges to the General Fund.

<table>
<thead>
<tr>
<th>Zone Maintenance</th>
<th>General Fund Budget</th>
<th>FY 07</th>
<th>Beginning Budget</th>
<th>Ending Totals</th>
<th>Remaining Balance</th>
<th>Under/Over</th>
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<tr>
<td>Labor</td>
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<td>($381,085)</td>
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<td>($402,798)</td>
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</table>

Section IV: Year-End Operational Highlights

The PM program continues to evolve in Zone Maintenance and appears to be making a significant difference in the number of corrective repairs and catastrophic failures that we’ve experienced in the past. This year the Zones as a department completed 95.5% of the assigned PM work, that’s a 3.93% increase over FY 2006.

<table>
<thead>
<tr>
<th>PM Completion Rate by Zones</th>
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<tbody>
<tr>
<td>M2050 Fire Extinguisher</td>
<td>94.65%</td>
</tr>
<tr>
<td>M2100 South Campus</td>
<td>92.09%</td>
</tr>
<tr>
<td>M2200 North Campus</td>
<td>95.29%</td>
</tr>
<tr>
<td>M2250 North Campus II</td>
<td>97.24%</td>
</tr>
<tr>
<td>M2300 Medical</td>
<td>94.43%</td>
</tr>
<tr>
<td>M2400 SPH &amp; Dental</td>
<td>96.74%</td>
</tr>
<tr>
<td>M2500 LS&amp;A</td>
<td>98.01%</td>
</tr>
<tr>
<td>M2600 Chemistry</td>
<td>93.12%</td>
</tr>
<tr>
<td>M2900 LSI</td>
<td>99.02%</td>
</tr>
</tbody>
</table>
Overall, the PM effort in all of Zones Shops was outstanding! Over the next year, we’ll be working with Work Control to bring other areas of Zone Maintenance, primarily the Fire Protection Shop, into the PM program.

**Electrical Alarms & Radio Shops, M2001**  
John Birkle, Foreman

The Alarm Shop is divided into three distinct groups: electronic and radio repair; fire alarm testing and repair; and mechanical fire pump testing, valve inspection, and fire piping repair. Much of the work is mandatory testing of fire alarm systems for Housing dormitories.

This shop has been extremely busy this fiscal year with the testing and inspection of new buildings. The Walgreen Drama Center was one of the major new buildings completed in ’07 along with several major renovation projects in various buildings.

The Alarm Shop underwent a rather painful change in leadership in the fall of 2006 and it took the rest of the year to recover from the loss. In the interim period, the staff did an outstanding job of staying on task and attending to their work. In particular, Chris Berry and Dan Black provided leadership at a critical time. The shop also spent time reviewing their purchasing practices and there have been some changes as a result. This effort helped to simplify what material is purchased and through which vendors we procure items. We expect the reduced cost of materials will help support the purchase of items that are much needed in the daily operation of the shop.

**Areas of Improvement**

NFPA mandates that every building fire alarm system be inspected and tested annually. While we planned to attend to this in 2007, in the coming year we will focus on improving our fire alarm testing programs by including them in the PM program. We also need to take advantage of existing technology available to us within each of the new fire alarm systems to increase our efficiency.

**Fire Extinguisher Shop, M2050**  
John Hirsch, Supervisor

This unit was initially tasked with the inspection of over 10,000 fire extinguishers. Due to the efforts of the shop staff, that inventory has been refined and reduced to approximately 8000 units today, with more reductions in the future as we bring the campus more in line with the requirements of NFPA 10.

In addition to the two AFSCME regular employees, we utilize U of M students for the additional labor needs in the inspection program. During the school year, we hire five work study students. The students have been able to inspect approximately 75% of the fire extinguishers in General Fund buildings on campus, every month. Access to secured spaces is preventing our department from reaching the 100% goal. In late FY 07, we set a goal of having every extinguisher on campus updated prior to the end of FY 08.
Areas of Improvement
The department plans to expand into a number of different areas. The first will be the inspection, testing, and certification of Ansul Fire Suppression hood systems. Another goal is to develop plans for all buildings, showing the locations of all the fire extinguishers, on each floor.

South Campus Zone, M2100
Andrew Strobl, Interim Foreman
M2100 is a 16 person shop with 6 skilled trade, and 9 AFSCME employees. The primary mission of the group is preventive and corrective maintenance of 40 classroom and administrative buildings totaling 2,289,223 square feet, along with the coordination, and manning of small electrical construction projects on Central Campus with Turner Electric temporary staff, as needed.

Since July 2006, the new construction of the new Ross Business School continues. The Zone has taken over responsibility for Weill Hall, also part of the Business School area. M2100 continues to meet customer needs pertaining to the small electrical construction projects throughout central campus.

Areas of Improvement
Some small training classes have been well attended by many Maintenance Mechanics that included a class on “Belts and Bearings” and a “Lock-tite” seminar.

We continue to support the special events and provide several employees for the many projects. We helped apply plywood to the stadium floor for commencement activities on the football stadium field.

Work Control auditors have inspected most buildings in the South Campus Zone and targeted many areas for improvement. Those areas are being addressed so when our next review comes along, we will meet or exceed the standard of Preventative Maintenance in those areas.

North Campus Central Zone, M2200
Doug Good, Foreman
M2200 maintains 1,175,480 square feet with 4 skilled trades and 4 maintenance mechanics. The focus in this zone like all others is preventive and corrective maintenance. This year the group completed 95.29% of the required PM work, slightly better than FY06.

In FY 07, we added the Walgreen Drama Center to our list of responsibilities. This building has a variety of maintenance challenges, but we’re excited to be a part of this new performance venue for the University of Michigan.

Areas of Improvement
The biggest area of improvement with the Zone split will be developing more one-on-one relationships with facility managers and customers on North Campus. We’ll also work hard to keep our expenditures in line with our budget.
North Campus II Zone, M2250  Joel Foos, Foreman
This zone maintains 25 buildings totaling 1,683,970 square feet of lab and classroom space. There are 6 maintenance mechanics, and 3 skilled trades working out of the shop. The mission of this shop is preventive and corrective maintenance, and the coordination of small electrical construction projects on North Campus. The shop is located in room 2912 of the Computer Science Building.

One significant portion of our work is maintaining the Gerald R. Ford Presidential Library. In addition to monitoring all of the Plant Operations work going on in this facility, we oversee the annual maintenance budget for Plant Operations. We’re also responsible for sending a variety of reports to managers in Grand Rapids, MI, that oversee this building.

Areas of Improvement
With the creation of Zone M2250, we have been able to build upon and improve our one-on-one relationships with building facility managers. In FY 08, the shop will, for the first time, have a budget in place to cover its activities for a full fiscal year. We’ll be monitoring that budget to make sure we stay at or below budget.

Medical Zone, M2300  Gerry Heath, Foreman
The Medical Zone has a 13 man crew with 6 skilled trades and 7 maintenance mechanics. They maintain approximately 1,639,086 square feet of laboratory, and classroom space.

This year has been a busy year in the Medical School with many departments moving from the Medical Science Research Buildings into the brand new Biomedical Sciences Research Building. When the occupants move out of the MSRB’s, other departments move in from the Kresge Complex which is slated to be demolished next year. Medical Science I and Medical Science II have entire floors being updated and the Med Zone crew has been busy with the contractors helping them with shutdowns and serving as consultants as to what should be repaired and what should be replaced during the process. The purified water system in Med Sci II was replaced as a result of our input when we discovered the designers intended to leave it in place -- so our advice was well received and taken. Because of all the construction, we will be facilitating a lot of moves over the coming year.

The PM team completed over 95% of their required PM work - a significant increase over last year and it is starting to have an impact reducing the daily work load of the Med Zone staff.

Areas of Improvement
The plumbers in the Med Zone have entirely replaced the old galvanized metal piping for the domestic hot water systems in MSRB I and II with new copper piping because we were having many leaks on the old system. This was a collaborative effort between Facilities Operations and Facilities Management at the Med School.

The emergency lighting system in the Med Zone has had a thorough going over with one man dedicated to replacing and repairing all emergency lights and exit lights throughout the school.
By adjusting staff shifts, allowing some staff to work four-10 hour days, and working more closely with lab personnel, many of the shutdown issues have been resolved with most shutdowns now occur on regular time, before building occupants arrive for the day.

**Dental Zone, M2400**

**John Hirsch, Foreman**

The Dental Zone is approximately 1.6 million square feet of museums, office space, and student recreational facilities. The facilities are maintained with 6 AFSCME employees and 4 skilled trades. For the past year, we’ve been kept busy dealing with various aspects of the Dental School fire protection upgrade.

**Areas of Improvement**

Many of the facilities in this zone are older, and many of the mechanical and electrical systems are maintenance challenges. In the Dental School, for example, suction pumps have been replaced and the old pumps are in the process of demolition. The vacuum system is still limping along and the building drain piping is a continual source of problems. Thankfully, a capital project is underway to replace the main drain piping and, when complete, will reduce this maintenance burden.

**LS&A Zone, M2500**

**Chuck London, Foreman**

The LS&A Zone shop consists of 4 skilled trades and 9 AFSCME maintenance mechanics. The primary mission of the Zone is preventive and corrective maintenance, and Special Events. The Zone is approximately 2,145,878 square feet of class room space.

This was another successful year of coordinating over one hundred special events ranging from Art Fair to both Winter and Spring Commencements.

**Areas of Improvement**

M2500 continues to find new ways to save the University special events dollars. We’re also working to better monitor our general fund budget to make sure we stay at or below budget. One way we’ve been able to reduce costs is through hiring one carpenter, working out of M2500, who covers several other Zone Shops. When needed, the M2500 carpenter is dispatched to the other shops to complete work they have for a carpenter.

**Chemistry Zone, M2600**

**Ron Sweeny, Foreman**

The Chemistry Zone has been in service since 1992 and is operated with four skilled trades and eight AFSCME maintenance mechanics. One maintenance mechanic III covers the entire campus on the midnight shift, one electrician covers the entire campus on the afternoon shift and one maintenance mechanic I covers the entire campus on the Sunday day shift.

The Chemistry Zone is responsible for approximately 2,247,363 square feet of classrooms and laboratories. Many of the buildings in the Chemistry Zone are very old and require a lot of care, especially the plumbing, heating and cooling systems. Within the Chemistry Zone reside some very prominent buildings on the University campus including Hill Auditorium, Rackham building, and Burton Tower.
During FY 07, the Thayer St. building was completed, and is now fully occupied. This year marked the end of the Frieze building. The building has been completely razed.

Areas of Improvement
The Chemistry Zone continues to make significant improvements in almost all of their Performance Measurement Reports, especially in Turn Around Time, and PM Completions. They made these improvements while almost eliminating shop overtime by using flexible schedules.

Off Site Zone, M2700  Jeff Bolgos, Supervisor

The E.S. George Reserve consists of approximately 1400 acres and is located near Pinckney, Michigan. The Museum of Zoology is the primary user of the property and Plant Operations is responsible for the maintenance of roads, fences, and buildings on the site. In addition, the Radio Astronomy on Peach Mountain, the W.U.O.M. Radio Transmitter, Newcomb Tract, and Stinchfield Woods are also part of the off-site properties.

At the end of FY07, ownership of the 172-acre Fresh Air Camp was turned over to University Hospital. When the property has been developed for other uses, perhaps we will be able to once again maintain this property.

Areas of Improvement
Overall the conditions of the buildings on the Reserve must be addressed. We will be compiling a list of potential projects and working with the College to address them in FY08 and beyond.

Life Sciences, M2900  Jim Barnes, Foreman

The Life Science zone continues to grow in work load. Our present responsibilities include the Life Sciences Building, Palmer Commons, Undergraduate Sciences Building, Bioscience Research Building, Public Health 1 and 2, Observatory Lodge, and Arbor Heights. We also provide the necessary preventative maintenance for three parking structures located near our Zone.

Much has been learned about all the new buildings and how they operate over the past year. We are now in the early learning stage for Public Health Tower, Public Health 1 renovation and the newly renovated Observatory Lodge. A lot of communication is needed by everyone involved to keep everyone informed on building problems and warrantee issues.

Areas of Improvement
We are always looking for new ways to improve our work process and improve customer service. Our goal is to maintain or improve our PM completion rate of 99%.