

Fermilab

Self Assessment FY2003

November 15, 2003

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Fermilab Mission Statement

“Fermi National Accelerator Laboratory advances the understanding of the fundamental nature of matter and energy by providing leadership and resources for qualified researchers to conduct basic research at the frontiers of high-energy physics and related disciplines.”

Science

Objective 1: Advancement in the understanding of the fundamental nature of matter and energy.

Indicator 1: Success in producing original, creative scientific output that advances fundamental science and opens important new areas of inquiry.

Scientific output from the laboratory includes the introduction of scientific instruments and the scientific results there from.

The new phase of the running of the Tevatron, that is called Run II, has been established. The first results from these data, with probes of the parameter space of new theories surpassing the previous understanding have been shown at conferences.

The MiniBooNE detector has started operations and the first results from this experiment that is looking for neutrino oscillations suggested by a previous experiment at Los Alamos have recently been shown at a conference. The Far Detector for the two-detector MINOS Neutrino oscillation experiment started taking data. It can distinguish the charge of the muons produced in neutrino interactions and so introduces a sensitivity that no previous “atmospheric neutrino” experiment enjoyed.

The Auger experiment in Argentina that is managed from Fermilab, started taking data with the engineering array.

Over the last decade, only six papers presenting experimental results from accelerator-based particle physics experiments worldwide are cited more than 500 times in the SLAC Spires database. Three of these six papers come from Fermilab experiments.

In the particle astrophysics arena, Fermilab physicists were lead authors on a paper that indicates that there may be a distant band of stars around our galaxy, the Milky Way. This band may be an indication of the distribution of dark matter within the galaxy. In addition from the data taken, the Sloan Digital Sky Survey collaborators have published 141 papers and the public using the SDSS data has published 59 papers.

In the year ending June 1, 2003, 30 graduate students completed Ph.D.s. for research at Fermilab. Of these 10 were from foreign institutions. Most of these degrees were awarded for particle physics research.

Metric A.1.1.1.1 is rated **Outstanding**

Indicator 2: Success in achieving sustained progress and impact on the field.

The central role of Fermilab in the field of particle physics is demonstrated most clearly by the continuing growth in the number of particle physicists who choose to conduct their research at Fermilab. There are many exciting opportunities for research, and most particle physicists are in a position to choose the

opportunity in which they will be most productive scientifically. In the official 1995 survey conducted for the DOE and NSF by the Division of Particles and Fields of the American Physical Society, 1665 experimental particle physicists responded to a question asking on what experiment they did their research. 921 of those 1665 physicists named a Fermilab experiment.

The number of particle physicists working at Fermilab has continued to grow in recent years. The total number of Ph.D. scientists using Fermilab as their primary research facility numbers about 1916, of whom 1163 are from U.S. institutions. This compares with 2500 Ph.D. experimental particle physicists in the 2002 census. In addition 699 students are doing their research at Fermilab. A large fraction of the scientists working at Fermilab are members of the two collaborations working at the Tevatron. The D0 collaboration consists of 508 physicists from 74 institutions in 18 countries plus 139 students. The CDF collaboration consists of 454 physicists from 56 institutions in 12 countries plus 266 students. About 45% of the D0 collaborators and 40% of the CDF collaborators are from foreign institutions.

The Tevatron will remain the only collider addressing the issues at the energy frontier until the LHC starts producing physics results at CERN, no earlier than 2008. The recent HEPAP subpanel described the role of the Tevatron collider program in the field of particle physics: "The energy frontier is at the very center of our roadmap. For the immediate future, the Tevatron collider will remain the world's highest energy accelerator. Its CDF and DØ experiments have embarked on Run II, pursuing a rich physics agenda that includes the search for the Higgs and supersymmetry, studies of CP violation, and the first detailed examination of the top quark." HEPAP recently reiterated this view. In transmitting the recent recommendations of the Particle Physics Projects Prioritization Panel, they wrote " The Run II program addresses the most fundamental questions of particle physics and the Tevatron will be the forefront facility in high-energy physics, not just nationally but worldwide, for most of the decade.

Metric A.1.2.1.1 is rated **Outstanding**

Indicator 3: Recognition from the scientific community, including awards, peer-reviewed publications, citations, and invited talks.

Through the first 9 months of calendar year 2003, scientists affiliated with Fermilab have published 137 scientific papers in journals: 43 on experimental physics, 73 on theoretical physics, and 21 in instrumentation. By far most of these were published in the primary peer-reviewed journals for particle physics: 16 in Physical Review Letters, 40 in Physical Review, 14 in Physics Letters B, 5 in Nuclear Physics, 23 in Nuclear Instruments and Methods, 4 in Physical Review Special topics, 9 in Astrophysical Journal and 3 in Astronomical Journal. Fermilab produced another 370 papers so far this year, including 26 Ph.D. theses, many of these submitted to the arXiv.org e-print archive that has become the standard means for rapid distribution of new physics results, and some to conference proceedings.

The principal conference for our field in 2003 was the Lepton Photon Symposium at Fermilab. Six of the twenty six plenary talks on experimental particle physics were given by affiliates of the Fermilab program: Deborah Harris, Fermilab and MINOS on future neutrino experiments; Patrizia Azzi, Kevin Pitts, and Michael Schmitt, from CDF; Emanuelle Perez and Terry Wyatt, D0; Jussara de Miranda, E-791.

The 2004 APS Panofsky Prize for Experimental Particle Physics was awarded to Arie Bodek "For his broad, sustained, and insightful contributions to elucidating the structure of the nucleon, using a wide variety of probes, tools and methods at many Laboratories"; the tools included neutrino experiments at Fermilab.

The APS Fellows (0.5% of current APS members selected each year) appointed in 2004 included: Marcela Carena, Andreas Kronfeld, Nikolai Mokhov, and John Womersley, Fermilab, Janet Conrad,

Columbia and Fermilab experiments NuTeV and MiniBooNE, Peter Meyers, Princeton and Fermilab experiment MiniBooNE, Harrison Prosper, Florida State and Fermilab experiment D0.

The 2004 APS Apker prize for undergraduate research was awarded to Peter Onyisi, University of Chicago and Fermilab experiment CDF.

Metric A.1.3.1.1 is rated **Outstanding**

Objective 2: Successfully construct and operate research facilities

Indicator 1: Construction and commissioning of new facilities on time and within budget; achievement of facility performance specifications and objectives.

Fermilab had several projects underway in FY2003; the status of some examples is given below.

NuMI Project

FY2003 has been another very successful year. Overall NuMI is now 92% complete, significantly advanced from 71% at the start of the year. The project remains on the re-baselined budget and schedule (TPC of \$171.4M, CD4 due September 2005). The Far Detector at Soudan is complete and recording data on atmospheric neutrinos. At Fermilab the outfitting contract is proceeding well and as September ends we are three weeks away from an on-time delivery of the Target Area. Installation in the MI continues successfully. Technical component fabrication proceeded on schedule throughout the year. In preparation for physics running after project completion, MI studies resumed and will continue after the shutdown. The Near Detector planes are completely fabricated and are awaiting installation in the MINOS Near Detector hall early in 2004.

All six DOE milestones for this project due in FY03 were met well ahead of schedule along with two due in FY04 that are already complete. One year ago the project forecast project completion (CD4) on February 25, 2005. Today CD4 completion is forecast on February 4, 2005. During FY2003 over \$30M of work on the NuMI project was accomplished. The project drew \$1.7M of contingency, \$13.5M remains.

This progress is monitored by the directorate through regular PMG meetings, periodic director's reviews focusing especially on installation, and weekly meetings with the project management. The project status continues to be "satisfactory".

Metric A.2.1.1.1 is rated **Outstanding**

US-LHC Accelerator Project

Good technical progress continues across the Project. All equipment to be supplied for the LHC - IR quadrupoles, beam separation dipoles, IR absorbers, and IR feedboxes - are in production, and testing of cable at BNL for the main LHC magnets is proceeding at essentially the planned rate. Based on an earned value of \$94.3M, the Project is 89% complete as of the end of FY2003. The EAC is \$108.0M, and the contingency is 19% of the estimated cost to complete the Project. Overall, the Project is slightly behind schedule, but we still project that we will deliver all equipment in advance of CERN need dates and before the end of FY2005. Delay by CERN in sending tested correctors needed to complete the Fermilab IR quadrupole assemblies is a concern that is being dealt with actively.

Metric A.2.1.1.2 is rated **Outstanding**

US-CMS

The US-CMS Project continues to make excellent progress. During the past year the installation of components in the surface area of Point 5 of the LHC in France has commenced. It appears as though this installation is being spearheaded by the US-CMS since the first components available are from the US. As the components are installed, they are tested with moveable Data Acquisition components.

The cost performance has been good and has permitted the project to undertake some scope replacement. Initially this involved reinstating some inner layer muon chambers in the high occupancy region near the beams. Of the projects with some way to go, the Silicon Tracker assembly work, for the Tracker Outer Barrel, and the Pixel detector, the former has been hampered by late delivery of parts from collaborators in Europe.

Overall, the project is 79% complete with 49% contingency on the work remaining. Both costs and schedule performance measures are within the acceptable range.

Metric A.2.1.1.3 is rated **Outstanding**

Indicator 2: Reliability of operations and adherence to planned schedules for accelerator run hours and delivered integrated and peak luminosity.

Accelerator Complex Performance Measures

The unscheduled down time for the accelerator complex was 15.5% during FY2003, well within the goal of 20%. The cumulative store time for the collider was 3556 hours, which for Metric A.2.2.1.1 gives a grade of **Outstanding**. The total up time (store hours, shot setup and accelerator studies combined) was 5366 hours for that same period.

Metric A.2.2.1.1 is rated **Outstanding**

The peak luminosity averaged over 20 consecutive stores exceeded $4 \times 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$ at times. The typical weekly-integrated luminosity over the latter part of the year was 6.5 pb^{-1} . The peak weekly integrated luminosity was 9.7 pb^{-1} that equates to a grade for Metric A.2.2.1.2 of Excellent. The cumulative integrated luminosity for the fiscal year was 239.9 pb^{-1} , which is classified as Outstanding for Metric A.2.2.1.3. A detailed plan for FY2004 has been developed which takes into account the planned shutdown periods and the need to allocate time to commissioning the Recycler machine.

Metric A.2.2.1.2 is rated **Excellent**

Metric A.2.2.1.3 is rated **Outstanding**

Accelerator Performance Self-Assessment

The Fermilab accelerator complex was operated in support of both the Tevatron Collider (Run II) and the short-baseline neutrino (MiniBoone) programs in FY2003. The Tevatron Collider operated at a center-of-mass energy of 1.96 TeV throughout the year. Total integrated luminosity delivered was 239.9 pb^{-1} to each of the (CDF and D-0) detectors. Operations in support of MiniBoone were based on 8 GeV protons delivered directly from the Booster to the MiniBoone production target. The total number of protons delivered to MiniBoone was 1.5×10^{20} .

Assessment of Run II Accelerator Performance

At the beginning of FY2003 Fermilab established “base” and “stretch” goals for delivered luminosity of 200 pb^{-1} and 320 pb^{-1} respectively. The actual delivered luminosity was 239.9 pb^{-1} . This was achieved

with three additional weeks of scheduled operations relative to the original plan (implemented by delaying the fall accelerator shutdown).

Luminosity performance within Run II as a whole has failed to meet expectations established prior to the initiation of the run. Reasons for the shortfall derive from both technical and management difficulties. A great deal of effort has been expended over the last year in identifying problems, implementing solutions, and integrating laboratory-wide effort. The result has been creation and initial implementation of a comprehensive plan for achieving realistic performance goals given available resources. This has been accompanied by a renormalization (downward) of long-term luminosity goals.

Technical Issues

Technical issues are related both to peak luminosity performance and to the reliability of the accelerator complex. Over FY2003 reliability was better than anticipated (79 hours of luminosity/week actual, 69 hours/week planned, base). However, luminosity performance was not as good (67 nb⁻¹/hour actual, 75 nb⁻¹/hour planned, base). The additional three weeks of scheduled running (45 weeks actual vs. 42 planned) were a program planning decision, not the result of improved reliability.

Responsibility for overall collider reliability has been assigned to the Beams Division Associate Head for Engineering. Primary components of the accelerator complex reliability program include:

- Scheduled preventative maintenance on systems that can be maintained without disruption to collider activities.
- Review and analysis of every failure that causes a subsystem downtime of greater than 5 minutes (this includes premature termination of a collider store as a subset).
- Specific attacks on systematic or repeat offenders among the downtime generators.
- Specific attacks on systems identified as representing major vulnerabilities in the case of failure.
- One major annual shutdown for implementation of accelerator improvements and repairs accumulated over the year.
- Run-to-failure philosophy during the balance of the year.
- Preventative maintenance during periods of unscheduled downtime or when delay is no longer viable.

The run-to-failure philosophy has been utilized for the last 15 years within the complex. Experience has shown that better performance is achieved in this manner than through scheduled weekly (or bi-weekly) down periods. This is because the complexity of collider operations results in a several day recovery period for performance following a (short) maintenance period. Several systems were specifically dealt with in FY2003 under the aegis of “systematic or repeat offenders” or “major vulnerabilities” including:

- VFC (voltage to frequency convertor) cards
- Cryogenic engine rebuilds
- Linac power amplifier tubes

This approach will be continued in the following year with the addition of initiatives to improve configuration control within the complex.

Peak luminosity performance in FY2003 improved significantly over the course of the year (by roughly a factor of two) but remained 10-15% lower than anticipated in the base plan. The shortfall was primarily related to larger beam emittances in collision and poor antiproton transmission efficiency from the Antiproton Source to collisions. Major issues that were dealt with included:

- Antiproton transfer efficiency
- Antiproton emittance dilution

- Proton and antiproton lifetimes at 150 GeV
- Proton beam instabilities in the Tevatron

Significant progress was made in all areas with the exception of antiproton emittance dilution during the Main Injector to Tevatron transfer. Unresolved issues will continue to be pursued in FY04.

Management and Organizational Issues

Management and organizational issues have also contributed to difficulties in Collider Run II. Major issues identified include:

- Less coherence in Beams Division planning than demanded by the situation
- Difficulty in integrating help from outside the Beams Division
- Lack of coordination between the accelerator and the experiments

A major reorganization of the Beams Division was undertaken in FY2003 to address the needs for improved performance over both the short and long term. Included are:

- Appointment of a new Beams Division Head and Deputy Head
- Creation of the position of Associate Division Head for Accelerators
- Creation of the position of Assistant Division Head for Instrumentation and Controls
- Creation of the position of Assistant Division Head for Run II Upgrades
- Creation of a stand-alone Instrumentation Department
- Creation of a stand-alone Recycler Department

These changes were all aimed at creating within the Beams Division the capability to simultaneously plan for and execute short-term operations and long-term upgrades strategies. The above organization was fully in place by July and over the last quarter of FY2003 demonstrated an improved ability to work together on stabilization of operations, development of a comprehensive plan for accelerator upgrades over the next four years, and successful integration of significant effort from outside the Beams Division.

In parallel laboratory management undertook several initiatives with the goal of strengthening oversight and fostering intra-laboratory cooperation and communication. Examples include:

- Established a monthly Run II Strategy Meeting including representatives from the CDF and D-0 collaborations, the Beams Division, and the other scientific divisions within the lab. This meeting sets short term operating strategy.
- Established a Run II Project Management Group, which meets monthly, to monitor development and execution of the Run II Upgrade Plan.
- Established a Run II Advisory Committee to advise the Director on strategies. This meeting was abandoned after roughly six months when it was not deemed effective.
- Initiated a daily meeting within the Beams Division to stabilize operations and implement short term improvements.
- Established a Run II Task Force, meeting bi-weekly, to assist the Director in evaluating effectiveness of the Run II effort.

The first and fourth of these appear to be particularly effective. With the exception of the Advisory Committee we anticipate continuation of these meetings in the coming year. All meetings will be evaluated periodically for effectiveness.

Assessment of Accelerator Performance in Support of MiniBoone

During FY2003 the Booster delivered roughly 1.5×10^{20} protons to the MiniBoone target. This compares with a laboratory goal of delivering at least 5×10^{20} protons by the start of NuMI operations in early 2005. Roughly 80% of the protons accelerated in the Booster in FY2003 were delivered to the MiniBoone target with the other 20% sent to the antiproton production target.

The primary issue related to support of MiniBoone is the ability of the Booster to deliver high average intensity. In FY2003 Booster hardware was upgraded to support operations at up to 7.5 Hz. Actual operations were closer to 2.5 Hz, being limited by beam loss during the Booster acceleration cycle resulting in activation of components. Major initiatives in FY2003 aimed at improving performance through reduction and/or better control of beam loss were:

- Implementation of a new extraction septum capable of 7.5 Hz operations.
- Design of a collimation system to localize losses to a well shielded area
- Diagnosis of beam optics problems induced by dogleg magnets in the extraction areas, and development of a remediation plan. This is aimed directly at reducing beam loss.
- Establishment of an ad-hoc committee to identify opportunities for further improvement.

The collimation system and remediation of the extraction areas is being implemented in FY2004. In addition the ad-hoc committee report has been received and will be used as a basis for developing a plan for further improvements.

CDF and Dzero Detectors

The large detector facilities CDF and D0 made great progress this year. They presented substantial physics results in plenary talks at the Lepton Photon Symposium at Fermilab. During 2003, both detectors operated with efficiencies typically in the range 85-93%. The computing farms built to handle the unprecedented data rates have kept up with the flow of data from the experiments.

Decision on the silicon detector upgrades

(Memo from the Director – Michael Witherell)

“I have been considering this difficult issue for a few months, with input from not only the Physics Advisory Committee but also from a large part of the Fermilab community. I have spent a great deal of time in trying to understand every ramification of what is a very important decision. I have decided that we will not include the silicon detectors in the continuing detector upgrade projects. I have made this decision in order to optimize the science we can achieve in Run II by concentrating our available resources on the accelerator upgrades and the other parts of the detector upgrades.

We have considered the possibility of upgrading the D0 detector alone, because of the additional benefits of replacing their current detector. Although the D0 physics sample might be increased somewhat in this case by the end of Run II, the CDF physics sample would probably suffer somewhat from the installation and commissioning of the D0 detector. The combined physics sample would be at best slightly larger, and could be comparable. The net gain to the total Run II science program would not be as great as the benefit of pushing the full list of accelerator improvements as quickly as possible.

Finally, I reaffirm the laboratory's strong commitment to Run II. This decision does not represent less commitment, but rather an attempt to ensure that we get the most science

done with the real resources available. We have reorganized the accelerator effort to improve delivery of luminosity in the short term, and the new team is working well. We will now have the resources necessary to make immediate luminosity improvements, execute the luminosity upgrade program, make improvements to reliability, and hire additional accelerator physicists to fill specific outstanding needs. We will be able to do this accelerator work without delaying items for budget reasons and still have the modicum of budget flexibility needed to overcome unexpected problems with the Run II effort. Finally, we will support rapid completion of the nonsilicon parts of the detector upgrades.

I have made this decision with the goal of optimizing Fermilab's physics program over the rest of this decade. Although the detector upgrades have been a topic of discussion for P5 and HEPAP, this was a decision for Fermilab to make. I paid careful attention to the arguments of the CDF and D0 collaborations and the oral discussion and written report of the Fermilab PAC, as I always do, but the responsibility for this decision rests with me. This decision should not be misinterpreted as a sign of lessening the intensity of focus on Run II. On the contrary, I have confidence in our ability to get the most integrated luminosity possible out of the accelerator complex and to do great physics with it.

Strategy and prospects for Run II

The strategy to pursue this exciting physics in Run II will be:

- to understand the factors that limit the present luminosity and act to resolve them,
- to address maintenance items and increase reliability of the complex,
- to pursue the ambitious upgrade program, including electron cooling in the Recycler, and
- to carry out the non-silicon upgrades that are needed for the CDF and D0 detectors to operate at higher luminosity.

We will increase luminosity as quickly as possible and will continue to focus the entire laboratory on the success of Run II.

The data sample will double to about 0.5 fb^{-1} in about one year and reach 1 fb^{-1} a year or so after that. By the end of Run II we will have delivered data samples to the detectors that are a factor of 30-60 times than that of Run I. Each detector is more capable than either of those used for Run I, even accounting for possible degradation in silicon detectors late in Run II, and the energy is somewhat higher, giving a large bonus for the most important physics studies. The prospects for discovery in Run II will remain brighter than anywhere else in particle physics until the LHC produces major new results."

Metric A.2.1.1.4 is rated **Outstanding**

Sloan Digital Sky Survey

The Sloan Digital Sky Survey has been operating for a couple of years. As of August 2003, the telescope work has completed 78% of the planned imaging work and 48% of the spectroscopy to is on target to complete the foreseen scope by the middle of 2005. This plan leaves some limited portion of the sky uncovered and a proposal is being developed to consider covering that region over a further period of two years. The public has downloaded nine Terabytes of data from the first Release of Data from the survey.

Objective 3: Provide for effective and efficient program management for a world-class research program.

Indicator 1: The extent to which effective management programs support the research program.

In the annual weeklong summer meeting the Physics Advisory Committee provides the major peer review of the program as a whole. In the Summer 2003 meeting they said : “Over the past few years, a number of important projects at the Laboratory have moved from being concepts or proposals to positions well on the road to realization. The Tevatron Run II detectors have been completed and are now reaching stable operation with efficient data-taking and have begun producing physics results. The civil construction for NuMI is nearly complete and the construction of the MINOS far detector has been completed. The MiniBooNE experiment is taking data with a proton flux approaching expectation. For the future, the BTeV and CKM projects have been granted Stage I approval and have carried out R&D programs that have resolved many of the important technical challenges. Over the rest of the decade, these experiments will allow the Laboratory to make major contributions to our understanding of fundamental physics. The Laboratory has constructed large-scale components for the LHC accelerator and the CMS experiment. By the end of the decade, physics analysis for the CMS experiment should be a significant part of the Laboratory’s program. Finally, the Laboratory has begun its involvement in the great project of experimental high energy physics beyond the LHC, the international Linear Collider. Thus, the Laboratory has excellent opportunities before it. “

The Directorate maintains a keen oversight on the activities within the Laboratory with a series of Program Management Groups, one for each activity defined as a project, for example, NuMI and US-CMS. This has led to the rather good performance of the projects over the course of the past year. The DOE measures reviews the progress of these projects with teams which are composed of management experts from the Office of Construction Support supplemented by accelerator and particle physics experts from around the world. In analogous fashion the Fermilab Directorate conducts internal “Director’s Reviews”. These reviews have many of the same characteristics but provide Fermilab management with early indications of problems. This, in turn, permits remedial action. The success of this aggressive program is reflected in the consistently good performance of our projects, particularly in their management aspects over the past two years.

List of Director’s Reviews for FY2003

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|---|------------------------------|
| 1. Director’s Status Review of BTeV
Conducted by OPMO | September 30-October 1, 2002 |
| 2. Director’s Review of Run II Luminosity
Conducted by Holmes/Tigner | October 17-18, 2002 |
| 3. US CMS Software and Computing
Oversight Panel Review - Conducted by
Program Planning | October 24, 2002 |
| 4. Director’s Review of NuMI Installation
Conducted by OPMO | December 4, 2002 |
| 5. Director’s Status Review of CKM
Conducted by OPMO | February 24-25, 2003 |
| 6. Director’s Status Review of Fixed Target
Experiment Anal - Conducted by Program Planning | February 26, 2003 |
| 7. Closeout Report of the Director’s Review Committee
NuMI Installation Plan - Conducted by OPMO | April 8-9, 2003 |

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|---|--------------------|
| 8. Fermilab Cyber Security Peer Review
Conducted by Other/VW | April 22-23,2003 |
| 9. Director's Review Committee of Run II
Accelerators - Conducted by Holmes/Tigner | May 5-7, 2003 |
| 10. Closeout Report of the Director's Review of
MINOS/CDMS Soudan Mine Operations
Conducted by OPMO | May 14-15, 2003 |
| 11. Director's Review of Run II Luminosity
Conducted by OPMO | July 1-3, 2003 |
| 12. Director's Review of BTeV
Conducted by OPMO | October 21-23,2003 |

The month by month planning of the operation of the scientific complex involves regular Strategy Meetings in which the Accelerator experts and the operating experiments provide input to the Directorate which then determines the emphasis, data taking, machine studies, and maintenance for the upcoming period. A measure of how well that works is that the collider luminosity rose steadily through FY2003 and that the integrated luminosity performance measure was satisfied. Three times per year the Physics Advisory committee meets and hears proposals for experiments. It also discusses and recommends to the Director, the evolution of the Physics Program. Similarly, the Accelerator Advisory Committee hears about plans for the accelerator complex. As a result of this planning over the past years, the Laboratory has experiments and initiatives in all the important areas of Particle Physics using accelerators at Fermilab and elsewhere, as judged by several recent national panels of both DOE and the National Research Council.

The Director has commissioned a study of the long range plan for the laboratory which is attempting to mesh the global ambitions of the field into a program for Fermilab. The committee will report out in FY2004 but already the discussions are making progress towards clarifying the process for establishing the United States as the site for a major new international accelerator initiative in comfortable juxtaposition with a healthy program of other particle physics at Fermilab.

Metrics A.3.1.1.1, A.3.1.2.1, A.3.1.3.1 and A.3.1.4.1 are rated **Outstanding**

Objective 4: Relevance to DOE Missions and National Needs.

Indicator 1: The laboratory successfully contributes to DOE missions and programs of national importance.

In his testimony before the House Science Committee, the Director of the Office of Science gave a statement of what its mission is :

“The Office of Science fills a unique and central role in the country's scientific endeavor. While our work is complementary to that of other government research agencies, we distinguish ourselves by our emphasis on research that takes the long view, is open and interdisciplinary, requires the use of large-scale facilities, and takes risks commensurate with the high pay-offs we expect...” “[The Office of Science] is the steward, and by far the principal funding agency, of the Nation's research programs in high-energy physics, nuclear physics, and fusion energy sciences.”

Fermilab is the largest U.S. laboratory dedicated to high-energy physics. About 40% of the nation's high-energy physicists choose to conduct their research here because of the facilities available. The recent HEPAP subpanel described broadly the central role of Fermilab and SLAC in the U.S. program: "At the center of the high energy physics program in the U.S. are the two large national laboratories – Fermilab and SLAC. These laboratories house major accelerator and detector facilities, provide much of the field's technical infrastructure, and create intellectual hubs of activity. Historically, the centralization of resources in these laboratories evolved as accelerator facilities became large collaborative ventures. Today, the national laboratories enable the development of accelerators and detectors and efficiently provide and support shared facilities for carrying out the high-energy physics research program."

We believe that accurately characterizes the central role of Fermilab in the national program of high-energy physics. Given the stewardship of the Office of Science for high-energy physics, it is clear that Fermilab contributes not just successfully to DOE missions and programs but in fact irreplaceably.

Metrics A.4.1.1.1, A.4.1.2.1 and A.4.1.3.1 are rated **Outstanding**

Leadership

In FY2003, URA continued its program of internal and external reviews that assess Fermilab operations and management. Internally, URA's Fermilab Board of Overseers, an eighteen-member panel of senior scientists and industry managers met at the Laboratory four times (Oct. 4, 2002, Feb. 7, 2003, June 6, 2003, Aug. 6, 2003, and Oct. 3, 2003) to monitor the status of Fermilab's scientific, administrative (including human resources, procurement, and litigation) financial, internal audit, ES&H, and facilities management functions (see attachment). URA Corporate Officers attended closeout sessions for critical DOE reviews at Fermilab. In addition, URA's CEO-level Board of Trustees, as part of its corporate fiduciary responsibilities, receives semi-annual briefings on the status of Fermilab from the Laboratory Director, the URA President, and the Chair of the Fermilab Board of Overseers (an ex officio URA Trustee).

Externally, URA's Visiting Committee for Fermilab Science Programs held its annual review of those programs on March 14-15, 2003. The members of this Committee are senior scientists from leading research universities and national laboratories with expertise in experimental and theoretical particle physics, astrophysics, accelerator science and engineering, and supporting activities (e.g., scientific computing). The Visiting Committee submitted a comprehensive report on its review to URA (see attachment). The Visiting Committee's review focused on Laboratory efforts to improve luminosity performance of the Run II accelerator complex. The report was distributed to members of the Fermilab Board of Overseers and was discussed at subsequent Board meetings to provide an integrated assessment of Laboratory operations and management.

URA's annual external Administrative Peer Review covered the Laboratory's administrative and operations support functions. The Peer Review Committee members are active or retired senior managers with experience in human resources, procurement, ES&H, facilities engineering and maintenance, and related support areas at other research laboratories and in industry. The Committee's findings and recommendations are reported to URA and the Fermilab Board of Overseers (see attachment). The most recent Administrative Peer Review was held on October 8-10, 2003. URA Officers and the Board of Overseers monitor the implementation, as appropriate, of the Committee's recommendations

As part of its financial oversight responsibilities, URA commissions an annual independent audit of Fermilab by an outside accounting firm, KPMG. In addition to the audit of the Fermilab financial statements, the external audit firm examines the Laboratory's internal controls and issues a management letter with any comments or recommendations for Laboratory management. The Audit Committee of the

Fermilab Board of Overseers meets with the external auditors to review the audited financial statements and the associated management letter. The Audit Committee of the URA Board of Trustees also reviews the annual external audit of Fermilab. The Audit Committee of the Fermilab Board of Overseers reviews and approves the URA/Fermilab annual internal audit plan prior to submission to DOE.

Metric B.1.1.1.1 is rated **Excellent**

During FY2003 URA Corporate management took the following actions to resolve important issues.

Run II issues: The Fermilab Board of Overseers, with the Laboratory Director's concurrence, established a URA Run II Advisory Council, consisting of six senior outside experts, including three members of the Board of Overseers (including the Board Chair). The Council met twice in FY2003 with the Director and his staff to consult on Run II management strategies, and will meet every 6-8 weeks to review progress.

Run II issues: The Fermilab Board of Overseers urged the Laboratory Director to establish an internal Laboratory Run II Task Force. The Task Force, chaired by the Director, consists of the Head of the Beams Division, the Head of the Technical Division, the Associate Director for Accelerators, the Fermilab Director Emeritus, and an eminent accelerator physicist who is currently an Assistant Beams Division Head and Science Advisor to the Division Head. The Task Force, which meets every two weeks, monitors Run II progress and advises the Director.

Procurement issues: URA engaged an outside resource (the Grant Thornton audit firm) to conduct an independent review of certain procurement and property management matters brought to the attention of Laboratory management by the Office of the DOE Inspector General (IG). The review led to recommendations that have been adopted by Laboratory management.

Personnel issues: URA engaged an outside law firm to conduct an independent investigation of allegations of sexual harassment and improper e-mail use. The investigation led to appropriate personnel actions and Laboratory-wide reinforcement of personnel policies.

Labor contract issues: URA General Counsel independently reviewed Laboratory handling of labor and management negotiations for a union contract renewal, as a result of a written complaint to the URA Board of Trustees.

Legal issues: URA General Counsel monitored Laboratory legal policy and litigation.

Metric B.1.1.2.1 is rated **Excellent**.

During FY2003, the URA Chief Financial Officer provided guidance to the URA/Fermilab Internal Audit Department in order to increase overall professionalism. In particular, the CFO provided guidance in formulating portions of the annual internal audit plan, and technical assistance in increasing the quality of the reports issued by the Internal Audit Department.

During FY2003, URA's compiled information regarding new best practices and emerging trends in corporate governance for non profit corporations. This information was considered by the Audit Committees of the URA governing boards for prospective corporate policy implications.

During FY2003, URA Corporate Officers and the URA Board of Trustees developed strategies for improving the public appreciation of the critical role of the physical sciences in the national interest, and for advocating increased Federal support for research in the physical sciences. In particular, URA is leading initiatives that explain the role of the DOE Office of Science in the physical sciences. In November 2002, the URA President and a number of URA Trustees met with Secretary Abraham to

discuss the importance of adequate support for the Office of Science and ways to secure that support.

On a continuing basis, the URA corporate office in Washington serves as an active communications link to DOE, and more generally to the Executive and Congressional branches of the Federal Government, for the exchange of information on management issues and initiatives of importance to Fermilab and the scientific research community.

Metric B.1.2.1.1 is rated **Outstanding**.

In FY2003, in addition to its regular oversight activities URA Corporate management, with the advice and support of its Fermilab Board of Overseers, Board of Trustees, and Visiting Committees, followed up on previous recommendations to Laboratory management to undertake a number of critical actions to improve operational and managerial performance, including the following:

1. Ensure flow-down of rigorous ES&H contract provisions for all subcontractors and their sub-tier contractors, and carryout more effective oversight to assure meaningful subcontractor implementation. At the end of FY2003, Laboratory employees and on-site subcontractor personnel completed twelve continuous months without a lost time injury. In recognition of that achievement, the National Safety Council awarded Fermilab its "Perfect Record" award.
2. Implement the new Project Accounting System as rapidly as possible. Implementation across the entire Laboratory was successfully completed in FY2003 with assistance from URA Corporate Office funds.
3. Supplement Laboratory resources in the Beams Division to meet Run II Collider Luminosity goals by seeking accelerator expertise from other laboratories and Universities, and by reassigning qualified personnel from other sectors of the Laboratory. During FY2003, in addition to new Beams Division management, additional accelerator expertise and other qualified personnel have been brought into the Division.
4. Improve communications between top-level Laboratory managers and DOE on-site senior managers through regularly scheduled meetings. In FY2003, such communications substantially improved.
5. Utilize a risk-based approach in the development of internal audit plans. The FY2003 internal audit plan was implemented using a quantitative risk-based approach developed by the URA/Fermilab Internal Audit Manager and approved by the Audit Committee of the Fermilab Board of Overseers.

Identified opportunities for improvement

URA recognizes the need for more rapid and aggressive action on the part of management in response to serious employee concerns (e.g., as in the case of recent sexual harassment complaints).

URA recognizes the need for industry representatives on its Administrative Peer Review Committees.

Schedule for implementation of improvements

The Administrative Committee of the Fermilab Board of Overseers is currently following up on the adequacy of, and improvements in, Laboratory policies and procedures regarding employee concerns.

The last Administrative Peer Review Committee that included industry representatives was a larger group which convened in November 2001. It is planned to have industry representatives, including some who served on the larger initial review team, on the next Administrative Peer Review Committee that will meet

in Fall 2004.

Metric B.1.2.2.1 is rated **Outstanding**

Attachments:

1. Board of Overseers Membership, Committee Structure, Charter, Meeting Agendas
2. Report of the 2003 URA Visiting Committee for Fermilab
3. Report of the 2003 URA Administrative Peer Review Committee

Self-Assessment

The self-assessment function continues to evolve at Fermilab. For FY2003 the strategy and approach to self-assessment has been changed from the process-based methodology that was utilized in FY2002. That method resulted in massive amounts of paperwork that was not readily useable nor did it accurately depict the overall condition of the management systems of Fermilab. In discussions held with FAO and CH in July of 2003 a decision was made to modify the self-assessment strategy to more strongly investigate the condition of Fermilab's management systems. As a result of this decision, Appendix B of the contract was totally rewritten to redirect the self-assessment. This improvement will result in an assessment that is more useable and that is focused on parameters used to manage the laboratory. The self-assessment for FY2003 will be more narrative in form but with adequate data to support the grades. Also, the page count will be drastically reduced.

Peer reviews are routinely used as a management tool. In FY2003 six Director's Reviews were planned and six such reviews were conducted. In addition, six additional reviews were conducted. The primary purpose of each review was met. Further indicators that the Reviews are deemed of value include the BTeV and CKM Reviews whose results were relied on heavily by P5 and the Luminosity Upgrade program that survived the DOE Review to a significant extent based on assistance from OPMO and the Director's Reviews.

Metric E.1.1.1.1 is rated **Outstanding**

The self-assessment for FY2003 has extended to all Divisions and Sections. This is the second year that the Divisions have been included in the self-assessment. They demonstrate good progress and participation in the self-assessment process. All assessment were completed on time.

Metric E.1.3.1.1 is rated **Pass**

DOE participated in and approved the complete re-write of Appendix B, which contains the self-assessment plan. DOE approved the plan and issued a contract modification to include it in the contract for FY2003.

Metric E.1.3.2.1 is rated **Pass**

The self-assessment process has significantly improved from FY2002. Not only has the process improved, but the content is more useable and more clearly descriptive of the management systems in use at the laboratory. All Divisions and Sections participate in the assessment and are using the assessment to aid in the management of their day-to-day work.

Metric E.1.3.2.2 is rated **Outstanding**

As the individual self-assessments reflect, opportunities for improvement from the previous assessment are considered and resolved during the current performance period. Greater than 95% compliance has been achieved.

Metric E.1.3.2.3 is rated **Outstanding**

The Administrative and Operations Peer Review Committee met at Fermilab October 7-10, 2003 and conducted an extensive review of the administrative functions of the laboratory. Their report is available as attachment 3 to this document.

Metric E.1.3.2.4 is rated **Pass**

Opportunities for improvement

Several opportunities for improvement have been identified. They are:

- Continue to refine the definition of management systems that are in use.
- Define a format for the self-assessment for use by all concerned parties.
- Conduct training for all assessors prior to next year's assessment.

Foreign Travel Approval

Last year there were 492 foreign travel trips processed. This was a decrease from FY2002's number of 584 foreign trips. The data requirements required by the DOE Foreign Travel Management System have been an area of considerable frustration to those members of the Fermilab staff engaged in foreign travel and those that must process the paperwork. While we haven't resolved all of the issues, considerable progress was made this year in decreasing customer frustration by providing shorter response time for the portion of the process that performs the data QA, data entry and final trip approval. The improvement was facilitated by the decrease in activity noted above and increased management attention. The management attention involved using monthly activity reports and daily interactions to monitor paperwork backlog and when it was growing to provide trained on call staff to assist. Basically this was a load leveling activity activated earlier in the process. It did require an early investment in training two on-call staff persons in the process. Additionally, the written Laboratory foreign travel policy implementing DOE Order 551.1B was revised, for clarification, twice during the year and provided to Division travel representatives and placed on the Web for the benefit of travelers. The management actions were guided by an informal survey of similar DOE contractors contacted early in FY2003 (see attachment 4).

There are two aspects to determining the overall effectiveness of the process. One is customer satisfaction alluded to above and the other is timeliness and quality of the data entry into FTMS in compliance with DOE Order 551.1B. The customer satisfaction is gauged by the level of complaints received during the year and whether the issue was raised to the Administrative Peer Review Team. This year there were few complaints during the year that reached the Associate Director level or above. The measure related to the Peer Review results from the fact that last year during the Review Team's customer interviews foreign travel was a frequently raised topic although foreign travel was not an item formally on the list of topics to be reviewed. This year the Review closeout did not mention foreign travel and in a private session with the Review chair it was mentioned that while foreign travel did come up it was at a much lower level than last year. With respect to compliance with the data requirements of O551.1B Fermilab retained its foreign travel FTMS routing authority. Fermilab was one of the first two laboratories to be granted this authority by DOE Headquarters in FY2002. Further, during FY2003 the Fermilab Senior Foreign Travel Organizational Point of Contact was one of five M&O representatives to work on a "FTMS Reports Working Team."

Timeliness continues to be an issue although the issue is with the travelers and Division travel representatives and not the central system. However, during FY2003 no one was denied permission to travel due to tardiness.

Opportunities for improvement:

The primary area needing improvement is in the timeliness of the traveler making the travel request. In some cases the tardiness is beyond the traveler's control, e.g. a last minute invitation to give a paper at a conference or the need to travel to CERN for a meeting scheduled by CERN. We will continue our traveler education efforts to address this issue. Now that the traveler frustration level is reduced we will consider a more formal method of accessing customer satisfaction.

Adjectival Score:

Based on the above the FY2003 rating is **Outstanding**, while recognizing the need for further internal improvements.

See Attachment 4 for comparative travel system performance data from FY2002

Project Review

Project Management Oversight is comprised of several areas. For this assessment, three areas of responsibility will be examined:

- 1), Meeting Departmental Project Requirements
- 2) Arranging, Coordinating and Leading Regular Director's Reviews of key projects, and
- 3) Training and Mentoring Project Teams.

Descriptions of these activities follow:

Meeting Departmental Project Requirements:

Early on in the project development phase, tutorial sessions are held with the project team and the requirements under DOE Order 413.3 are described. Practical means of meeting these requirements are suggested and discussed. Assistance in the initial stages of system development to meet these requirements is offered, e.g. development of resource loaded schedules, plans for using and use of the Fermilab earned value tool COBRA, and development of DOE required documentation. Such sessions were held this past fiscal year for BTeV, CDF and D-Zero Detector Upgrade projects, the Run II Luminosity Upgrade program, MUCOOL, and Industrial Building #3.

Arranging, Coordinating and Leading Regular Director's Reviews of key projects:

1. At the request of one of the laboratory directors, lead Director's Reviews to determine the readiness of projects to proceed.
2. Employ expert consultants to review project technical, cost, schedule, and managerial readiness to advance to succeeding stages of project execution.
3. Provide recommendations and advice to project teams and laboratory management for appropriate improvements.

Based on requests from “Directors” – Fermilab Director, Deputy Director, Associate Director for Accelerators, Associate Director for Research, or Associate Director for Operations Support or suggestions by OPMO followed by discussions with the Directors set up, coordinated preparations for, and/or lead Director’s Reviews 2003 as follows:

- 1) 2 NuMI Installation Reviews
- 2) BTeV Status Review
- 3) CKM Status Review
- 4) 4 Compact Muon Solenoid (CMS) Detector Technical System Reviews
- 5) Run II Accelerator Luminosity Upgrade Review
- 6) Soudan Underground Laboratory Operations Review
- 7) MUCOOL Construction Completion Review
- 8) Industrial Building #3 Decision to Initiate Review

Employ Expert Consultants

Consultants 4 to 12 in number with expertise covering all aspects of the project are recruited. This is done by creating a list of candidate reviewers (an initial list is created by OPMO [this is facilitated by Temple’s vast background in the field and personal knowledge of or acquaintance with a large number of practitioners in the field {for example for an extremely important Director’s Review of Luminosity Improvement Plans, he provided a list of 30 prominent accelerator physicists from various laboratories in the US and abroad}]) which is then discussed with one or more Directors and either the cognizant Director or Temple extend the invitations / requests to the candidate reviewers.

Led preparation of Review Reports for six of these eight reviews, with initial draft being available in each case about one week after the review.

Recommendations and Advice to Project Teams and Laboratory Management for Appropriate Improvements

The Review Reports are structured in major technical (typically at Work Breakdown Structure – WBS level 2), cost, schedule, and management categories with Findings, Comments, and Recommendations under each category. Findings are statements of fact that summarize noteworthy information presented during the review. Comments are judgment statements about the facts presented during the review. The reviewer’s comments are based on their experiences and expertise. The comments are to be evaluated by the project team and actions taken as deemed appropriate. Recommendations are statements of actions that should be addressed by the project team. A response to the recommendation is expected and that actions taken are reported on during future reviews. Examples include results from the two NuMI Installation Reviews and the Luminosity Upgrade Review. Many recommendations from the first NuMI Installation Review were incorporated into the largely successful installation activities carried out during the January shutdown. Some thirty recommendations from the second NuMI Installation Review were supported strongly by the subsequent DOE NuMI Review team and are being implemented for the NuMI installations that are being carried out during the ten-week shutdown that has just begun and further NuMI installation that will occur once the Buildings and Outfitting contracts are completed. Many recommendations were made during the Luminosity Upgrade Director’s Review that were acted on in preparation for the subsequent DOE Review. This improved the Beams Division Luminosity Upgrade team’s performance markedly.

Training and Mentoring Project Teams

Worked extensively with Run IIb CDF and D-Zero Detector Upgrade project teams, continuing to now from December 2001, and MI-31 project team, February through early May, to familiarize them with current DOE and Fermilab project requirements and assisted in the early stage preparations of some critical project documentation. To do this suggested, initiated, and lead BTeV Project Biweekly Working Meetings (beginning in May) with Directorate principals to prepare for the October 2003 CD-1 Director's Review. OPMO worked intensely with the CDF and D-Zero Detector Upgrade project teams to get the cost reporting (Earned Value Management System) software package Cobra installed, configured for the individual projects and running to provide Earned Value reporting. Provided extensive mentoring of the new Run II Luminosity Upgrade Project Manager on many Project Management principles, processes, techniques, and procedures and provision of the first resource loaded schedule for these activities.

Results of the assessment:

1. The existing process controls are adequate.
2. Notable practices have been identified which are used as examples for other (especially new) projects. For example, select reviewers for Director's Reviews of on-going projects from the lists of principals in nascent projects so that as an extra benefit they get exposure of Project Management techniques, skills, procedures, and requirements. Such expert technical reviewers were selected from the BTeV and CKM projects in FY2003.
3. Some major deficiencies in project plans and/or procedures have been identified which to a large extent have been corrected.
4. The process is working effectively. Few, if any improvements can be made with the current staff size.
5. How does 2003 performance compare to the 2002 assessment, other similar labs, and industry? Current excellent performance compares well to last years excellent performance. This assessor knows no other assessments such as this; therefore a direct comparison cannot be made. However, some input can be provided. The assessor has served on the Los Alamos National Laboratory (LANL) Director's Project Management Advisory Panel (PMAP). As a member of the panel he was charged with assessing the LANL group performing the same function. We're doing a much better job than that group did in the beginning. They developed a formal system that covers project performance in detail on a monthly basis. We do not have this. Even so, I believe OPMO has a greater impact on contributing to successful project performance.

Six Director's Reviews were planned and six such reviews were conducted. In addition, six additional reviews were conducted. The primary purpose of each review was met. For example, see the comments on the two NuMI Installation Reviews in section 2)c under the Description of Process above. Further indicators that the Reviews are deemed of value include the BTeV and CKM Reviews whose results were relied on heavily by P5 and the Luminosity Upgrade program that survived the DOE Review to a significant extent based on assistance from OPMO and the Director's Reviews.

Adjectival grade – **Outstanding**

Requisition Approval

Purchase Requisition:

The approval process for purchase requisitions is well documented and understood by the Fermilab staff. A spreadsheet showing the various approvals required at different dollar thresholds is available on an internal web page. In addition to dollar thresholds there are various other criteria where a requisition must have out of the ordinary approval. Examples are: building modifications, lasers, radioactive materials, vehicles, etc.

The process transitioned from a paper to an electronic requisition several years ago. The process, in general, works smoothly, although customers (requisitioners and approvers) complain about the obscure nature of the web interface for the approvals. However, the advantage of the electronic form is that anyone interested is able to determine where a requisition is waiting for approval. This ability greatly reduces the need for shadow requisition tracking systems in the various Fermilab organizations.

Since there have been essentially no complaints about the process no detailed studies have been performed to see if there are processing bottlenecks. The basic data exists in the electronic records and if there is an indication that there are efficiencies to be gained an analysis can be made. In addition, Requisition preparers meet periodically with Procurement and system administrators to review the process, share information, and update training.

Opportunities for Improvement:

During FY2004 an upgrade to version 11i of the Oracle Federal Financial software is scheduled. This version should markedly improve the web interface for the requisitioners and approvers. When time permits a study of process cycle times will be undertaken to identify potential process bottlenecks.

Personnel Requisition:

The personnel requisitioning process is also well understood within Fermilab. All requisitions require either the Director's or his Deputy's approval before Human Resources can act on the requisition. Further, within HR each requisition must be reviewed by the Fermilab EEO office prior to job posting. There has been very little hiring during the past two years so the process has worked smoothly with essentially no complaints.

Opportunities for Improvement:

There has been training of hiring managers with respect to filling out the personnel requisition form, in particular to correctly describing job functions, both essential and desirable. If the budget in coming years permits more extensive hiring this training will need to be offered again. At current hiring rates individualized attention remains the most cost effective approach.

Based on the above the FY2003 rating is **Outstanding**.

Housing Allocation

Fermilab Village Accommodations Allocations

Twice per year messages are sent from the Fermilab Housing Office to Fermilab users asking for requests for Village accommodations. These are reviewed by the Housing Office. When the requests for either houses/apartments or dormitories exceed those available, the allocation is made by Assistant Director Roy Rubinstein, based upon the priorities of the Fermilab operating schedule. If at any time an accommodation becomes available (for example, because of a cancellation), it is reallocated by Rubinstein based upon the same priorities.

This process has been in place for over two decades, and works well.

Budget Formulation/Financial Management:

The general process used by the divisions and sections to allocate budget dollars and track performance against that budget is:

- 1) Receive guidance from the Directorate for general funding and any particular project defined funding for the next fiscal year.
- 2) Initiate discussions among the Division/Section Head, the Division/Section Financial Manager and Department heads on the work to be accomplished in the next year and number of FTE's/M&S required to accomplish the defined work. The depth of this discussion varies among the various Divisions and Sections.
- 3) Allocate SWF and M&S budgets to various tasks within the Division/Section operating project and any applicable scheduled projects up to the total amount of the Division/Section budget. The Division/Section Head may retain some reserve.
- 4) On a monthly basis, compare actual obligations are to the budget at a department and Division/Section level.
- 5) Budget adjustments are made from the Division/Section Heads' reserve or between departments if absolutely necessary. A strong effort is made to hold departments to previously defined budgets so that the laboratory as a whole will meet the DOE funding guidance.

Assessment:

The process for allocation of budgets and tracking actual costs and obligations against those budgets works well. The implementation of the Oracle Projects module in mid-FY2003 has provided the opportunity for the Divisions and Sections to improve the structure of their cost and obligation reporting for easier analysis at summary levels. As we go into our first full year of using the new system in FY2004, the level of skill among the financial staff in use of this data is expected to improve. A measure of the effectiveness of the budget allocation process is whether or not the program is delayed in any aspect due to lack of funds. This assessment of course is a measure of the effectiveness of matching the overall program to the funds available. Given the Fermilab program the budget allocation appears to be well matched based on the success of the program and the ability of the major organizations within Fermilab to operate within their assigned budget allocations. One concern has to do with facilities maintenance investments. Overall Fermilab's facilities remain in good condition and a one-year assessment of funding is not a good indicator.

Opportunities for Improvement:

As the financial staff and line management become more familiar with the new capabilities provided by the "Project Accounting" system opportunities to reformulate budget allocations will present themselves. On the financial management side Fermilab is seriously studying automating the effort reporting system. This would permit the collection of data as to how personnel effort is expended on activities at a lower level of detail.

The performance measures for the financial area are based on the percentage of uncosted balances remaining at fiscal year end. At September 30, 2003 the results were:

Operating: 5.7%
Capital Equipment and Construction: 2.2%

Metric H.1.1.1.1 rating is **Outstanding**.

Policy Formulation and Publication

Policy at the Directorate level continues to be published in the same manner that was developed in 1999. At that time the Director's Policy Manual was completely re-written to bring it into compliance with all current DOE Orders, Federal, State and local regulations. Since that time the manual has been continuously monitored and updated as necessary. It has also been a topic of debate during the Administrative Peer Review when some people have objected to some of the policies. Without exception, those policies were again reviewed and modified if necessary. It should be noted that most of the reviews did not result in changes. Some of the policies considered to be objectionable by some organizations were specifically put in place to change undesirable behaviors. These policies remain in place.

The manual is available on line for all who need to use it or have an interest in its contents. On line publication is the chosen method to make this manual available to the widest possible audience.

Community Involvement

The goal of the Fermilab Office of Public Affairs is to increase support for Fermilab, the Department of Energy Office of Science and particle physics worldwide by strengthening communication within the Fermilab/Office of Science Community; between Fermilab and members of neighboring communities; and within the global particle physics community. Toward that end, we worked with the Fermi area Office and Chicago Operations Office Public Affairs staff to agree on the goal, strategy, actions and measures for Fermilab community involvement and stakeholder relations during FY2003. This constituted the Fermilab Communications and Community Involvement Plan for FY2003. Achieving the plan's milestones provides the first measure of the self-assessment. The second measure called for the design of two new publications, one internal and one external.

As set forth in the Communication Plan, during FY2003, the Office of Public Affairs planned to:

1. Hold Fermilab focus groups, conduct employee survey, develop new internal media.
Measure: To the extent that resources permit, complete the focus groups, carry out the survey, and use the results to develop and implement new print, electronic or other means of communication within the Fermilab community.
2. With the support of the Illinois Coalition for Accelerator Research, establish a Community Task Force.
Measure: Following the time line established by the staff of the Center for Governmental Studies, carry out the preliminary work within the community necessary to establish a Fermilab-Community Task Force that will begin meeting in September 2003.
3. With the partnership of Aldrich-Pears, Inc. create a master plan for visitors to the Fermilab site.
Measure: Produce a master plan for Visitors to the Fermilab site by September 2003.
4. Develop and publish new Interactions magazine.
Measure: By September 30, make and communicate an informed decision either to continue publishing FermiNews or to replace it with a more effective joint Fermilab-SLAC publication.
5. In collaboration with the InterAction Collaboration, create and implement a worldwide strategic communication plan for global particle physics.
Measure: Develop strategic communication plan for InterAction Collaboration. Implement at least one third of the action items called for in the plan.
6. With InterAction collaboration, roll out new Interactions website and image bank; develop subscription news wire.

Measure: Develop and implement subscription news wire. Roll out Interactions website in mid-August 2003.

7. Establish a year-round Public Affairs internship program.
Measure: Make sure that Fermilab's science writing internship is listed among the internship opportunities at every major U.S. university program for science journalism.
8. Write and produce Institutional Plan; organize Onsite Review.
Measure: Produce Institutional Plan by Summer 2003. With DOE and Fermilab Directorate, plan and organize October 16 Onsite Review.
9. Support Office of Science Communication
Measure: As requested, provide Fermilab contribution to all appropriate Office of Science collaborative communication efforts.
10. Support Fermi Area Office Community Outreach
Measure: Participate jointly with FAO staff in local community meetings, homeowners' gatherings and other community events.

Assessment

Based on the above measures, and as discussed and presented to DOE Fermi Area Office and CH public affairs staff in October, 2003, the Office of Public Affairs has achieved more than 95 percent of the milestones in the Plan.

Metric F.1.1.1.1 - Outstanding

The Office of Public Affairs has designed and produced a new daily internal publication, Fermilab Today. As agreed in the above Communication Plan, and at the recommendation of the DOE CH public affairs staff, the Office of Public Affairs had made an informed decision by September 30 to replace FermiNews with a more effective joint Fermilab-SLAC communication. While this publication has not yet been designed, the organizational and advisory structure is in place and we expect to see the first issue by April 2004. The Office of Public Affairs also launched a major new Web site, www.interactions.org, in August 2003.

Metric F.1.2.1.1 and F.1.2.2.1 - Outstanding

Opportunities for Improvement

Organization of the internship program could be put on a more systematic basis. The role of the Office of Public Affairs in the production of the Institutional Plan should be clarified.

Intellectual Property

The Office of Research and Technology Assessment reviews, for possible technology transfer opportunities, all publication documents prior to their release. In addition invention disclosures are recorded and provided to DOE for processing. In FY2003 there were 516 such documents reviewed. None of these resulted in patent disclosures. There were 4 patent disclosures issued during FY2003 that

resulted from employees bringing forward potentially patentable ideas. There were no patents granted during FY2003.

Fermilab's outside Patent Counsel administers the renewal date file and requests direction from the ORTA shortly in advance of a required renewal date what disposition the laboratory wishes for a given patent. The ORTA responds in writing to the outside counsel. Fermilab is in the process of changing outside patent counsel. This process takes time as active files at the current patent counsel need to be completed prior to moving all existing files. During FY2003 all new patent activity went to the new patent counsel and there remains one active file at the previous patent counsel.

Fermilab's legal office reviews all subcontracts for the appropriate IP clauses.

Metric G.1.2.1.1 is rated **Outstanding**

The procedures are current and largely being followed. The administrative support of the ORTA is only part time assigned to the ORTA and remains overwhelmed with other activities and thus the ORTA processes are slower than is ideal. However, given the low level of activity Fermilab has decided not to expend additional resources on this activity.

Fermilab continues with the pilot program with ANL to have them involved in the licensing efforts for some of Fermilab's patents. Since the licensing process involves identifying potential licensees and then executing a license, to date there is little progress. However, both Fermilab and ANL believe this approach may effectively and efficiently enhance Fermilab's licensing efforts.

Opportunities for Improvement:

With the current low level of activity indicating little need for additional resources there are no planned improvements to this activity. By the nature of the basic research done at Fermilab and the emphasis on open publications there is little chance that the intellectual property activity will increase substantially.

Metric G.1.1.1.1 is rated **Good**.

Counterintelligence

Counterintelligence is a developing program at Fermilab. The primary requirement of an all employee annual briefing concerning counterintelligence was met on time. Again this year, with the concurrence of the DOE Chicago Office Counterintelligence Office this briefing was accomplished by issuing an all employees memorandum. A major activity connected to, but not exclusive to CI, was the implementation of the Deputy Secretary's December 17, 2002 Interim Guidance concerning Unclassified Foreign Visits and Assignments. This activity required extensive changes to the policies, practices, and procedures used by Fermilab employees with regard to its scientific users and long-term sub-contractors. These changes were effectively put in place by the required deadline.

Other counterintelligence activities that weigh on this evaluation include: 1) providing information in the Foreign Travel Management System such that CH-CI can conduct, as they deem appropriate, pre-trip briefings for travelers; 2) timeliness of sensitive country foreign travel trips reports for use by CI; 3) a joint classified CI status briefing for the Fermilab Director, Associate Director for Administration and DOE Manager of the Fermi Area Office, and; 4) a special morning long CI briefing of Division/Section heads and a laboratory wide seminar titled "Terrorism Awareness – What You Need to Know" both given by the DOE Counterintelligence Central Training Academy. All of these actions were met effectively with the exception of item two.

Opportunities for Improvement:

Item two in the above list needs work. While CH-CI has not raised an issue, our records show most trip reports for travel to sensitive countries were late to CI.

Metric I.1.1.1 and I.1.1.2.1 are rated **Outstanding**.

Business Services Section

Administrative Support

Procurement

Fiscal Year 2003 has seen the Procurement Department continue to refine procedures and processes for subcontractor evaluation, contract administration, construction, safety, and Procurement credit card activity.

Procurement continued to pursue effective delivery of products and services to its lab customers and all stakeholders through the use of procurement tools aimed to deliver "best value." Among the actions taken were presentations showcasing the full compliment of Procurement's offerings and capabilities to various lab entities.

Internal audits of the Procurement credit card program and subcontract administration were performed. Administrative fine-tuning and revisions of appropriate procedures resulted from these audits.

Additionally, FY 2002 Balanced Scorecard and Affirmative Procurement results were furnished to DOE.

A Balanced Scorecard Plan for FY2003 was submitted to and approved by DOE. This plan has been analyzed using information available to date and the Laboratory appears to be on track to meet all of its FY2003 Balanced Scorecard targets.

Metric K.1.1.1.1 is rated **Pass**

All of the issues identified as "opportunities for improvement" during the last performance period have been implemented. These are:

1. The ProCard User's Guide was updated in September of 2002.
2. ProCard training for cardholders was offered in October 2002 and training for ProCard holder supervisors was accomplished in the summer of 2003.
3. Clerical changes and a list that reflects current "restricted items" was incorporated into the ProCard User's Guide in August of 2003.
4. "Short Order" users were reminded of the advantages of insisting upon complete deliveries in November of 2002.
5. The Commercial Procurement Procedure was updated in September of 2003.

The subject of Procurement Department improvements was discussed with the Procurement Staff throughout the past year at scheduled staff meetings.

K.1.1.1.2 is rated **Outstanding**

DOE has approved the lab's Procurement System. The Procurement Department continually assesses many of its processes. This year has seen self-assessment of the Procurement Credit Card, Subcontract Administration, Subcontractor Evaluation, Procurement Approval, Procurement Close out, File Retention and Expediting components of the Procurement function. This represents 34% of the Procurement processes.

Metric K.1.2.1.1 is rated **Pass**

Fermilab once again participated in the DOE Contractor's Benchmarking Study as performed by the Center for Advanced Purchasing Studies (CAPS). And once again the efficiency, value and timeliness attributes of Procurement become apparent.

Of course there is room for improvement, and Procurement continually strives for it. Documenting processes, clarifying procedures and defining roles and responsibilities are ongoing efforts that we are presently working on. The Procurement Balanced Scorecard is available at [attachment 5](#).

In view of the above, the overall rating for the Procurement Department is **Outstanding**.

Property

Property Management is responsible for the implementation, development and administration of policies, programs and procedures for effective and economical receipt, storage, use, control, physical protection and disposition of government personal property in the custody of the Lab. The Property Office currently has a certified Property Management System, which was approved by DOE on December 20, 2000.

Fermilab submitted the FY2003 Balanced Scorecard (BSC) plan, which was approved by DOE on November 6, 2002. This plan targets four perspectives: Customer, Internal Business Process, Learning & Growth and Financial. The FY2003 BSC Report for Property is provided as an attachment to this self-assessment.

Opportunities for improvement as outlined in the FY2002 Balanced Scorecard were to improve our 180-day Excess and Surplus Assets disposition rate and improve accuracy of the Warehouse Storage Locations. Both areas were addressed and improvements were made. The 180-day disposition rate increased from 42% in FY2002 to 73% in FY2003, and the accuracy of storage locations increased from 96.3% in FY2002 to 98.4% in FY2003.

Metric J.1.1.1.1 and J.1.1.1.2 are rated **Outstanding**

As a part of the Balanced Scorecard Plan, all major processes, such as accountable equipment, sensitive items, precious metals, stores inventory and motor vehicles, related to Property and a Certified Property Management System are assessed each year. The BSC Report ([attachment 6](#)) provides details regarding the performance of these processes.

Metric J.1.2.1.1 is rated **Pass**.

Property Balanced Scorecard Summary

This section summarizes the separately attached BSC Report for Property. For the Customer Perspective there are four core and two local measurements. The first two concentrate on the extent that both our internal and external customers are satisfied. For Core measure #1, six surveys were sent out to external customers and four were returned. The ratings of all four returned, or 100%, were "positive," exceeding the national target of 80%. For Core measure #2, there were fifty surveys sent out to internal customers and fourteen were returned. The ratings of all 14 returned, or 100%, were "positive," exceeding the national target of 80%. The feedback from these surveys was positive and will help us improve our operations. The other two core measurements for the Customer Perspective concentrate on the verification of properly assigned equipment and sensitive assets. This random sample occurs each year for sensitive assets and biennially for equipment assets. Both of these measures were applicable for this year and the results for the sensitive sample were 651 out of 655 or 99.4% properly assigned. For the equipment sample, the results were 582 out of 587 or 99.2% properly assigned. Regarding the two

local measures: the accuracy of warehouse storage locations was 98.4%, exceeding the target of 98%, and the "Fill Rate" for the ISS Stockroom was 96%, exceeding the target of 95%.

The Internal Business Perspective has one local and five core measurements that are applicable to Fermilab this year. Core measure #1 is the percentage of surplus assets sold using online sales media. In FY2003 Fermilab sold 378 items online out of a total of 1145 items sold, or 33.01%. This is an increase of 5.64% over FY2002, so the Fermilab exceeded the expectation of a 5% increase. Core measure #1D is the total number of items located and the acquisition cost for these items in the ISS Stockroom during inventory cycle counting. In FY2003 the numbers are 99.71% and 99.82% respectively, exceeding expectations. Core measure #3 focuses on excess and surplus assets disposed of within 180 days. The result for FY2003 was 73%, which is up dramatically from the FY2002 performance mark of 42%, although Fermilab did not achieve the goal of 90%. With the improved reporting tools from our Property Management System, Sunflower, we have been able to focus more on this performance measure. Core measure #1C is the percent of sensitive assets located during the most recent physical inventory. The percentage of items located and acquisition cost were 99.99% and 99.97% respectively, exceeding expectations. Core measure #2 is the percent of motor vehicles meeting usage standards. The result for FY2003 was 98%, well exceeding the expectation of 90%. Core measure #1B, the percent of equipment items located during the physical inventory was not reportable in FY2003, because this inventory is conducted only every two years, and is scheduled for FY2004. The local measure is the turnover ratio for the ISS Stockroom. In FY2003 Fermilab averaged 2.9 turns, which is above the previously existing national target of 2.

The Learning & Growth perspective has three core measurements. Core measure #1 is the extent to which reliable property management system measures are in place and communicated regularly. In an effort to remind employees, users, and subcontractors to protect Government property from theft, loss, or misuse a memo was issued from the Directorate to all Fermilab employees on March 21, 2003 on the "Use and Care of Government Property." The Property Office conducts bi-weekly meetings to review important Property issues and procedures. This met expectations. Core measure #2A is the percent of scheduled training supporting BSC objectives completed by Property and Stores Inventory Management employees. Training was scheduled for 15 Property employees and all 15, or 100%, completed the training. This exceeded the performance expectation of 90% in FY2003. Core measure #2B is the percent of Property and Stores Inventory Management employees with an individual development plan based on BSC objectives. Managerial staff did participate in monthly conference calls with the Sunflower users group and the Office of Science Property Managers, and monitored the minutes from the National Property Management Association. Due to travel budget constraints and the lack of availability of local courses, there has been a limited amount of external training for the three managerial employees. Fermilab met expectations for this measure in FY2003. Core measure #2C is the percent of Property and Stores Inventory Management employees that received annual performance reviews based on BSC objectives. Each of the three managerial employees, or 100%, has specific BSC objective goals that were part of their annual performance evaluations. Fermilab exceeded the expectation of 90% for this measure in FY2003.

The Financial perspective core measurements concern decreasing the administrative costs associated with online sales. We are in the second year of trending these costs and do not currently have enough information to evaluate what improvements need to be taken.

The Property Office received the last of the 10-ton "green" and "blue" blocks for the NuMI and MiniBoone projects. Approximately 800 of these blocks, which were produced from excess low-level radioactive steel at Duratek, near Oak Ridge, Tennessee, were acquired to use as inexpensive shielding. Property also assisted the Technical Division in shipping the remaining muon detector chambers to the Institute of High Energy Physics/Beijing and Petersburg Nuclear Physics Institute/Russia for the LHC Compact Muon Solenoid project. Over the past twelve months the business activity at the "second hand stores"

operation for computers and computer peripherals has increased dramatically. Re-utilizing internally excessed computer equipment has resulted in significant savings to Fermilab.

The Sunflower property database was upgraded from version 2.5 to 3.5. Some of the resultant changes to the software, such as web-based information availability and the potential to provide information update functionality to the field have been, and as installed features are implemented, will be even more beneficial to improved Property Office operations.

Overall the performance of the Property Management function is rated **Outstanding**.

Travel

One improvement in the overall travel process that has been identified in several previous years' self-assessments is the potential implementation of an automated travel settlement system. A set of requirements, project charter, and cost estimate were prepared and the Laboratory continues to monitor progress at similar institutions on this matter, awaiting budget and resources for implementation. A tentative budget line item for this project has been included in the FY2004 preliminary guidance, and the costs and benefits of implementation will be weighed against other potential improvements to the Laboratory's business and financial systems in that period.

Security (BSS)

Cyber (BSS)

The Business Services Critical System consists of the Laboratory's core Oracle Financial and PeopleSoft Human Resource Management systems. These systems reside on Compaq Alpha database servers and Compaq Windows file servers located in the Feynmann Computer Center and Wilson Hall 5W. This critical System does not include desktop clients attempting to access these systems.

Business Services implemented ongoing network security upgrades to its Critical Systems this past year. These included upgrading its existing firewall (hardware and software), implementing new host-based detection processes, and improving upon its monitoring and audit capabilities. Business Services experienced no security exploits to its Critical System this past year and achieved greater than 99% production systems availability during production hours (which translates to unplanned production downtime of less than about 20 hours a year). This exceeded performance expectations set forth by senior management at the beginning of the year.

An internal Critical Systems Review (CSR) was conducted in December 2002, and determined that the Business Services critical systems are being operated in accordance with the documented Critical Systems Plan (CSP) of the Fermilab Computer Security Program Plan (CSPP), Revision 5.1.

In addition, an external Self-Assessment and Peer Review was conducted in April 2003, and determined that recommendations of a prior 2001 review were implemented and that Business Services computer activities were in compliance with the laboratory's CSPP. The review committee recommended creating a remote access policy addressing access to PeopleSoft and Oracle financials. An internal committee has been formed to recommend policy to Fermilab management. The review committee also recommended an examination of certain features of the server and network architecture for PeopleSoft, and these studies are underway.

Property Protection (BSS)

During FY2003, in response to findings from a previous HPR inspection, Business Services Section initiated a project to add fire alarm pull stations to Warehouses 1 & 2. A contract was awarded in FY2003 and work was completed in early October, FY2004.

ES&H (BSS)

BSS worked all of FY2003 without an OSHA Lost Workday Case (Days Away, Restricted, or Transferred). At the end of the fiscal year there were 413 days worked since a DART, surpassing the previous record for the Section of 389 days.

Section management continued its comprehensive, periodic ES&H walkthrough program of all its areas during the year, with participation from the Directorate and the DOE-FAO.

BSS ended FY2003 with a 99.3% completion rate for required ES&H training.

A Tripartite Assessment of the Railhead operations was conducted in FY2003. Several Noteworthy Practices were identified:

1. BSS diligently continues to maintain the Railhead as a well-organized storage area while supporting other division/sections, under the Equipment Held for Future Program Use and Excess programs.
2. The requirements of the DOE moratorium on the recycling of scrap metals from radiation and radioactive materials areas are being diligently followed and efforts continue to seek out opportunities for on-site reuse as a preferred alternative to bulk disposal. It should be noted that indefinite continuation of the moratorium may require review of on-site storage capacities.
3. BSS-Support Services conscientiously monitors for changing levels weekly and seeks support from ESHS Groups as needed.
4. Prompt, effective actions were taken upon realizing that increased radiation levels were present in 2002. This effort was initiated by the landlord, BSS, but involved a considerable amount of timely and effective coordination with personnel from the ESHS and all organizations who store items at the Railhead, especially BD and PPD. These efforts included further reorganization of the Railhead by BSS with help from ESHS, expedited radioactive waste disposal.

Accounting

The Accounting Department operated in a challenging environment in FY2003. DOE shortened the month-end close window and the time demands due to the Project Accounting implementation increased, and the Department experienced significant staffing changes spurred by the retirement of the Chief Accounting Officer in December, 2002. Following is an assessment of the performance of the Accounting function in FY2003:

Project Accounting Implementation

The Project Accounting (PA) module of Oracle Public Sector Financials was implemented in March 2003, on time and within budget. Accounting was a key contributor to the successful implementation, devoting almost 2FTE's to the Core Team and a large number of hours to the design, setup, and system testing of the new module, interfaces and reports, as well as procedure development and documentation. The PA implementation affected virtually every job in Accounting -- the PA module is our new core accounting system. The new system was characterized by very few post-implementation problem reports, and

Accounting was able to close the first month on PA nearly error-free, and on time under DOE's new accelerated close requirements.

DOE Accelerated Close

Beginning with the January 2003 month-end close, DOE required submission of the monthly close data by noon on the third working day of the next month, reduced from the fourth working day previously, a 30% acceleration. Accounting coordinated earlier due dates with the field budget officers, and revised internal procedures, so that accurate financial data was submitted timely each month. DOE's year-end close schedule for FY2003 reflects a similar acceleration in submission time compared to FY2002.

PeopleSoft upgrade

Accounting was again a key participant in a major system upgrade. PeopleSoft HRMS was upgraded to version 8 during FY2003, and went live on time and without event in May 2003.

Payment Processing

Despite the major system implementation/upgrade projects in FY2003, the Lab's quarterly Erroneous Payments Reports to DOE indicate a 99.95% error-free payment rate for the first 3 quarters, consistent with FY2002. On a dollar basis, the erroneous payment rate for the first three quarters of FY2003 was .05% (\$95K erroneous on over \$181M payments), almost all of which was recovered.

Accounts Receivable Metric

Accounting is responsible for Financial Management metric H.1.1.2.1, "95% of receivable dollars at the end of any reporting period are not more than 90 days delinquent, and the remaining 5% of receivable dollars are not more than 180 days delinquent."

Following are our quarterly results for FY2003 to date:

	12/31/2002	3/31/2003	6/30/2003	9/30/2003
0-90 Days	98.90%	99.85%	99.89%	100.00%
91-180 Days	0.87%	0.15%	0.08%	0.00%
Over 180 days	0.23%	0.00%	0.03%	0.00%
Total	100.00%	100.00%	100.00%	100.00%

The items over 180 days at 12/31/02 and 6/30/03 translate to approximately \$25,000 and \$1,700 respectively, on estimated annual A/R activity of over \$10,000,000.

Metric H.1.1.2.1 is rated **Outstanding**

Internal Controls and Audit Findings

For the third year in a row, Fermilab's annual financial statement and A-133 (grant) audits completed by KPMG LLP for FY2002 resulted in no findings or suggestions for improvements in internal controls. In addition, Internal Audit reports issued in FY2003 have included no significant findings related to internal controls in Accounting.

Opportunities for Improvement

In prior years, we have identified the following opportunities for improvement:

1. A Time and Attendance system would eliminate pay errors that are due to manual entering of data and eliminate the need for a separate effort reporting system outside of the Payroll environment.
2. The Accounts Receivable process could best be improved by developing a more efficient invoicing system.
3. Implement a Travel Settlement system to improve travel expense processing.
4. Treasury operations procedures, except for cash handling, need to be updated.

Current status of the opportunities for improvement is as follows:

1. Accounting has taken no action to further the implementation of a Time and Attendance system due to resource constraints arising primarily from the PA implementation.
2. Accounting developed a detailed requirements document for a new Accounts Receivable system, which is being reviewed by Oracle for a high-level gap-fit analysis with their software. Development work is slated to begin in FY2004 after the software selection has been completed.
3. A project charter has been drafted, putting forth objectives, deliverables, goals and justification for an automated Travel Settlement system. Software selection and implementation of the system is dependent on availability of functional and technical resources, and funding.
4. Accounting has not yet updated treasury operations procedures.

Overall assessment

The core functions of accounting—timely and accurate payment processing, strong internal controls, timely and accurate reporting inside and outside the Laboratory—are being performed in an “Outstanding” manner, an assessment based primarily on the financial results achieved above in the midst of designing, testing and implementing major changes in systems and processes.

The overall assessment of the Accounting management area is: **Outstanding**.

Business Systems

The Business Systems Department supports the business information needs of Fermilab. It is comprised of 25 IT professionals and staff and is organized into four competency groups: Production Systems Services, Project Services, Technical Services and Training & Administrative Services.

Production Systems Services

The Production Systems Services group supports Fermilab’s core business information systems, which consist of Oracle Financial and PeopleSoft Human Resource Management systems. These systems are continuously upgraded to enhance existing systems functionality and to maintain currency with vendor support requirements. Upgrades are scheduled and implemented in accordance with business needs and vendor support requirements. Fermilab’s business systems are up-to-date and reside at version levels that are supportable by commercial software vendors. Oracle Financial systems have been upgraded to version 11.0.3 and PeopleSoft Human Resource Management systems to version 8.3. These systems are highly reliable and have excellent support capability.

Significant emphasis is placed on minimizing customizations to vendor provided software. This industry “best practice” is a key aspect of Fermilab’s Systems Development Life Cycle (SDLC) methodology for its business systems. It is also a key tenet of its Strategic Information Systems Plan (SISP) for its business

systems. Major systems initiatives like Oracle Project Accounting (PA) this past year provide an excellent example of eliminating unneeded software customizations and costs by requiring business justifications throughout the SDLC process.

Production Systems software development is managed using structured SDLC methods and tools. These tools allow for collaboration on development activities and provide an institutional memory of procedural and problem solving information. Controls such as automated approval hierarchies provide assurance that Fermilab personnel and contractors carry out the systems development procedures management has prescribed for them. Electronic documentation is in place for management, auditor and operational review, and a clear separation of responsibility exists between individuals performing software development (Application Developers) and individuals migrating changes to production systems environments (Production Control). This past year, 527 code packages were migrated from development into production systems environments without incident.

Project Services

The Project Services group provides Fermilab with expertise and leadership in project management and new systems implementations. Its focus is on building systems capabilities that enhance business functionality and service and enable management to exert better control over Fermilab operations and expenses. This past year, Project Services implemented a new laboratory-wide project management and accounting system (PA). This highly successful effort was achieved on time, within budget, and resulted in minimal impact on the end user community. It accomplished the goals set forth by senior management at the beginning of the project, and produced deliverables that were high quality and achieved as planned.

Project Services also implemented enhancements to the Centralized Name & Address system (CNAS) in support of Fermilab computer security initiatives, converted telecommunications assets into a centralized system, and upgraded the Sunflower Asset Management system to version 3.7 to leverage new features of this software.

Technical Services

The Technical Services group provides technical support for Business Systems computer hardware, operating system software, databases, and desktops. Priority is placed on providing a reliable, cost effective computing environment for Business Services and its customers. Industry standard computing solutions are utilized to exploit economies of scale through these solutions.

Business Systems File Servers, Database Servers and desktops are continuously upgraded in order to provide reliable and effective computing environments for customers and to maintain currency with vendor support requirements. These upgrades are scheduled and implemented in accordance with business needs and vendor support requirements. Industry "best practices" of standardizing hardware and software configurations is strongly emphasized.

The business systems technical architecture is comprised of Compaq Alpha Database Servers running Tru64 UNIX and Compaq Proliant File Servers running Windows 2000. These systems are up-to-date and reside at version levels that are supportable by commercial software vendors. These systems are highly reliable with excellent support capability. This past year, the laboratory's business systems achieved greater than 99% production systems availability during production hours (which translates to unplanned production downtime of less than about 20 hours a year). This exceeded performance expectations set forth by senior management at the beginning of the year.

Desktop hardware and software configurations have been standardized across the Business Services Section (BSS). This industry "best practice" has resulted in a common set of supported desktop

applications that are highly dependable. This has reduced demand for “low-level” desktop support, increased service levels and allowed resources to be redeployed to other tasks. Standard desktop configurations are built, tested, distributed and monitored using network management tools. Database Management Systems have been standardized on Oracle across all platforms.

Training & Administrative Services

The Training & Administrative Services group trains Fermilab personnel in new and upgraded versions of business systems software. It also oversees the creation and maintenance of procedural documentation, administers the Business Systems Help Desk, and provides administrative support as required. This past year approximately 500 person/training sessions and 7 Town Hall meetings were conducted for PA, and more than 280 pieces of procedural documentation were created. The Help Desk also successfully closed out more than 1400 customer service requests.

Business Systems conducts meetings with its key customers (e.g. Accounting, Procurement, etc) on a regularly scheduled basis to review and prioritize enhancements to existing systems and to agree upon metrics and measures of importance. Prior to FY2003 these meetings were held annually, but based on input from the customers, the schedule has been changed to once every two years. In addition, written Customer Satisfaction Surveys are performed every other year in conjunction with the customer meetings. Typically these meetings and surveys are conducted with senior laboratory management, senior business leaders (e.g. Chief Accounting Officer, Budget Officer, Head of Procurement, etc.) as well as functional representatives and users of business software throughout the laboratory. The primary objectives of these meetings are to review Business Systems past performance and to identify future opportunities for applying technology to help solve business problems. A formal questionnaire consisting of approximately ten questions is provided to customers. These questions pertain to services provided and customers are asked to rate services on a scale of 1 to 5 (1=Poor, 5=Excellent). These responses are compiled, compared against previous years results, and are reviewed by Business Systems Management and the entire staff. Items warranting follow-up have electronic Action Items created in Lotus Notes and are assigned for resolution. For FY2002, the composite Service Level Rating of Business Systems by its customers was 4.4. The Customer Satisfaction Survey for FY2004 has not yet commenced, but ratings are expected to approximate those of FY2002.

Based on the above information, Business Systems operations are rated **Outstanding**.

Legal Operations

The Fermilab Legal Office provides legal support to Fermilab management and staff concerning all aspects of Fermilab operations. As the size of the Legal Office is small (two full-time attorneys), the Legal Office must also oversee the use of outside counsel for the provision of legal support in specialized areas of the law and for representation of the Laboratory in litigation. As stated in the Fermilab prime contract's Performance Measures for FY2003, the primary objective of the Legal Office is to ensure the provision of quality, timely, and cost-effective legal services that protect the interests of Fermilab and the U.S. Government. To that end, these Performance Measures include two measures for Legal Management. As these two measures are extremely broad in scope, a comprehensive analysis of the Fermilab Legal Office's performance against them will also serve as an overall assessment of legal operations at Fermilab. The two measures and the associated performance analyses are set forth below. In this regard, Fermilab believes that it has earned an outstanding rating for each of the measures.

Metric L.1.1.1.1 and L.1.1.2.1 are rated **Outstanding**

Accordingly, the overall performance of Fermilab with respect to legal operations should also be considered **Outstanding**.

(See [Attachment 7](#) for the detailed assessment.)

Support Services

The Distribution and Receiving groups worked together to process and deliver approximately 36,000 packages, which represents 17% more activity than FY2002 and 12% more than FY2001. In addition there were approximately 8,100 pickup, delivery and move jobs assigned to various drivers, up 14% from FY2002 and 32% from FY2001. These levels of activity are driven by the varying programmatic needs of the Laboratory and thus are not accurately predictable, but the service goals are to clear the dock each day and accommodate the on-site delivery demand without need for additional internal or outside resources, and these goals were achieved. The on-site Taxi service also provided by this group handled 18,696 passengers, which was a decrease of approximately 13% from the two prior years. This year, due to labor issues, no summer student taxi drivers were employed to handle the typical seasonal increase in demand, which reduced capacity and may have driven up wait times somewhat, consequently decreasing passenger load. These activities were accomplished with a reduced staffing level.

The Shipping, Traffic, and the Mail Group work contiguously with the Receiving group. To offset staff reductions in these groups in recent years, a significant amount of cross training has been done to increase the flexibility and utility of the work force. The sharing of workers from the Receiving group to the other groups has been very helpful in insuring uninterrupted operations. Five employees were crossed trained on DOE's Automated Transportation Management System (ATMS) this year.

An important goal for Fermilab is to meet the requirements of Executive Order 13149 as prescribed by the DOE-URA prime contract, to achieve a 20% reduction in the consumption of petroleum based fuels by FY2005 as compared to a FY1999 base. To this end, in FY2003 Support Services installed a new 6,000-gallon E85 (85% ethanol, 15% gasoline) fuel tank and pumping system to serve the 20 existing E85 alternate fuel vehicles as well as future units that may be acquired as aging vehicles are replaced. The project was funded through DOE-HQ's Office of Energy Efficiency and Renewable Energy, and administered by DOE-Idaho, and was completed on-time and on-budget. In addition, both the pumping and storage capacity of the existing compressed natural gas (CNG) fuel service were doubled, to better serve the 40 existing CNG-capable vehicles. Fermilab is now on target to achieve the 20% petroleum-based fuel use reduction by FY2005.

Another important goal for Fermilab is to meet the DOE mandate to reduce the size of the vehicle fleet by 5% by the end of CY2002 and 3% by the end of CY2003, for a total of 8%. This amounts to a total reduction of 19 vehicles, from 249 to 230. Fermilab met the CY2002 target and will meet the CY2003 target when the remaining vehicles to be eliminated (3) are returned to GSA this fall. The Vehicle Maintenance group was able to keep the CY2003 fleet of 233 vehicles running with existing staff in spite of the increased age of the fleet.

Even with reduced staffing levels, the work was performed safely as evidenced by there being no lost-time injuries for more than a year. All training has been accomplished and procedures have been kept up to date. The overall assessment of the work performed in Support Services is **Outstanding**.

Telecommunications

The Fermilab Telecommunications department is responsible for providing all voice related services and associated hardware to the entire Laboratory community. Our operations are segregated into 3 core functional areas – phone services, wireless services and radio services. The department's primary goal is

to recommend, procure and provide support for products and solutions that meet the customer's needs and provide the best value for Fermilab.

The department's activities are assessed on its own internal managements' policies and procedures. Although there are no DOE measures or metrics which this department is responsible for, we do use DOE Orders 1450.3A and 5300.1C as guides.

Phone Services

A remote phone switch (5ESS-Centrex), housed at our Batavia facility supports approximately 4400 analog and digital lines. A variety of features are supported on these lines including in-house voice mail. Software support for the feature programming as well as voice mail capabilities is maintained within the department with additional support provided under maintenance agreements with our Local Exchange Carrier (SBC). A 7-year rate-stabilized contract with SBC provides the terms of the lease agreement for the 5ESS switch, Centrex lines, local usage and on-going maintenance support. This contract is up for renewal in FY2005. A recently renewed 3-year Local Usage Agreement gives Fermilab additional savings on its calls to locally dialed exchanges.

A staff of 2 technicians provides support for customer requested phone moves, adds and changes as well as most repairs to wiring and hardware on our side of the network point of presence (NET-POP). Of the more than 325 work orders and approximately 350 repair requests which were processed this year, an estimated 85% were completed the same day or within 1 business day of receipt. This one-day or less response time will be monitored for consideration as a long-term performance measure.

Multiple annual contracts totaling \$1.56M provide such services as cellular and paging, video and audio conferencing. Contracts providing international and domestic long distance dialing are coordinated with DOE-HQ as part of the larger GSA contracts with AT&T-ID3 and Crossover and FTS-2001.

The department manager closely monitors expenditures on all contracts through the monthly review of invoices as well as a bi-annual budget analysis. Due to the newly negotiated Local Usage contract, Fermilab was able to adjust annual contract amounts for invoiced Centrex (local) services downward by 16%. Similarly, Telecommunications was successful in shifting many of its cellular (accounts) to more cost-effective monthly call plans thereby reducing expenditures of this type by up to 40%. One final cost saving measure realized this year was the elimination of nearly 100 phone lines that will result in an annual savings to the Laboratory of roughly \$20K.

Wireless Services

During the past year, Fermilab internal auditors examined the policies and procedures, internal controls and the general administration functions of the departments wireless program. The auditor's report noted 7 findings – most of which were procedural or administrative in nature. The Telecom department will institute some new procedures in response to the recommendations of the audit, such as completing an update of our departmental wireless procedures and usage guidelines for employees and requiring the co-signature of the cell phone user's supervisor on monthly invoices to show business justification. The auditor's trend analysis on cellular call data focused on three areas of concern: calls over 30 minutes in duration, calls made to a specific phone number multiple times in one month and lack of use (underutilization). The results of this analysis were presented to Fermilab management for review and action if necessary. Most of the activity scrutinized in the analysis was not found by Fermilab managers to be problematic; however, service to 4 underutilized phones was eliminated. Areas of operation that were noted to be performing well included: cost control of monthly service and reduction of overall costs; adequate inventory tracking procedures; and employee awareness of "Use of Government Telecommunications" policy.

Radio Services

One of our objectives over the last few years has been to work cooperatively with DOE-CH and also, more recently, their contracted spectrum specialist to meet an FCC mandated migration of all radio systems operating on government frequencies to narrowband compliance by January 1, 2005 (for VHF) and January 1, 2008 (for UHF).

Fermilab has 9 independent systems providing network communications for various functional areas (Fire/Security, Transportation, Site Maintenance, Scientific). More than 50% of the fixed and portable equipment associated with these network systems, remains to be replaced. Funding has been requested in our FY2005 budget plan, though Fermilab may need to accelerate the funding profile to ensure the purchase of narrowband compliant radio equipment far enough ahead of the VHF migration deadline of January 1, 2005. Business Services has provided detailed requirements to the divisions and sections. Meanwhile, we are continuing to replace damaged or non-repairable radio equipment as well as upgrade individual radio systems that have obtained division/section funding approval with narrowband compliant equipment.

Telecommunications is responsible for ensuring the up-time and continuity of all of Fermilab's radio networks and coordinating the necessary activities to make this happen. Most of the maintenance, installation and repair of these networks is out-sourced to a single vendor source under a multi-year contract. A few of the larger projects undertaken this year include upgrades to some of the emergency warning siren system components which were either obsolete or un-repairable. Both our Fire/Security as well as the Site Operations and Maintenance networks are also undergoing a transformation to repeater-based radio systems to provide more reliable site communications. Each of these projects is expected to be complete by the end of calendar year 2003.

Opportunities for Improvements from Previous Assessment:

1. One objective from last year's assessment was to improve the property inventory method used to track government telecommunications equipment. Data records were prepared for migration and custom reports and queries were developed, and cutover to the Oracle Sunflower Asset Management system was successfully accomplished in late September, 2003.
2. Progress on the development of departmental wireless procedures has been slow. It is believed that once the responsibilities of year-end close and property management system migration are complete, resources will again be available to focus on this task.

Despite a small staff size (5 FTE's), the Telecommunications department continues to provide a consistent and high quality level of customer service, oversees the maintenance, support and continuity of our hardware and software systems and assists the Fermilab community in support of its scientific mission. We have been successful in reducing Telecom expenditures despite increasing demand for more varied services like teleconferencing and wireless technologies. The Business Services Section (including Telecommunications) was also favorably rated by members of the Fermilab scientific community during the last annual review.

The Laboratory rates its performance in Telecommunications as **Outstanding**.

Labwide Environment, Safety & Health

Security – Property Protection (Labwide)

The Property Protection Program is a major component of the Lab's Integrated Safeguards and Security Management (ISSM) system. Its purpose is to assure protection of DOE property through the implementation of appropriate physical and administrative controls. This program depends upon the cooperation of employees, users, and subcontractors to take reasonable precautions to safeguard DOE's assets from loss or theft. The Lab Director affirmed his expectations regarding these responsibilities in a March 21, 2003 memorandum to all onsite personnel.

The Support Services Department in the Business Services Section plays a significant role in the Property Protection Program. Their functions are divided among Material Distribution, Shipping/Traffic, and the Property Office. The Material Distribution Group receives all materials delivered to the Lab and manages their onsite movements. Shipping/Traffic manages and coordinates shipping arrangements with carriers and performs freight billing audits and approvals. This organization also serves as the liaison with commercial carriers, prepares necessary traffic documentation, and coordinates import and export activities. The Property Office is responsible for the identification, labeling, tracking, inventory, and control of all property items at the Laboratory. This includes processing of new items, disposition of used equipment, establishment of loan agreements, and scrap operations. Within the Lab's ISSM system, the Security and Support Services Departments are jointly responsible for establishing, documenting, and recommending the appropriate physical and administrative requirements to safeguard property, equipment and supplies.

Self-assessment is an integral component of the Lab's Property Protection Program. One type of review is based on the Site-Specific Threat Guidance and the Design Basis Threat Assessment. This technique considers factors such as theft potential and equipment attractiveness as they may contribute to deliberate criminal acts. Another approach tests the mitigation factors that are currently in place to protect property.

One threat that was evaluated in FY2003 is the supply of potable water at the Lab. Much of this water is supplied through onsite wells. The ES&H Section's Security Department conducted an evaluation of potential threats and several straightforward recommendations resulted. Their implementation has minimized the threat of sabotage/tampering and subsequent interruption of service or waterborne illnesses to onsite personnel.

Another positive aspect of the Lab's security program is the focus on property protection areas. The primary security threats to Fermilab are programmatic impacts and theft/vandalism. There are no targets that would be of special interest to terrorists or otherwise related to national security. This has allowed for a more efficient use of security resources to protect programmatically significant facilities. In particular, access to property protection areas is controlled with ID key-cards. In this way, individuals can be limited by location, day of the week, and time of the day. Further, the status can be quickly modified, e.g., in the event of a termination. This system has proven to be both effective and well-accepted by the Lab population.

Fermilab management believes that a satisfactory ISSM system has been put into place, meeting all of the applicable criteria established by the Office of Science. In addition, the Chicago Operations Office assessed Safeguards and Security during December 6-18, 2002. This organization determined that the Lab's Property Protection Program deserved a satisfactory rating (the best rating possible).

Metric E.1.2.1.1 is rated **Pass**

A single suggestion arose from the Chicago Operations assessment; that being for the Lab's Security Department to work more closely with the Property Management Office to reduce the amount of government property losses. As a consequence, the heads of the Business Services and ES&H Sections conducted an internal review of property losses. They concluded that improved tracking and communication of property losses would likely enhance the control of government property. The status of property losses is now reported as a lagging indicator at the Lab Director's weekly planning meeting with division/section heads. Since the implementation of this process, property losses have been observed to decline. Additionally, new procedures were implemented for loaning equipment to outside institutions that decrease the potential for such equipment to become misplaced.

At the end of April 2003, Fermilab was visited by the Nonproliferation and National Security Institute Training Approval Program (TAP) Review Team. This group determined that Fermilab's TAP self-assessment report was successfully completed and granted approval through September 2006. In addition, the team found that the Lab's nuclear materials representative "is to be commended for an excellent attitude and outstanding effort..." Further, the Lab's security training captain "is to be commended for his attention to detail, his efforts to ensure that his program is well structured and documented..."

Below is a review of the Lab's property protection status with regard to implementation of ISSM's guiding principles.

Line management owns security.

Every manager at the Lab is responsible for integrating appropriate security controls into his/her work and for ensuring active communication of security expectations up and down the management line. As noted above, the Lab Director affirmed his expectations regarding these responsibilities in a March 21, 2003 memorandum to all onsite personnel.

Clear roles and responsibilities are defined and communicated.

The Property Management Office in the Business Services Section is responsible for the implementation, development and administration of policies, programs and procedures for the effective and economical receipt, storage, use, control, physical protection and disposition of government personal property in the custody of Fermilab. This includes the processing of new items, disposition of used equipment, establishment of loan agreements, and scrap operations. The Property Management program is periodically reviewed and approved by the Department of Energy. The Security Department in the ES&H Section consists of the Security Team and the Communication Center Team. The Security Team provides physical security. Major functions are training, loss prevention, and operations. They may also serve as Incident Commander in accordance with *Fermilab Emergency Response Plan*. The Communication Center Team provides routine and emergency communication for the entire Laboratory, 24 hours a day, seven days a week.

Cyber and physical security, export control management, and counterintelligence functions are integrated.

Cyber Security is primarily implemented by the FCC Computer Security Team and is described elsewhere in this assessment report. Physical Security is a component of the Security Department in the ES&H Section. Export Control is contained within Business Services Section and the DOE Chicago Operations Office directs Counterintelligence functions.

Security is a value-added activity supporting research and support operations.

Security operations are constantly reviewed and modified to optimize the use of resources. For example, over the past year, the Security Department in the ES&H Section reviewed contract patrol coverage so that patrol time would yield the greatest loss control benefit. Increases were recommended for Wilson Hall and the Village Area. In addition, false alarm problems at West Wilson Gate and South Eola Road Gate have been rectified. An audit of the Village Gymnasium Alarm System was completed and a proposal to correct false alarm problems at this facility was implemented.

Security controls are tailored to individual and facility requirements.

Each Division/Section has a security point of contact. This individual works directly with the Security Department in the ES&H Section to develop an integrated security plan that meets the business needs of the group.

Define the required security elements and threats.

As part of the planning process, managers are expected to evaluate threats and seek implementation of appropriate controls. For the majority of the work at the Lab, threats are minimal and security precautions are routine in nature.

Develop appropriate countermeasures to threats, and communicate information regarding threats, countermeasures and controls.

Appropriate controls for activities at Fermilab are described in the Site Safeguards and Security Plan.

Based on the assessment conducted by the Chicago Operations Office and numerous internal property protection evaluations, the Lab's ISSM program is deemed to be acceptable.

Metric	Subject	Rating
O.1.1.1	Self-assessment of S&S focusing on ISSM	Pass
O.1.1.2	Immediate correction of deficiencies uncovered via O.1.1.1.	Pass
O.1.1.3	Track remaining corrections of deficiencies uncovered via O.1.1.1 until resolved.	Pass

Metric O.1.1.3.1 is rated **Outstanding**

CD completed a number of security improvements in FY2003:

- Installed an Uninterruptable Power Supply (UPS) for Emergency Power Outages at FCC.
- Purchased locks and tags for e-mail center laptops, as well as locks only for fixed PCs for individual laptops.
- The security card reader system was upgraded and an outside broken window was replaced at FCC.
- PPD rekeyed the KTeV Hall to make it more secure.

Integrated Safety Management

It is the policy of Fermilab senior management to systematically integrate excellence in Environment, Safety and Health (ES&H) into the management and work practices of all activities at all levels so that the mission of the Laboratory is achieved while protecting the public, the worker, and the environment.

The Fermilab Integrated Safety Management System (ISMS) has proven effective as evaluated by the performance measures and system assessments described the contract with the Department of Energy. When the FY2003 ES&H measures are combined, a rating of **Outstanding** results. The ratings for individual metrics are tabulated below.

Metric	Subject	Rating
C.1.4.1.1	Completion of ISMS Assessments	Outstanding
C.2.1.1.1	Injury Cost Index for Fermilab's Employees	Outstanding
C.2.1.2.1	Injury Cost Index for Fermilab's Subcontractors	Outstanding
C.2.1.3.1	LWC Rate for Fermilab Employees	Outstanding
C.2.1.4.1	LWC Rate for Fermilab Subcontractors	Outstanding
C.2.1.5.1	Total Effective Dose Equivalent	Good
C.2.1.5.2	Unplanned Radiation Exposure	Outstanding
C.2.1.5.3	Loss of rad Material/Spread of Radiation Contamination	Excellent
M.1.3.1.1	Pollution Prevention (P2)/Waste Minimization (Wmin) Program Implementation	Pass
N.1.1.1.1	Environmental Management Systems	Pass
S.1.1.1.1	ITNA Completion Rate	Outstanding
C.1.1.2.1	ES&H Training Completion Rate	Outstanding

Metric C.1.4.1.1 - Completion of ISMS Assessments - Outstanding

Fermilab completed all four of the scheduled tripartite assessments on the implementation of ISM within selected divisions and sections. These organizations were the Beams Division, Facilities Engineering Services Section, Laboratory Services Section, and the Environment, Safety, and Health Section. A team consisting of a member of the reviewed division or section, a representative of the ES&H Section, and the appropriate DOE-FAO Facility Representative conducted each assessment. It was determined that ISM has been successfully implemented in these organizations. Highlights include the following:

1. Employees throughout the Lab are aware of their responsibility for working in a safe and environmentally sound manner.
2. Managers accept their responsibility for assuring a safe work environment.
3. Training was provided to all employees in accordance with their responsibilities.
4. Many employees mentioned that they transferred what they learned about ISM into their offsite activities.
5. Safety concerns were readily brought forward, and quickly addressed.
6. Employees are involved in planning their work and, where required, preparing formal hazard analyses.
7. Many interviewed personnel remarked how there is more job planning and hazard analyses taking place than there was in previous years. There is also a realization that work must be done safely.
8. Appropriate levels of review are conducted prior to starting work.
9. Lessons learned are shared so as to improve performance.
10. Long-term employees feel that there is a new, more positive, attitude toward safety at the Laboratory than existed ten years ago.

Many noteworthy practices were also identified in the ISM assessments. These include improved work planning for the January 2003 accelerator shutdown, ES&H training, examples of new employee mentoring, and the rapid response of many supervisors to employee concerns. No findings were identified as a result of these assessments. However, there were recommendations to (1) communicate injury information further down the line, (2) periodically remind personnel about ISM (e.g., annual update), and (3) formalize expectations in some areas. The reviewed division/section heads readily accepted the applicable recommendations; implementation is already underway, and in many cases already completed.

Metric C.2.1.1.1 - Injury Cost Index (ICI) for Fermilab's Employees - **Outstanding**

Metric C.2.1.3.1 - Lost Workday Case Rate (LWC) for Fermilab Employees - **Outstanding**

Fermilab had an outstanding year with regard to employee injuries. In FY 2003, there were only 28 employees (out of ~2100) who had injuries that required medical treatment beyond first aid. Of these, only nine involved days away from work or restricted duty days. This corresponds to an ICI of 1.90 and an LWC of 0.35. Both of these rates are the lowest Fermilab has ever experienced within a fiscal year. Four divisions/sections had no lost workday cases and two had no recordable injuries at all. This compares favorably to the Lab's FY2002 rates: ICI of 16.41 and LWC of 1.46. Relative decreases are 88% and 76%, respectively.

This past year the Lab's senior management placed greater emphasis on working safely and injury reduction. Leading ES&H indicators were established and tracked at the Laboratory Director's weekly staff meeting. The indicators included training and management presence in the field. The Laboratory Director reviewed this information at his staff meetings and placed emphasis where needed. For example, January 2003 shutdown plans were discussed at the Lab Director's staff meeting, where he emphasized his expectation that safety would not be compromised in order to complete a work activity. This resulted in an unprecedented amount of preparation and planning. Prior to starting the work, Division/Section heads assured themselves that their employees had the training appropriate for the planned work, insisted upon hazard analyses, and met with their employees to share with them their expectations and concerns regarding safety. As a result, the shutdown work was completed with only a few minor injuries. This success went a long way toward setting the tone for the rest of the year.

In late FY2003 Lab management established a safety incentive program to encourage the elimination of DART (Days Away, Restricted, or Transferred) cases among Lab employees. When all divisions/sections have compiled 100 days or more without a DART case, three employees are selected at random each day to receive a Fermilab Polo shirt until the next DART case occurs. This was actually accomplished for seven days in 08/2003. The program was well received and apparently encouraged a greater attentiveness to safety in the workplace.

Metric C.2.1.2.1 - Injury Cost Index (ICI) for Fermilab's Subcontractors - **Outstanding**

Metric C.2.1.4.1 - Lost Workday Case Rate (LWC) for Fermilab Subcontractors - **Outstanding**

Similarly, Fermilab's subcontractors had an outstanding year regarding occupational injuries. In FY2003, there were only six subcontractor employees who had injuries that required medical treatment beyond first aid. Of these, only two were severe enough to result in days away from work or restricted duty days. Their ICI was 6.90, and their LWC was 0.99. This compares favorably to FY2002's ICI of 32.29 and LWC of 6.16, a decrease of 78% and 84%, respectively. Both of the lost workday cases were associated with the NuMI project, and the last of these occurred in February 2003. Below is a summary of the most recent lost workday cases by subcontractor type.

Subcontractor type	Last lost workday case
Fixed price	2003 February
Food service	2002 June
Custodial	2002 April
T&M	2002 January
Service	2001 May
Security	1998 April

This is indicative of better subcontractor management and job planning. During the January 2003 shutdown, over 90 subcontractor employees were hired to perform work. None was injured, despite the potential exposure to numerous hazards.

DOE-SC performed a review of the Laboratory's Construction Safety Program in December 2002. This was done as a follow up to the June 2001 Drill Rig incident. The report indicated that the corrective actions taken in response to that incident were either completed or in various stages of completion.

In response to several near-miss incidents involving lockout/tagout, the Laboratory Director established a safety panel to examine the problems that keep construction subcontractors from working safely at Fermilab. The panel included members from Fermilab and subcontractor management, as well as outside experts from DuPont and ExxonMobil. The reviewers concluded that Fermilab has a sound construction safety program. There was ample evidence of ownership and safety leadership on the part of most Fermilab employees. There was also a demonstrated desire on the part of subcontractors and their employees to work safely. In addition, the panel identified several positive aspects of the program, including the use of an integrated project team to manage activities from the very beginning, as well as the observation that subcontractor personnel indicate that Fermilab is a safe place to work. Recommended improvements included the need for regular communication of Fermilab's expectations and improved definitions for roles and responsibilities for the project management, safety support, and oversight staffs. The Laboratory Director has accepted these recommendations and has initiated development of an action plan.

Radiation Protection Program Functional Description

The goal of the Fermilab Radiation Protection Program is to conduct the scientific research program in a manner that keeps radiation exposures to employees, visitors, and members of the public As Low As Reasonably Achievable (ALARA). Radiological services to the Laboratory are described in the Fermilab ES&H Manual (FESHM) and the Fermilab Radiological Control Manual (FRCM). The FRCM is a detailed document developed, in part, to comply with Regulation 10 CFR 835. However, the objectives of the FRCM pre-date 10 CFR 835 and go beyond mere compliance since they have been regarded as possessing high importance throughout the history of the Laboratory.

The Radiation Safety Subcommittee of the Laboratory Safety Committee serves as a forum for coordinating the Radiation Protection Program in accordance with its detailed charter in FESHM 1030. It serves to identify the needs for program updating and its scope encompasses all radiological issues concerning both occupational and environmental protection. This includes the responsibilities of the ALARA committee specified in the FRCM.

Labwide, 39 people are engaged on a full time basis in leading the implementation of the Radiation Protection Program. However, the success of the program is due, in part, to the involvement of hundreds of people going about their work while applying the tenets of Integrated Safety Management.

Division/Section Functions

Divisions/Sections carry out major portions of this program by means of teamwork between their designated radiation protection staff and all the employees who work with radioactive materials or develop, operate, and maintain the accelerators and other radiation-generating equipment. This includes the preparation of safety assessment documents and shielding assessments, the institution and maintenance of the ITNA program, the development and implementation of radiological work permits, the supervision of radiological work, the conduct of investigations of radiation exposures, the development, testing, and maintenance of radiation safety interlock systems, the conduct of reviews of experiments, the performance and documentation of radiation surveys, and the implementation of measures to survey, label, and control access to radioactive materials.

Metric C.2.1.5.1 - Total Effective Dose Equivalent (TEDE) - Good

The TEDE is the sum of deep dose equivalent received by individuals monitored at Fermilab and has units of person-rem. Due to the time required for processing the results, this measure covered the period from July 1, 2002 through June 30, 2003.

The TEDE for this period was 18.97 person-rem which corresponds to a rating of good. Almost half of this value, 8.48 person-rem was recorded during January 2003. This time frame is associated with a major maintenance and development shutdown of the accelerator that was necessary to achieve the scientific goals of Run II. In order to realize the scientific potential of the research program, the accelerator complex is being required to accelerate an unprecedented number of protons. In particular, the 8 GeV Booster synchrotron is now delivering protons at rates nearly 10 times historic levels. Despite these higher intensity levels, the maximum exposures to individuals continue a longstanding downward trend. For example, the highest dose equivalent to an individual recorded during CY2002 was only 360 mrem. This is approximately half of that experienced in recent years. This continuing reduction in radiation exposures reflects that, Labwide, exposure control methods continue to improve. Fermilab's dosimetry experience is similar to that found at comparable single-purpose laboratories such as SLAC and TJNAF.

Metric 2.1.5.2 - Unplanned Radiation Exposure - Outstanding

An "unplanned radiation exposure" is any work activity, discovered during FY2003, that results in a confirmed occupational whole body exposure that exceeds an expected exposure by > 75 mrem for a non-emergency work activity and is not controlled either by a written job specific Radiological Work Permit, specific sealed source procedure, Radiological Control Organization supervision, or documented planned special exposure. Since there were no such confirmed exposures during FY2003, the rating for this metric is outstanding.

Metric 2.1.5.3 - Loss of Control of Radioactive Material/Spread of Radioactive Contamination - Excellent

As required by the Fermilab Radiological Control Manual, radioactive materials must be located in posted areas labeled in accordance with exposure rates. This metric applies to the discovery of unlabeled radioactive material(s)/contamination in excess of thresholds specified in the DOE Occurrence Reporting Program, outside of controlled, radioactive material, or radiological areas. The metric also applies to the discovery of inappropriately labeled radioactive materials found outside of the aforementioned areas.

During FY2003, there were two such events. Both involved materials with levels slightly above Fermilab's threshold for labeling radioactive items that were either not labeled at all or were labeled improperly. In both instances the levels were below the DOE ORPS reporting threshold. Neither of these events

involved the receipt of a measurable dose equivalent, and both appeared to have originated during the January 2003 shutdown. Corrective actions have been completed. The associated program requirements will continue to be monitored. Nonetheless, a rating of excellent was achieved due to the small number of events. Given the large number of radioactive items handled at Fermilab, this rating reflects the overall effectiveness of the Lab's radioactive materials program.

Metric M.1.3.1.1 - P2/WminProgram Implementation - Pass

This process includes the Lab's community-like recycling program (paper, plastic, aluminum), as well as the development and implementation of miscellaneous projects that encourage use of recycled materials and/or the adaptive reuse of materials/spaces rather than generation of wastes.

The Laboratory's objective to minimize waste and promote recycling is a three-fold approach. The first is to assure that the concept of P2/Wmin is incorporated into work planning and experimental review. These issues are addressed through the construction design review process and NEPA for projects. For experiments, it has been implemented through division/section ES&H Group involvement. For example, the demolition of the Neon Compressor Building involved recycling about 85 percent of the material of the building. The building was stripped of virtually everything inside before it was taken down. Concrete foundations were smashed and dug up with backhoes. Concrete companies will recycle the crushed concrete and sell it as gravel.

The DOE moratorium on the recycling of materials originating from radiological and radioactive materials areas that was imposed in 07/2000 has had a major negative impact on recycling. While BSS attempts to arrange for reuse of these materials onsite, the area of the Railhead hardstand tied up by these materials continues to increase. If the moratorium remains in force, either more hardstand area will be needed or other disposal methods such as bulk disposal in landfills pursued. Its continuation translates into an annual revenue loss of up to \$250k to the Laboratory. It is estimated that at present, this inventory of materials otherwise available for sale as scrap metal, amounts to 50 to 60 truckloads at 40,000 to 50,000 pounds each. Approximately 75,000 square feet of hardstand is now tied up with so-called "Group 2" items; defined as those items which do not meet Fermilab's DOE approved criteria for identification of radioactivity but cannot be recycled as scrap because of the location from which they originated as defined at the time of the institution of the moratorium.

The second piece of the approach to minimizing waste is for employees, line management, and experimenters to identify and propose viable P2/Wmin opportunities for projects, experiments, and routine operations. Division/Section representatives propose projects for P2/WM within their organization at Environmental Protection Subcommittee meetings. Suggestions are presented for discussion and acceptable smaller-scale projects are generally funded by the proposing/benefiting Division(s)/Section(s). Larger-scale more costly projects may be brought before the Directorate in the hope of securing Labwide funding. Plans are underway to construct a visitors' center that utilizes the principles of energy efficiency and sustainable design.

The third piece of the Laboratory's approach to waste minimization is division/section participation in P2/Wmin efforts. As noted above, proposals are part of each monthly agenda of the Environmental Protection Subcommittee. The degree of participation is commensurate with the mission of the Division/Section. Significant accomplishments in this category over the past year include completion of a new P2/WM awareness training video to be shown during new employee orientation. In addition, significant improvements were achieved in the amounts of paper being recovered for recycling due to further expansion of the program and by hiring a new recycling vendor. Technical Division further improved their paper-recycling program by purchasing a new automated recycling bin tipping system. The new equipment makes handling bins safer and increases the efficiency of disposal.

Metric N.1.1.1.1 - Environmental Management Systems (EMSs) - Pass

The Lab is expected to implement a compliant EMS by 2005. Over the past year, the implementation guidance in Executive Order 13148 and DOE N450.4 (now DOE O 450.1) was reviewed. A lead person was assigned to document the Lab's EMS. This individual attended an EMS development workshop sponsored by EPA Region 9. Following the workshop, the Associate Laboratory Director for Operations Support (and Chair of the Laboratory Safety Committee), tasked the Environmental Protection Subcommittee to assist in the assessment of Fermilab's Environmental Management System and develop a gap analysis. The EMS Lead developed and presented training to Fermilab EMS Team. The Lead and Team identified the essential elements of Fermilab's EMS. These elements are based on ISO 14001 and include a policy statement, aspects and objectives of the EMS, an environmental management plan, identification of roles and responsibilities, training, methods of communication, documentation of the EMS, monitoring of the ongoing programs, means for auditing the programs, and management review of the EMS.

The EMS Lead reviewed existing Fermilab EMS documentation, conducted a self-assessment against the identified elements, and developed a matrix for the gap analysis of Fermilab's existing EMS against ISO 14001. The draft gap analysis draft was reviewed by the EMS Team. This group also provided suggested actions to close the identified gaps. Milestones for addressing these issues have been identified, culminating with a management review. Based upon the assessment, it appears that Fermilab has a functioning environmental management system. It is expected that necessary upgrades will be in place by the required December 2005 deadline.

Metric S.1.1.1.1 - ITNA Completion Rate - Outstanding

The Laboratory has established a web-based process (Individual Training Needs Assessment (ITNA)) that allows for supervisors to identify the hazards to which an employee may be exposed while performing his or her job. Once these hazards have been entered, corresponding training requirements are identified on the employee's Individual Training Plan (ITP). At the end of FY2003, the percentage of employees that had completed ITNAs was 99.4%. This is clearly an outstanding effort.

Metric S.1.1.2.1 - ES&H Training Completion Rate - Outstanding

Once ES&H training requirements have been established in the ITP, the TRAIN database allows for the employee to quickly link to the class schedule in order to sign up for the required course. At the end of FY2003, the completion rate for required ES&H courses was 96.6%. There is one course that accounts for the greatest number of incomplete requirements - Fire Extinguisher Training. This past fiscal year, this course was modified from a hands-on class every year, to hands-on training every three years, with a video refresher on other years. Some additional computer programming is necessary in order to remove those who took the refresher video from the requirement for the hands-on class. Taking this issue into account, the completion rate for ES&H required training is actually 97%. Re-programming will be completed in early FY2004.

Division/Section ES&H Input

Below are ES&H highlights from FY2003 that were contributed by divisions/sections for inclusion in this Labwide assessment of ES&H. To the extent practical, the individual items have been grouped by topic.

Accident prevention

1. A motorized dolly capable of traversing stairs was purchased by BD to assist with moving equipment into and out of enclosures that do not have an elevator.

2. Almost all of the TD employees that had previously taken back safety training were put through a refresher back safety class. Employees who entered TD since the initial back safety training are also going through these classes as space permits.
3. The FESS Operations Group implemented a back injury prevention program that improves core strength and overall flexibility based upon the principles of Pilates. Facilitated sessions are specifically provided for craft personnel, though any FESS employee may attend. This volunteer wellness program was developed from employee recommendations and supported by management. It is expected that the frequency and severity of back injuries will be reduced.
4. Incident investigation and reporting procedures were modified within the FESS Operations Group to authorize overtime so employees and supervisors could complete this work on the same day as the incident.
5. Ergonomic improvements were made throughout LSS (Compensation, Employment, EOC, Benefits, and Housing Offices). Modifications primarily involved new office and workstation furnishings.
6. PPD put a barrier around the liquid nitrogen tank at CDF to improve security and make it less likely that individuals could get near the tank and injure themselves.
7. The head of PPD once again distributed merit pay increases to those PPD employees who came up with the best ideas to improve safety and the environment around the Lab.

ES&H management and review

1. Several findings arose from a consultant review of CD facilities, especially for the WH7W computer room. These findings will either be addressed during FY2004, or the computer equipment will be removed from that location.
2. While reviewing a plastic scintillator extruder using PPD's internal Operational Readiness Clearance process, workers discovered that a nitrogen supply line valve was out of date and improperly rated. The valve was replaced. In addition, an expanded review of older dewars was conducted that had similar valves.
3. The FESS Engineering Construction Group was reorganized into integrated project teams.
4. FESS Engineering is now working in accordance with DOE Order 413.3, "Program and Project Management for the Acquisition of Capital Assets." A key element of this plan is the establishment of a construction manager position to centralize all formal communication with construction subcontractors.
5. PPD revised its internal ISM procedure and is in the process of training all supervisors on this improved procedure.
6. The FESS Services Group (Roads and Grounds) utilized a checklist for summer employees to assure their familiarization with equipment manuals, PPE requirements, MSDS information, and identification of poisonous plants.

Accelerator shutdown planning

1. Before the major fall shutdown, the Beams Division head issued a safety reminder memo to the entire division. In addition, he held a meeting with all personnel scheduled to work on the project to discuss the purpose of the shutdown, the need for high quality workmanship, and to reiterate the necessity for working safely.
2. The BD SSO met with the shutdown task managers to define the goal of zero injuries during the shutdown. Each task manager was provided an ES&H contact list should questions or problems arise and an FAQ of typical safety issues encountered during shutdowns.
3. Similarly, the Particle Physics Division head spoke to the more than 55 PPD technicians that will go to BD for the fall shutdown. The purpose of his speech was to remind them of his expectations that they will "work safely or not at all" when in the tunnel.
4. Pre-shutdown task planning meetings identified potential high dose activities.

Environmental initiatives

1. FESS redirected NuMI tunnel water from Indian Creek into the Lab's ICW system. This provided an adequate source of makeup water for CUB operations. Domestic water usage was subsequently reduced, as was the cost of electricity to pump from this source.
2. In order to encourage the further reduction of solid sanitary waste, FESS arranged for the consolidation of all paper products, including cardboard, as a single commodity. A new recycling vendor, Abitibi Corporation, was employed to implement this improvement.
3. TD significantly upgraded its cardboard and paper recycling program. A cardboard recycling program was first instituted that resulted in about a 50% reduction in the number of pickups for the refuse dumpsters. The paper recycling program, which had encompassed only a portion of the Industrial Area, was then expanded to include the entire division. Each employee was issued a personal recycling waste basket, and central collection points were established where 23 and/or 60 gallon containers were placed. The size of container depended on such factors as the number of employees in the area, the type of activity, and the space available. A "tipper" was also purchased that is used to dump the 60 gallon containers into the large recycling bins, thus considerably reducing the chance for an ergonomic injury by the collection crew.
4. PPD set up and began operating a plastic scintillator extruder at Lab 5. All of the plastic waste generated from that operation is being recycled.
5. With PPD in a lead role and with BSS in a support role, actions are being taken to dispose of unusable NEVIS blocks and segregated the radioactive and non-radioactive blocks being retained. All the blocks were unstacked, inventoried, surveyed, and restacked. Although this was a significant project with many hazards, the work was completed efficiently and safely.
6. FESS Roads and Grounds reduced the volume of salt that is used to maintain the roads during winter months by 15%. This was accomplished by using a corn-based by product that enables the salt to work effectively at lower temperatures, decreases the frequency of reapplication (reducing the overall effort level), and causes less deterioration to salt applying equipment.
7. Two DOE direct funded energy conservation projects were completed in FY2003. The first was "Main Ring Dehumidification" that involved the installation of additional dehumidifiers and subsequent removal of electric heaters from the TEVATRON tunnel. The second involved installation of timers on lights in the service buildings. This modification eliminates unnecessary electricity use when lights are inadvertently left on after the completion of a work assignment.
8. A new Underground Storage Tank that dispenses E85 (ethanol) was installed at the BSS Fuel Service Center. There are 20 vehicles that are equipped to use this "Alternate Fuel." The project was funded through DOE-HQ's Office of Energy Efficiency and Renewable Energy, and administered by DOE-Idaho, and was completed on-time and on-budget. In addition, there are 40 "Dual Fuel" vehicles that are set up to use unleaded gasoline and/or compressed natural gas (GNG), and three electrically powered vehicles. BSS also coordinated a reduction in the total Fermilab vehicle fleet by 19 vehicles in the past two years.
9. The new Phase II Storm Water Regulations became effective March 2003. We are now required to prepare and maintain Storm Water Pollution Prevention Plans (SWPPP's) for all "Construction Projects" that take up more than one acre. Previously this requirement applied only to projects that were greater than five acres. Essentially all construction projects will now require a SWPPP. Preparation can take from one to five person-days, in addition to administrative time. When the construction work commences there will also be additional inspection and documentation requirements.
10. There is good evidence of the recognition and integration of environmental aspects of FESS activities in ISM implementation. Examples include the winter road management program that considered environmental impacts and reduced salt quantities over the past three years, the prairie management program, pesticide and agriculture management program, reuse of water from NuMI, SWPPP and soil erosion control measures requirements for construction projects, and environmental issues discussed with subcontractors and identification of requirements such as washing out of cement trucks.

Radiation

1. BSS Support Services personnel survey incoming items in addition to those performed in the course of preparing the Material Move Request forms required for Railhead storage.
2. Prompt, effective actions were taken upon realizing that increased radiation levels were present at the northern site boundary in 2002. This effort was initiated by the landlord, BSS, with considerable coordination from the ES&H Section and all organizations that store items at the Railhead, especially BD and PPD. These efforts included reorganization of the Railhead by BSS, expedited radioactive waste disposal, development and deployment of new hippos (stationary radiation monitoring devices), and development of a criterion to provide early notice that dose rates are rising.
3. PPD eliminated all outdoor storage of radioactive materials.
4. ALARA planning meetings were held in multiple divisions/sections to discuss dose minimization to workers.
5. Efforts continue to improve the organization of radioactive materials in the Railhead to keep the dose equivalent at the adjacent site boundary at 0.7 mrem during CY2002.
6. The FRCM was revised to better clarify requirements pertaining to radiation generating devices.
7. A database for tracking pocket dosimeter results was implemented in the Beams Division and found to be useful during the January 2003 shutdown.
8. Major "hot jobs" continue to receive detailed attention and are documented in the Laboratory's ALARA file.
9. The timeliness of completion of dosimetry exposure investigations has improved by about a factor of two since 2001. More important, the number of lost dosimetry badges has dropped by a similar factor over that same period of time.
10. Major portions of the FRCM; Chapters 3, 5, 8, and 11 were extensively rewritten to be improve clarity and consistency during this year.
11. Increased levels of radioactivity in low conductivity water (LCW) systems, an expected consequence of the unprecedented beam intensities, were investigated and appropriately addressed at the Central Utility Building (CUB).

Fire protection

1. During FY2003, in response to findings from a previous HPR inspection, BSS initiated a project to add fire alarm pull stations to Warehouses 1 & 2. It is expected that a contract will be awarded in FY2003 and work will be complete in early FY2004.
2. LSS completed upgrading of the sprinkler system piping and heads at the complex housing, the Children's Center, Dorm 5, Dorm 6, and Neuqua apartments.
3. PPD began going through every flammable liquid storage cabinet in PPD to determine what is useful product and what may be waste or used by another person. PPD's chemical inventory is being updated at the same time.

Lead

1. PPD is inventorying all of the lead they have in storage, wrapping it, and will be storing it in the NEVIS barn, which is a more secure location. PPD is able to do this because additional room was created in the NEVIS barn when the blocks were restacked.
2. As part of a self-assessment of the TD lead program, it was discovered that Industrial Building 2A contained surface lead contamination in excess of the Fermilab standard. The concern was not so much for TD employees since they would not come into contact with the lead where it was located, but for FESS employees who would contact the surface lead during routine maintenance of sprinklers, lights and furnaces. TD trained several technicians as Lead Workers who performed a

lead decontamination in-house under the supervision of the TD SSO, and in accordance with a detailed hazard analysis.

3. PPD removed all of the exposed lead wool from the steel they store at the Railhead to reduce the likelihood of contamination. In addition, all of the steel was painted and labeled.

ES&H Section Assessment

Safety & Environmental Protection

The mission of the Safety and Environmental Protection (SEP) Group is to provide safety and environmental support and oversight to Laboratory organizations. This group was created in March 2003, when the Environmental Protection Group and the Safety and Health Group were combined to more fully integrate the ES&H aspects of the Lab's integrated management systems. Improved communication across these functional areas has resulted. There are currently 19 FTE assigned to this organization.

Although the SEP Group is a new organization, the processes within it have been long established. Most of the activities of the past fiscal year have been to "tweak" the processes, as opposed to developing new or overhauling old processes. These processes include the following:

Routine Waste Management Operations

This process includes day-to-day onsite collection, storage, processing, and offsite shipment and disposal of radiological, chemical, and biological wastes. These are the predominant activities conducted by the team at Site 40. In FY2003, the team began characterizing the Nevis shielding blocks. They also processed and shipped 34 truckloads of radioactive waste for disposal to Hanford, up from 20 truckloads in FY2002.

Pollution Prevention/Waste Minimization (P2/WM)

This process includes the Lab's community-like recycling program (paper, plastic, aluminum), as well as the development and implementation of miscellaneous projects that encourage use of recycled materials and/or the adaptive reuse of materials/spaces. Accomplishments by the group for FY2003 include the completion of a new P2/WM awareness training video to be shown during new employee orientation. The paper/cardboard recycling vendor for the entire Lab was changed in December 2002. Because of that change, FESS Roads and Grounds was able to stop picking up cardboard at more than twelve buildings and have placed their costly packer truck on the excess property list. The Environmental Team turned over the responsibility for recycling to the WCI Janitorial Group. This has saved numerous man-hours for the Environmental Team. Three more buildings have been added to the list of paper product recycling locations, bringing the total to 15. This addition resulted from talking to building managers already in the program, and sending out a site wide memo encouraging additional paper product recycling. The program is nearly automated and running smoothly.

Metric M.1.3.1.1 is rated **Pass**

Environmental Oversight

This process includes review of planned activities for potential environmental impacts and NEPA applicability, as well as participation in the Lab's self-assessment program. When found to be appropriate, the Environmental Team assists in the development of NEPA documentation for DOE review. This organization also inspects onsite facilities for compliance with environmental requirements (including permit conditions) and with best management practices. In FY2003 NEPA reviews for eight projects were performed. All reviews were conducted in a timely manner and the EENFs were produced

and forwarded in one to two days. In addition, the Environmental Group led a work group in revising the Generic Routine Maintenance Categorical Exclusion (CX) that was subsequently approved by the DOE. The FESHM chapter for NEPA was revised this year as well.

Environmental Permitting

Most, if not all, environmental permits are at least coordinated by the Environmental Team. In many cases, this organization is both the preparer and maintainer of the permit. This includes the following permits:

1. RCRA hazardous waste facility
2. RCRA Part B
3. NPDES
4. Air releases

Environmental permits often contain requirements for environmental measurements, periodic status reports, and as-needed analyses and proposals. Highlights of the activities in this area include preparation of a permit report for an Annual Facility Site Inspection for the NuMI project, preparing and submitting five applications for NPDES general permits covering construction activities occurring at the Lab, and the Annual Radionuclide Emissions Report that is submitted to the USEPA.

Environmental Measurements

The Environmental Team conducts most of the onsite environmental measurements. Various environmental permits require much of this. This includes preparation of sampling equipment, collection, storage, documentation, and reporting. In addition, the Environmental Team is responsible for managing the Lab's monitoring well network. This includes well placement, drilling, maintenance, sample collection and data analysis. All sampling, monitoring, and equipment maintenance has been completed according to the CY2003 sample schedule. All sample results have been entered into the relevant databases within the specified two-week goal.

Environmental Support

This process includes activities such as preparation of miscellaneous environmental plans, reports, and policies, as well as provision of environmental consultation. The plans and reports are mostly externally driven – Active Facilities Cleanup Costs, the Environmental Report to the Director, the DOI Questionnaire on Cultural Resource Management, and the Annual Radionuclide Emissions Report that is submitted to the USEPA. Significant effort was placed towards conducting a self-assessment on Fermilab's environmental management system (EMS) and developing an associated gap analysis. It appears that Fermilab has an EMS program in place with only modifications to documentation and training needed. Full implementation of an EMS is expected prior to the December 2005 deadline established in the associated executive Order.

ES&H Training

Training includes development and maintenance of the Individual Training Needs Analysis (ITNA) process. From this, the Individual Training Plan is produced. Based upon the results of the ITNA, training courses are developed, scheduled, and delivered. Highlights of activities completed in FY2003 include a major revision to the LOTO II Course, development of a Hearing Conservation Course, Pressure Safety Orientation, D-Zero Hazard Awareness, and Supervisor of Summer/Co-op Students as Computer-Based Training/Web-Based Training courses. Other accomplishment include the development

of a Spanish version of Subcontractor Orientation and the development and presentation of hazard analysis training to the subcontractors associated with the NuMI Tunnels and Halls project.

Safety and Health Support

This is the day-to-day operation of the Safety and Construction Safety Teams. Functional areas include industrial safety and hygiene, fire protection, and emergency planning. Products and services include program direction and development, Fermilab ES&H Manual (FESHM), Industrial Hygiene Manual, and Emergency Management Plan development and maintenance, daily consultations with employees and experimenters, interfacing with DOE, ergonomic and industrial hygiene assessments, IH monitoring, design reviews, record keeping/reporting, development and distribution of ES&H Updates, subcommittee support, experimental and SAD reviews, and drill/exercise development. Also included are the development and maintenance of site-wide safety and health databases. Highlights for FY2003 include the following:

1. Reorganization of the Construction Safety Team, including development of associated audit and inspection procedures.
2. Consulting with Computing Division to review electrical safety recommendations made by an outside consultant.
3. Reviewing Fermilab's emergency management program against the OSHA Compliance Directive to assure Fermilab meets the OSHA standard.
4. Organizing and participating in the Laboratory's conversion to a new confined space gas multi-meter.
5. Conducting flame tests of over 50 types of cables and numerous unique material composites for experimenters (in some instances steering experimenters to less expensive materials that met specifications).
6. Reviewing flammable gas operations such as the KEK hydrogen absorber test, MuCool Hydrogen window designs, and the Hot Horn review.

Safety engineering support was provided to the Pierre Auger project. Visits were made to the Argentina site in order to provide training and conduct assessments. Training in Spanish has been developed for the project to use. The Project manager has been very pleased with this support.

Support was also provided to the review of the Niobium Etching Chemistry Room being built at Argonne National Laboratory as part of a collaboration with Fermilab. The Lab's Industrial Hygienist was asked to participate in an incident investigation/critique of a near miss that occurred in FY2003. His input was incorporated into the revised work plans.

Task management oversight for asbestos removal projects throughout the Laboratory is provided as well. Due to staff changes, a new task manager was assigned this responsibility in February 2003. In short order, he completed the training required by the Illinois EPA to become an "asbestos supervisor" and also performed an internal assessment of the asbestos removal activities. A plan of action to improve the program was developed and implemented, including reorganization of old files, a new system to track projects, and an update of the asbestos materials location database. Eight asbestos removal projects were completed with favorable comments from customers. The new task manager has established an excellent working relationship with the asbestos removal contractor.

Safety and Health Oversight

This process includes daily construction safety oversight inspections, review of contractor ES&H plans against contractual requirements, tripartite assessments, and Highly Protected Risk ("HPR" for fire protection) assessments. It also includes independent investigations and investigation support as requested by the Laboratory Director. Safety and health oversight also involves action plan development

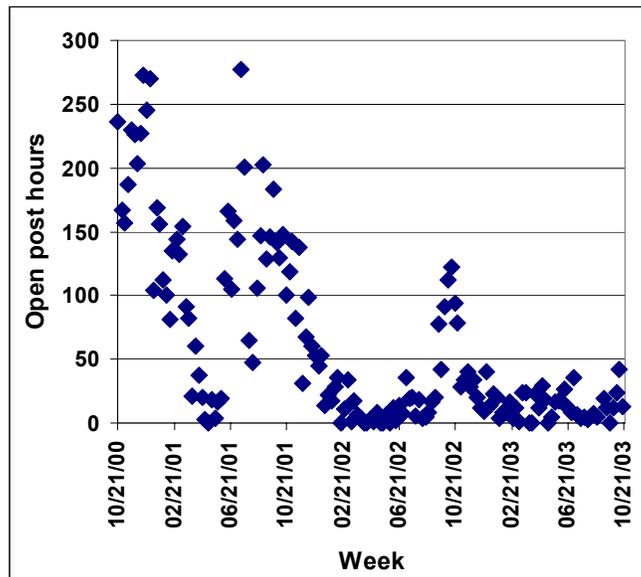
and tracking of findings to closure. In FY2003, over 150 HPR inspections were scheduled and completed.

Security Department

The Security Department consists of a Security Team and a Communication Center Team. The Security Team provides physical security. It does this by a combination of three security professionals (Security Supervisors), a locksmith, and approximately 23 subcontracted uniformed security officers. The Security Supervisors are utilized primarily as shift Duty Captains and representatives of the Laboratory during off-hours, and as program managers and administrators. The major functions they manage are training, loss prevention, and operations. They may also serve as Incident Commander in accordance with "Fermilab Emergency Response Plan." Additional staff duties are assigned to each Security Supervisor. The Locksmith maintains a removable core lock system, supports an electronic card access system, and installs and repairs other mechanical and electric lock systems.

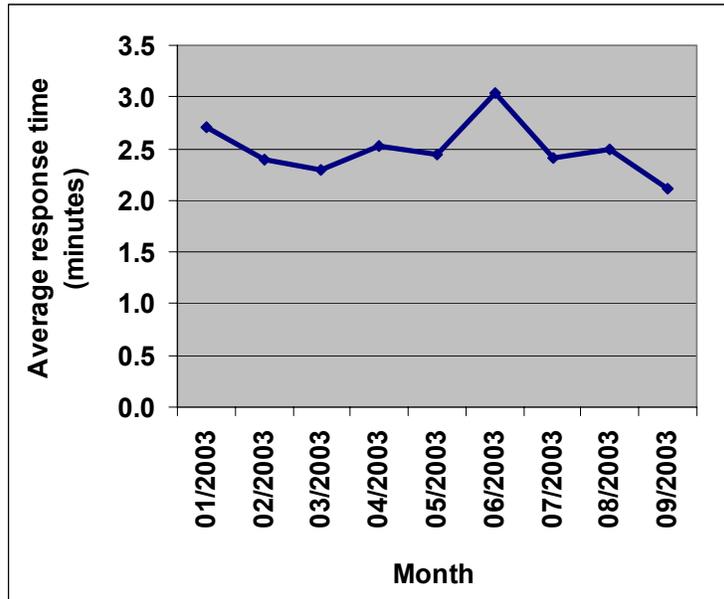
Uniformed subcontract security guards are assigned various patrol-related duties and are fully trained in accordance with appropriate state requirements and the "Security Training Management Plan" as approved by DOE. Physical condition is evaluated through a pre-employment physical and reviewed annually thereafter. The subcontractor provides a thorough background investigation for each guard. In addition, a formal Job Task Analysis has been completed for each security position at Fermilab.

Full staffing of subcontractor security positions had been a problem at Fermilab in 2000 and 2001. The chart below shows "open posts hours" as a function of week (= weekly contractually required hours – weekly actual hours).

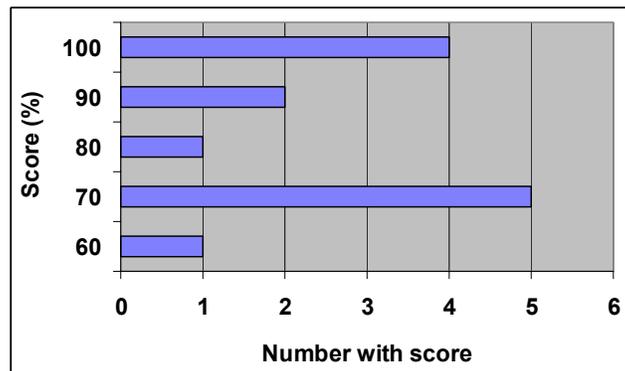


It can be seen that the long-term trend has been toward reducing open post hours. This improvement is due to the combined efforts of the Security Team and the subcontractor.

For the first nine months of CY2003, the subcontract security force responded to an average of 33 calls per month. Response time was recorded as a measure of performance. The graph below shows the average response time as a function of month. The average has been 2.5 minutes, with a slight bump in 06/2003. This increase was due to a handful of cases where officers had to wait for elevators in Wilson Hall or had trouble locating a building. At about twice the average, total response times were not overly excessive. In addition, feedback from these calls helped to reduce times in subsequent months.



The Security Team also conducts drills to assess subcontractor security force performance. In FY2003, a total of 13 drills were conducted. The drills involved simulated gate runs, security entries, access control alarms, and one duress alarm. Numerical grades were assigned to various aspects of performance with a total of 70% being considered acceptable. The chart below shows that only one drill produced unacceptable results, though another five barely passed. Weaknesses have been identified and corrected as appropriate.



The Communication Center Team consists of nine full time communication operators/dispatchers and provides routine and emergency communication for the entire Laboratory, 24 hours a day, seven days a

week. It also contains the Key & ID Office, staffed by one full time clerk, which produce the DOE Common Badge for Fermilab employees and Users and Fermilab identification cards for contractors. The office also distributes and collects other access control devices such as building and furniture keys, vehicle stickers and automatic gate system devices. The Key & ID Office clerk is cross-trained to assist in the Communication Center. Several communication operators/dispatchers are crossed-trained to fill in the Key & ID Office.

The Communication Center also provides switchboard transfer and directory services for incoming and outgoing calls 24x7. This includes long distance, international, and conference call services. Fax service is available 24x7 and several other "after hours" services are provided including issuance of housing contracts and rental car keys, as well as some services for the Recreation Department. The Communication Center supplies dispatching support to the contract security force as well as "after hours" dispatching services for FESS Operations and Services Departments.

Communication Center staffing has remained stable throughout the review period. One operator/dispatcher retired and a replacement was hired. One member is currently on Family Medical Leave involving intermittent absences. However, this has had minimal impact on the Center's operation to date.

During most of FY2003 the Lab's Secom/Amtech automatic gate system was inactive and mothballed due to increased Security measures implemented after 09/11/2001. The system was briefly activated in FY2002 and the need to inspect and service the equipment during long periods of inactivity was noted. The Loss Prevention Supervisor was assigned to oversee and routinely test this equipment. The system also continues to suffer communication interference believed to be caused by deteriorating phone lines. Cost estimates to replace phone lines to both the Pine Street and Batavia Road gates were high. Options are being investigated.

During the review period the quality of the Closed-Circuit TV (CCTV) taping system was improved. Time-lapse recorders were switched from a 180-hour mode to a 48-hour mode and the tape rotation cycle was changed to a 24-hour cycle.

The project to improve the Communication Center radio system progressed during FY2003. The remaining portable radios needed to meet the narrow band requirements were purchased. Locations for the back-up base and repeater for the main security/fire frequency were identified and approved, as was the location for the Illinois Fire Emergency Radio Network (IFERN) frequency station. Completion of this project is expected in October 2003.

The Key & ID Office Clerk maintained his cross-training as a Communication Center Operator/Dispatcher and another operator/dispatcher was cross-trained in the Key & ID Office Clerk. The Communication Center Operators/Dispatchers continued to carry out their assigned tasks with no significant discrepancies noted during the review period. One of the pending projects is to implement a formal Communication Center's training plan. A schedule was developed to complete this project in FY2004 and is currently on track.

During the current review period the severe weather procedure was reviewed and modified. This has resulted in an increase in the issuance of severe weather watches and warnings over the Laboratory's Site Wide Emergency Warning System (SEWS).

Fire Department

Normal duties of the Fermilab Fire Department include monthly inspections of water system valves and hydrants, semi-annual building inspections, monthly fire extinguisher inspections and maintenance,

testing and/or inspections of fire suppression systems, plan reviews, equipment maintenance and inspection, continuing education in emergency skills and procedures, buildings and grounds maintenance, fire drills, welding permit inspections and hose and pump testing.

The Fermilab Fire Department currently has a staff of nineteen professionals. With minimum manning of five men per shift it must depend heavily upon mutual aid from surrounding communities for any major emergency. The Laboratory is a member of M.A.B.A.S. Divisions 12 & 13, comprised of fire departments in DuPage and Kane Counties.

All members of the fire department are State of Illinois Certified Fire Fighter II. Many members have advanced certifications; officer certifications, fire inspector, instructor, haz-mat, fire inspection and arson investigation. All members have also received mine rescue training. All response team members are State of Illinois Certified Emergency Medical Technicians or higher. Some members have college degrees. In addition to ongoing drills conducted on a daily basis; an outside contractor conducts continuing education for E.M.T. certification on a monthly basis. Physical fitness and wellness training is provided on a monthly basis by a fitness instructor. Yearly training includes Hazardous Waste Storage Facility – Emergency Responder Training, Blood Borne Pathogens, Fermilab Controlled Access, Fermilab Fire Department Policies and Procedures, Self Contained Breathing Apparatus, S.C.B.A. fit-testing and O.D.H. certification. Every two years training is completed for CDF Supervised access, CDF/DO Initial Entry Survey Training, DO Hazard Awareness and Radiological Worker training. In addition, familiarization tours are ongoing for any new construction or experimentation conducted on the Lab. The Fermilab Fire Department also participates in combined training with surrounding fire departments.

The Fermilab Fire Department offers training for Laboratory employees. Fire extinguisher training in a live-fire, hands on class is provided on an initial and triennial basis. CPR and CPR refresher classes and certification are provided, as needed, to groups requesting training. Blood borne pathogen awareness training is also made available.

The Fermilab Fire Department is housed in a pre-engineered metal building with a trailer utilized for exercise and general storage and a small metal shed for storage of fire extinguishers and general storage. When funding permits, plans call for the Fire Department building to be expanded and upgraded. Security Team personnel would also be moved to the new building to share resources with the Fire Department and to upgrade their facilities as well. [The Security Team is currently located in an old farm house at Site 52.]

Current Fire Department response equipment is comprised of: three fire engines, one squad truck, a brush fire truck, an ambulance, a spill control trailer, a command vehicle and chief's car. In FY2004, a newer pump truck will be added and two older vehicles retired.

Response time for the Fermilab Fire Department to onsite locations is generally within five minutes with two engines. The captain is the incident commander, the lieutenant and one firefighter is the attack crew and the engineers are occupied with pump operations. On a five-man response this leaves no one to back-up the attack crew if both engines are committed. Current NFPA standards call for a minimum of two fire personnel standing by for back up or rescue. This requirement could delay attack on a fire for several minutes while waiting for additional personnel to arrive from surrounding departments. However, this delay is not perceived as a significant problem because:

1. The total response time does not carry an unreasonable risk.
2. Fermilab's structures are well protected with early fire detection, alarm, and suppression systems.
3. Master utility shut-offs are located on the outsides of buildings.
4. Current staffing level requirements are viewed by much of the fire protection community as being unrealistic and inflexible. The standards that guide them are under revision (NFPA 1500, NFPA

1710, DOE Order 420.1A, and Homeland Security initiatives). A relaxation of requirements is anticipated within six months.

The Fermilab Fire Department responded to 333 emergency calls in CY2002. These included fires, rescues, medical emergencies, car accidents, mutual and auto-aid, mine rescues, hazmat and radiation incidents.

Medical Department

Fermilab's Occupational Medicine (OM) program is primarily implemented via the Medical Department that is organizationally situated in the ES&H Section. This department is responsible for job placement reviews, medical exposure surveillance, and management of occupational injuries and illnesses. Job placement reviews occur upon initial hiring as well as with subsequent changes in work functions or level of work fitness (i.e., as occurs with injury, disease, or recovery). Medical surveillance is initiated whenever an employee meets or exceeds exposure criteria for a particular hazard. For example, work in an Oxygen Deficiency Hazards (ODH) operation requires that personnel meet a certain level of fitness. Although ODH is the prevalent surveillance at Fermilab, there are a number of others that are encountered including noise, lead, beryllium, lasers, and work-group-specific screenings (e.g., commercial drivers license, fire fighters, Roads & Grounds).

The Medical Department is extensively involved in the Lab's occupational injury and illness program. This department is the first place that injured/ill employees are required to go during normal work hours. [Severe cases are immediately transported to an offsite hospital via ambulance.] Upon arrival in the Medical Department, the condition of the injured/ill worker is immediately evaluated. From that point, the malady is managed in accordance with accepted medical practices: some require no action and some require immediate transport to an offsite facility, but most require some intermediate level of care. Minor treatment such as suturing is often administered within the Medical Department. Other care is typically coordinated through personal care providers or referrals to specialists. Once the worker's condition is stabilized, the Medical Department initiates a *new* case into the Lab's occupational injury and illness database. From that point, division/section ES&H personnel assure that a detailed investigation is completed. The Medical Department serves as a focus for the Lab's return to work program and for managing workers' compensation.

Besides the Medical Department, some OM functions rest with division/section ES&H personnel as well as personnel in Laboratory Services Section. ES&H personnel support OM responsibilities at the Division/Section level. For example, they are primarily responsible for selecting workers for inclusion in medical exposure surveillance programs and for checking that the results of job placement reviews are appropriate. Laboratory Services Section typically works with the Medical Department regarding fitness for duty issues.

In addition to explicit OM responsibilities, much of the Medical Department's time is spent on activities that can be classified as general health promotion and primary care. These include non-occupational Health Risk Assessments (HRAs, a.k.a., *medical exams*), general health education/counseling, first aid for and/or subsequent monitoring of non-occupational injuries/conditions, and non-occupational inoculations (e.g., flu shots).

At the start of FY2003, there were 6 FTEs working in the Medical Department: one physician, two nurses, and three administrative personnel. During the course of the year one administrative person retired (not replaced), one nurse left (replaced after six a month gap), another administrative person was off work for five weeks due to illness, and an ES&H manager was added at part-time. Current staffing levels are ~5.5 FTEs.

The Medical Department occupies ~2,500 ft² and is located at the ground floor northwest corner of Wilson Hall. There are office spaces for medical personnel, a reception/waiting area, three examining rooms, one quiet room (to test hearing) and two bathrooms. In addition to a typical array of office equipment, the Medical Department has a vertical carousel-style medical chart cabinet. Medical equipment includes an audiometer, spirometer, tonometer, centrifuge, two vision testers, two EKG machines, a defibrillator, sterilizer, and minor surgical supplies.

Fermilab's occupational medicine program functioned effectively in FY2003. Most importantly, medical exposure surveillance schedules were met and the needs of internal customers were satisfied. ODH continues to be the primary hazard for which surveillance reviews are performed with ~930 workers and ODH screening is a routine activity in the Medical Department. Second in frequency is testing for the hearing conservation program (audiometry). All of the ~200 workers in this program received their annual hearing test for the first time in several years. Beryllium surveillance affects few employees at Fermilab, ~20 beryllium associated workers. In FY2003 this program became fairly routine and well accepted.

The Medical Department expended the majority of their resources on non-occupational medicine. This is something that many/most other DOE facilities have stopped providing. Of the ~5,300 patient contacts that took place, ~3,300 were non-occupational in nature. About 2,000 of these were miscellaneous interactions, e.g., walk ins with a health problem or question. The remaining ~1,300 encounters were HRAs.

These non-occupational activities are viewed as being both valuable and cost-effective. They serve to minimize worker absences, provide a mechanism for the early detection and management of major health risks, and build rapport with employees for occupational activities. In particular, many Fermilab workers are reluctant to establish a relationship with an offsite personal health care provider. If it were not for the non-occupational services provided by the Medical Department, it is likely these individuals would suffer serious consequences from previously undetected and/or incipient health conditions that are detected and monitored in the workplace. This service is considered to be too valuable to abandon.

Another key service provided by the Medical Department was the provision of medical advice in cases of employee performance problems. This has become a fairly frequent occurrence (~weekly), the issues tend to be critical with respect to worker health and/or continued employment.

Some effort was directed toward automating the processes in the Medical Department. The primary goal is to reduce repeated handling of paper files. The issue of computer file security was closely examined and it was decided that several measures would be used in concert. All new workers' compensation files were scanned and are being managed in electronic format. A web interface was developed to simplify the entry and retrieval of images. Future plans include a pilot to see if medical charts can be handled in a similar fashion.

The Medical Department was able to provide this level of service even though staffing levels dipped in FY2003. For much of this period the staff was at two-thirds of its initial level and sometimes it was only at one-half. The staff had to work hard and some services had to be provided in a compressed form.

Radiation protection

The ES&H Section plays a major role in the radiation protection program. Some of these functions represent direct leadership of major aspects of the program while other functions provide support to Labwide endeavors. Within the ES&H Section 17 people are assigned full time to the radiation protection program. These associated processes are described below.

Radiation Protection Program Implementation and Oversight

This process includes the conduct of Laboratory's Price Anderson Amendments Act (PAAA) program along with the maintenance and implementation of the formal radiation protection program. It includes the updating and promulgation of the *Fermilab Radiological Control Manual* (FRCM) as part of the *Fermilab Environment, Safety, and Health Manual* (FESHM). Also included are the conduct of assessments and the coordination of responses to audits by other entities such as DOE-FAO and regulatory agencies as well as the review of technical basis documentation. Ongoing oversight activities are an important component of this process. The leadership of the Radiation Safety Subcommittee inclusive of its ALARA committee is also part of this process.

This year, tripartite assessments were conducted of environmental monitoring in the Beams Division and storage of radioactive materials in the Railhead. Several efforts were made to support the Congressionally-mandated external regulation study with OSHA and NRC. Compliance issues at other DOE laboratories were monitored for relevance to Fermilab and, where appropriate, shared with the Laboratory at large. Events continued to be screened against compliance criteria and all division/section heads and members of the Directorate have current training in the Laboratory's responsibilities under DOE's PAAA enforcement program. Due to diligence on program implementation Labwide, there were no events that were found to require submission to DOE's non-compliance tracking system (NTS), an experience similar to that found at other single purpose DOE laboratories.

Instrumentation

This process involves the design, specification, procurement, calibration, and eventual retirement of the Laboratory's stock of instrumentation for measuring and characterizing radiation fields and hazardous atmospheres. Some of the instruments and equipment have specialized properties designed to address the unique radiation fields present at Fermilab. Efforts needed to connect these instruments to the Laboratory's radiation safety systems in a particle accelerator environment are an important component of this work. The expertise involved with this process provides significant benefits to the Laboratory's scientific enterprise.

Routine maintenance and calibration of the Laboratory's inventory of over 1600 instruments was carried out on schedule and in a way that accommodated programmatic demands. No instruments in service for personnel protection were found to have expired calibration. Twelve new log survey meters were provided to meet programmatic demands. A new stack monitor was successfully operated for the MiniBooNE beamline and new 55 gallon "hippo" ion chambers were provided for site boundary radiation measurements. The "wallflower" personal radiation contamination survey meter is being modified with an "alarm disable" feature to eliminate confusing audible alarms in prompt radiation fields. Comparisons with other laboratories such as ANL-E, SLAC, and TJNAF over recent years indicate that Fermilab facilities and operations in this area are comparable or superior to those found elsewhere.

Radionuclide Analysis Facility (RAF) Operations

Radiochemical analytical work is performed in support of waste management, occupational radiation protection, and environmental radiation protection programs. It also has important applications to the Laboratory's scientific program by providing absolute calibrations of high energy beam intensities and beam flux estimates for radiation damage studies.

The RAF maintained a high level of output in FY2003. This group completed an average of ~7 analyses (beta-gamma or tritium) per day along the precision counting of ~28 contamination wipes per day. On several occasions, special analyses were performed as part of direct programmatic support in addition the routine work done for radiation protection purposes. This year, special jobs were done for D0, the Beams Division's Radiation Damage Facility, and CMS. No errata to analytical results were identified

during FY2003. Outstanding ratings continue to be achieved for this work in QA checks conducted by DOE's Environmental Measurements Laboratory (DOE-EML). An internal self-assessment of RAF operations identified only minor issues, all of which were already being addressed. Comparisons with other laboratories such as SLAC, and TJNAF over recent years indicate that Fermilab facilities and operations in this area are comparable or superior to those found at other DOE laboratories.

Radiation Field Characterization

This process supports Lab operations by providing accurate and reliable characterizations of radiation fields. The work involves the use of specialized instrumentation and equipment to measure radiation field configurations, energy spectra, and beam intensities; sometimes at remote locations. Also included are measurements of the airborne radionuclide emissions from the accelerator complex. Radiological calculations are provided in support of project designs and to aid operational safety personnel in the divisions/sections. For example, the review of shielding assessments is part of this effort.

In FY2003, the SADS developed by PPD and BD were reviewed. Similarly, BD's shielding assessments for the SY120 fixed target beams, associated experiments, and the Pellatron were examined. In addition, support was provided in the development of these documents. The section's TLD reader continued to provide greatly appreciated support to CDF and DO's efforts to improve their understanding of "background" radiation, some of which could be potentially damaging to detector components near the vertices. Seven shielding/activation calculations were performed in support of the NuMI project. Groundwater activation calculations were provided to MuCool, CKM, and the Main Injector. Finally, a new spreadsheet was developed to facilitate labyrinth attenuation calculations that was subsequently "debugged" and made available to interested parties Labwide.

Dosimetry, Sealed Source and MC&A Program

This process includes the provision of external radiation Dosimetry along with the all the associated administrative and recording functions. Dosimetry quality and reporting accuracy are intrinsic to compliance with the applicable regulatory standards. Internal Dosimetry services are procured as necessary.

This process includes the procurement and management of the sealed sources, as well as the implementation of regulatory requirements for Material Control and Accountability. The accomplishment of the scientific mission of Fermilab requires the usage of a number of radioactive sealed sources as well as reportable quantities of Atomic Energy Act source materials. Sealed sources are also required to support the instrument calibration program. As a consequence, this process includes all the reporting, training, and inspection activities needed to assure safe usage of the sealed sources in compliance with applicable regulations.

The radiation Dosimetry program continues to meet DOELAP requirements. Comparison with other similar laboratories indicates that Fermilab's program is consistent in quality but is being accomplished at significantly lower costs, especially in terms of manpower. This year, the utilization of computers in the issuing of badges and the preparation of required reports resulted in a significant improvement in efficiency.

There were no significant violations of the sealed source program identified this year. The source database was converted to a web-based display. On several occasions, neutron sources were provided to experimenters under conditions of constant supervision. In order to reduce radiation exposures at the calibration facility, new source projectors were procured to provide less "hand work" with wand sources. A Labwide source "round-up" was conducted to remove unwanted sources from circulation. In addition to routine activities, an assessment of MC&A compliance was conducted on short notice in response to an

ad hoc DOE-CH request. The successfully completed TAP review included good results reported for the MC&A program.

Radiation Protection Services

This process includes health physics services that support the divisions/sections in the implementation of the Laboratory's radiation protection program. A major feature is the long-established radiation physics liaison program with the divisions/sections. Another important component is the development and delivery of specialized radiation safety training such as radiation source user training, radiological control technician training, radiation safety staff training, and training in radiological emergency procedures. Also included are preparations for emergency response activities such as the provision of emergency dosimetry services, beam-on radiation dose assessments, and personnel decontamination procedures.

The longstanding liaison program continues to be effective for FESS, BD, BSS, and CD. Civil construction design reviews were conducted for about 30 projects. The radiation information pamphlet for visitors was revised. Emergency response facility procedures were reviewed and revised following a walk-through drill. A radiation physics college course was offered through the U. S. Particle Accelerator School to support worldwide accelerator programs.

Facilities Engineering Services Section

Administration

Organization Strategy

Monthly performance reviews are the method used for linking the four (4) groups that report to the FESS Goals we laid out at the beginning of FY2003. Further, by developing this management method, the various organizations can establish a clear line between what people in each organization are actually doing to meet these goals as well as the vision that they are striving to accomplish.

The process begins with an overriding mission statement and vision for the section, clear lines of responsibility and accountability, open dialog and information sharing and ends with the empowerment of each manager to provide the best service possible to our customers within the constraints of our budget.

Agreed upon internal metrics are reviewed during regularly scheduled monthly meetings with each of the four (4) Group managers and the ES&H department manager. Each manager makes a formal presentation to FESS Senior Managers in which they review the previous months accomplishments as well as areas of concern. These meetings typically last one hour and cover a broad spectrum of issues including ES&H items, financial responsibilities and forecasts, previously agreed to goals as well as a look into the activities for the next month. Specific project milestones are also covered and any resource requirements are discussed and acted upon.

Internal FESS metrics are associated with the process.

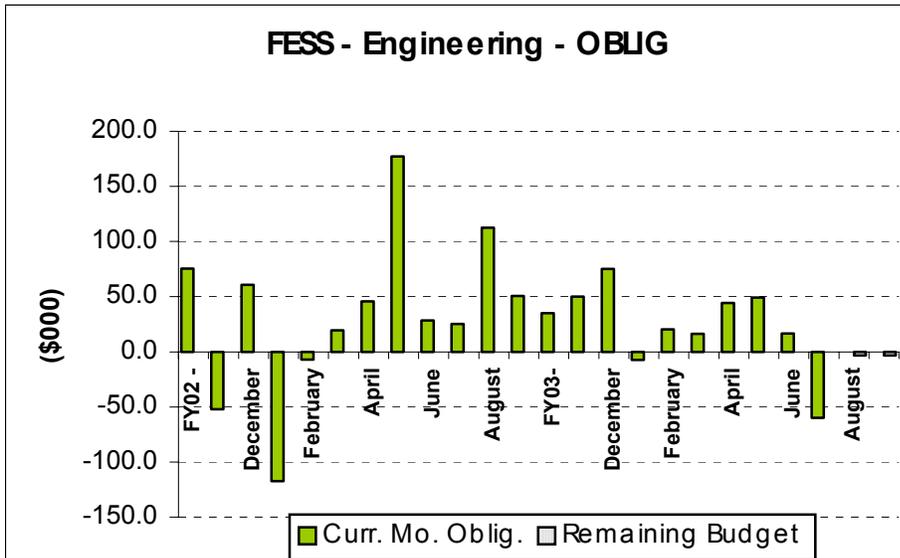
1. Continuous Improvement.
2. Zero Lost time accidents.
3. 100% of all FESS employees have taken their required Training.
4. Fiscal responsibility (Keeping within their allocated budget).
5. Meeting all DOE and Fermilab agreed to project milestones.

The results of each of the measures are posted monthly in each Group's bulletin boards for all employees to see.

It is obvious from these meetings that FESS continues to move forward along the road of continuous improvement. For the most part FESS meets or exceeds all of its goals. It is certainly significant that over the past five (5) years, faced with declining budgets, end of life infrastructure and increased square footage to maintain, FESS has constantly maintained a high degree of efficiency and efficacy, providing the lab with a more robust and reliable infrastructure, innovative engineering solutions to everyday problems as well as providing a work environment that is environmentally sound and aesthetically pleasing.

Monthly Financial Performance Review of FESS

The process consists of obtaining information after the month has financially closed by running queries and on-line reports. Cost, obligations, open commitment and reqs-in-process information are transferred to a master FESS budget spreadsheet. This spreadsheet in turn is used to create monthly budget reports and graphs for each Group and for FESS as a Section, showing cost and obligation information year-to-date, for the current month and the obligation budget balance. These reports and graphs are used in each Group's monthly meeting with the FESS Sr. Managers and any areas of fiscal concerns are discussed at this time. An example of the graphs utilized in these meetings is below.



Results of the assessment indicate that the monthly financial performance reviews are critical in that they serve to inform and reinforce the importance of fiscal responsibility within each of the Groups. Secondly, they serve to assist managers in their daily decision making process because they provide a clear picture of their financial situation on a timely basis.

Engineering

Project Documentation

During this year, we have moved aggressively to electronic filing of all project related information. This assessment looked at a number of recently completed and current construction projects, specifically evaluating the completeness of electronic project filing. Projects reviewed included MiniBooNE, Mu-Cool, and MI-31. Pertinent project documentation, including bid documents, revisions, construction logs, Notice to Proceed, and Final Acceptance were located, retrieved and printed. This project has significantly reduced our reliance on paper copies of drawings and documentation, the cost of their distribution as well as provided our customers with an efficient and effective way to electronically access their documentation.

All pertinent documents were found in the project files. Appropriate security was applied at the document level; bid documents and specifications were write-protected. All documents were retrievable and printable.

One area of concern is the inconsistent use of the folders within the project file. For instance, the Work Notification Permit is filed under “correspondence” in one project and under “construction” in another. In order to mitigate this problem we have formed a team to develop a “Table of Contents” to describe what documents belong in which file. This concern should be removed once the team findings and solutions are implemented.

Construction Coordination / Task Management

During this year, FESS Engineering has responded to the Project Management Order 413.3 by moving to a construction management office approach to the oversight of construction subcontractors on our larger

projects. Construction Managers are assigned to lead a team of construction coordinators, procurement administrator, safety coordinators, etc. Roles and responsibilities of individual team members are defined in a responsibility matrix as part of the Project Execution Plan.

The greatest impact from this management change is the moving of responsibility for direct communication with the subcontractor from the construction coordinator and procurement administrator to the construction manager. Our construction coordinators are adapting well to their new role. They continue to interface with the subcontractor on day-to-day issues and monitor compliance to both quality and safety requirements of the contract. Variances are brought to the attention of the construction manager and adequate documentation is provided to support requests for corrective actions. The benefits we have reaped from this change include a "One voice" approach to communications with our Sub-contractors that avoid confusion thus reducing the opportunities for "extras" claims against the Lab. Furthermore, one responsible person addresses day-to-day issues quickly.

During interviews, it was found that we needed to transfer the authorization of emergency field funds from the construction coordinators to the construction managers to better reflect the responsibilities of the team members. This will be pursued with the Business Services Section.

Infrastructure Management Group

In FY 2003 the Infrastructure Management Group continued to meet its established mission statement,

"To develop and execute strategies that increase the reliability and robustness of Fermilab's infrastructure systems to strengthen the base from which existing and future laboratory objectives can be accomplished"

The group also progressed towards "improving" its operations for increased efficiency and operational effectiveness. There are planned improvements for data accuracy as well as the collection and reporting processes, but none that present a current weakness or shortfall in the process. All elements of the Infrastructure Management Groups Area of Responsibility were satisfied in FY2003

Metric P.1.1.1.1 Real Estate Management Accuracy of square footage - **Outstanding**

DOE Energy Management Data base EMS4 and Facility Information Management Systems (FIMS) database reconciled square footage information to within 4% of each other that resulted in a grade of Outstanding. Additionally, an Internal Audit Report dated September 19, 2003 was completed on this measure that indicated reasonable assurance that this measure is working as intended. All findings and recommendations have been completed and closed out.

Metric Q.1.1.1.1 Maintenance Investment Index - **Outstanding**

The Maintenance Investment Index (MII) is defined as the actual maintenance completed divided by the Replacement Plant Value. For FY2003 the actual maintenance completed was \$7.4M. Considering the metric RPV of \$460M (buildings and utilities) the MII calculates to 1.6 resulting in a grade of Outstanding.

Metric Q.1.2.1.1 is rated **Pass**

Construction oversight inspections were conducted under a new procedure developed this past year. Safety and Environmental Protection (SEP) personnel participated in sixteen tripartite assessments, including ISM within BD, FESS, ESH, LS, and BS; review of Fermilab ES&H Manual (FESHM) 8000 series; forklifts; and emergency preparedness. SEP personnel also participated on the Laboratory

Director's Safety Panel on Subcontractor Safety, as well as an investigation into the incidents at NuMI involving severed energized circuits.

Safety statistics for T&M work monitored by FESS follow.

	OSHA	OSHA	OSHA	OSHA	OSHA	DOE Cost	FESS	DOE	OSHA	OSHA
	300 Log	Medical	DART	Restrict	Away		FTE	Cost	DART	TRC
	Cases	Cases	Cases	Days	Days		Hours	Index	Rate	Rate
FY 02	1	0	1	0	14	\$16,000	47,952	33.37	4.17	4.17
FY 03	2	2	0	0	0	\$4,000	37,514	10.66	0	10.66

A draft audit report was issued on August 15, 2003 for an internal audit conducted on Time and Material Operations. The report validated that there was reasonable assurance that T&M operations are economical, efficient, and effective. The report also pointed out a number of areas that are performing well such as change process, labor rate determinations, Davis-Bacon determinations, invoice support, contractor performance evaluations, and timesheet accuracy.

Condition Assessments

DOE Real Property Asset Management Order 430.1B is still in draft but is expected to be issued soon. Anticipating this, the group created a position and hired an Infrastructure Condition Assessment Administrator to plan for the new requirements and also take our building inspection program to the next level of effectiveness. In support of this, a sustainment (maintenance and repair) forecasting model was tested and purchased to assist in forecasting building requirements and identification of end of life systems to support condition assessments. Integration of this software with other existing systems will contribute significantly to compliance with the new DOE order, and even if the new order is not issued, this effort will result in more effective infrastructure management for the laboratory.

FESS Services Group

Computer Hardware Inventory Tracking

The Technical Support for Computing Group (TSC) continues to maintain a complete inventory of all computer hardware using the FESS Sensitive Item (SI) database. This database continues to provide all necessary data to support the annual Labwide inventory and provide on-time reporting information.

The FESS Sensitive Item Database allows us to maintain complete and accurate information about each piece of equipment within FESS possession. Each item within the FESS Sensitive Item Database is completely documented and tracked via an identifier (sensitive item number, property tag number, serial number, etc.). The database also has the capability of producing Sensitive Item Transfer forms that allow for each item in the database to be transferred from one person to the next. A yearly integrity check is performed prior to the release of the Property Office Sensitive Item Inventory. This integrity check consists of manually parsing through each record and verifying the correct owner and/or location of each item against the Property Office database.

Computer Support Work Order Tracking

The Technical Support for Computing Group (TSC) continues to utilize the FESS TSC Request Database to track customer requests for computer support within FESS. This system provides accurate accounting

of all requests, has reduced response time and increased customer satisfaction. Reports of request activity are provided at the monthly Services Review Meeting with the Section Head.

Performance Contracting (Janitorial)

The incentive-based performance contract for Labwide janitorial services continues to provide the laboratory with complete and economical cleaning services with a high degree of customer satisfaction. The subcontractor maintains a formal system to track all unsolicited customer responses, both positive and negative. If more than eight negative responses are received in any given month, the associated incentive payment is forfeited. In all cases however, every negative response is individually addressed and rectified to the satisfaction of the customer.

Land Management

The manager of the Roads and Grounds Group maintains his membership on the Laboratory Ecological Land Management (ELM) Committee. His input is instrumental in the development of the ELM Annual Plan. Each year this plan is submitted to the Laboratory Director and serves as the overall guideline for land management at the Fermilab site. The Roads and Grounds Group is charged with the implementation of major portions of the annual plan and has ample procedures and a well-documented training program in place in support of these activities.

Pesticide Application

The Roads and Grounds Group's Pesticide Application Program is an outstanding example of good management oversight combined with sound procedures and a well documented program for training and certification. Over the last year, improvements have been made to improve the communication with Building Managers and tenants during pesticide application activities.

Integrated Safety Management (ISM)

The Services DuPont Safety Audit Process continues to exemplify the ISM process within the group. All members of the Services Group participate in the bi-weekly audits on a rotating basis. Results are discussed with all affected members of the group in toolbox and staff meetings and are further reported in the Monthly Review meetings with the Section Head. All incidents, near misses or simply observations for improvement in work processes are reviewed and discussed for implementation. Employee input and participation is encouraged at every opportunity.

FESS-Operations

Fire Protection Disablement Process

The improvement plans identified in the 2002 self-assessment have been completed. Disablements are tracked using our computerized maintenance management system. The process is documented as a procedure and process flow chart. This completes all improvement plans to this process. The process fully achieves all objectives for notification, tracking and closing of fire system disablements.

Integrated Safety Management (ISM)

Operation's ISM process was assessed using the Tripartite Process Assessment program as part of a Section wide review in 2003. Best practices, suggestions for improvement and the overall assessment are part of the Tripartite Committee report. No findings were found. The process is well developed and implemented at all levels in the Operations organization.

Utility Outage Process

The process was significantly revised as the result of the assessment. It has been documented as procedures and as process flow charts. The process has been automated, maximizing detail and distribution while minimizing the effort required to generate, update and archive planned and unplanned utility outages. The revised process has been in full operation for several months and has met all expectations. It is an excellent process.

Storeroom Parts Acquisition and Excessing Process

This was the first formal assessment of this process. It yielded a number of improvement ideas and revealed a process that is working effectively and efficiently. The improvements will be incorporated into the larger planning effort of the department for implementation as software updates and resources become available.

Laboratory Services Section

Administrative Support - Human Resources

During FY03, Fermilab transitioned to a new performance management system. The Laboratory decided to review its performance appraisal system, which had been in place since 1969, based upon feedback from employees who participated in the 1999 employee opinion survey. A committee comprised of a representative from each division and section developed the new system. The committee received direction and guidance from the Directorate and Laboratory's Human Resources group.

Laboratory Services Section was responsible for managing the transition to the new system. The project management plan included a time schedule for implementation, a lab-wide communication effort, training and consulting.

Overall the division and section management responded that the LSS scheduling, communication and training efforts were sufficient for a smooth transition. Division and section heads held management meetings to discuss organization-specific procedures and deadlines. They encouraged their employees to attend LSS-sponsored training and to seek advice from human resources as needed. The transition got off to a shaky start because questions regarding the process spurred a Directorate review. After the review, a few changes were implemented. Although the Director communicated the changes in an all-hands memo, some supervisors were confused about the process and did not adhere to the initial time schedule for setting goals. In hindsight, Laboratory Services Section should have communicated with supervisors shortly after the review to get everyone back on track, but we thought the communication from the Director was clear. After the initial confusion, however, LSS increased its communication effort with presentations at the Laboratory Administrative Meeting (LAM) and memos to all employees. By the end of the process we had only 5 employees who did not receive a review. This represents a 99.7% compliance rate, which is much higher than last year under the old system when compliance was only 85%.

Our training and communication sessions were well attended. Nearly 90% of all review eligible employees attended the initial information meeting and nearly 40% of our employees attended goal setting training. This year we also offered training to help supervisors prepare for the performance conversation. LSS will continue to offer training during FY2004.

After the FY2003 performance management cycle is complete, LSS plans to hold focus groups with both employees and supervisors to discuss the process, understand problems and concerns, and recommend changes as appropriate. We will use all employee mailings, Fermilab Today newsletter and the LSS website to communicate recommendations and changes to lab employees.

Performance Appraisal Information Meeting and Training

Organization	Employees	PA Course Complete	% Complete
BD	572	513	90.0
BS	126	122	97.0
CD	253	231	91.0
DI	36	31	86.0
ES	65	63	97.0
FE	108	98	91.0
LS	84	78	93.0

PD	516	411	80.0
TD	188	177	94.0
FNAL	1948	1724	89.0

Employees Number of *regular and part-time* employees who are appraisal eligible.
 Complete Number of eligible employees who attended the information meeting/training
 % Complete Percentage of eligible employees who attended the information meeting/training.
 (Percentage rounded to the nearest 10)

Goal-Setting Training

Organization	Employees	Goal Setting Course	
		Complete	% Complete
BD	572	114	20.0
BS	126	108	86.0
CD	253	119	47.0
DI	36	19	53.0
ES	65	19	29.0
FE	108	71	66.0
LS	84	54	64.0
PD	516	170	33.0
TD	188	76	40.0
FNAL	1948	750	39.0

Employees Number of *regular and part-time* employees who are appraisal eligible.
 Complete Number of eligible employees who attended the goal-setting training
 % Complete Percentage of eligible employees who attended the goal-setting training.
 (Percentage rounded to the nearest 10)

Accommodations

Introduction

The Accommodations Group contributes to the Lab by providing comfortable and affordable housing to Fermilab’s visiting scientists and students from all over the nation and the world. For those visiting the United States for the first time or for those who do not speak English, arrival to the Fermilab Village reduces the stressful conditions they’ve encountered. Houses (45), apartments (20), and dormitory rooms (92) are available for singles, couples, and families. In addition, the Accommodations Group manages our subcontractor, Eurest, in its mission to provide nutritious and affordable meals and snacks to the Fermilab community including breakfast, lunch, and special event selections.

Accomplishments

- High-speed computer access – We installed significantly expanded high-speed computer access to almost all residential buildings in the Fermilab Village. This was in response to residents need to work on their computers in the evenings. Installing this service puts us on par with other local housing units and local dormitories.
- Linen supply service – We successfully bid and implemented a new linen supply service contract. This contract was up for rebid. Not only did the new contract freeze the prices the Lab pays at the old

contract rates, but it also locked the prices in for three years.

- Laundry vending service - A new laundry vending service contract was successfully bid and implemented. This contract was up for rebid. Our monetary return was increased from 71% to 76%. We also received new washers and dryers as part of the contract. This provides better service for our residents.
- Road repaving – We re-paved access roads for the Sauk Circle houses and apartments. A resident sprained an ankle due to the rough road earlier in the year. The repaving increases safety. It also improves the water runoff from the roads.
- Renovated house - A newly acquired house at 14 Shabbona was renovated and rented. We have more demand for housing than we can supply. This house was acquired from a different Section. Renovating it made it available as a rental house. It was rented the month after the renovation was complete.
- Invoice review process – We implemented a more comprehensive invoice review process with Eures. This was done in response to an internal audit in FY2002. The new system allows us to track costs in more detail.

Audits, Reviews and Evaluations

During FY2003 the DuPage County Health Inspectors conducted health inspections of the cafeteria on a surprise basis. We passed the inspections with only a few minor comments.

Improvement Opportunities

- The food services contract will be rebid in FY2004. We will look to improve services to customers and decrease costs to the Lab.
- In order to determine which areas of Housing need improvement we will conduct a survey of resident satisfaction and formulate action plans based on our findings.

Benefits

Introduction

The Benefits Office provides a function that is valuable to the individual employee and the Lab as a whole. Our biggest challenge is to provide a benefit package that is an asset in attracting and retaining employees, while at the same time containing costs.

The Benefits office maintains several pension and welfare plans. The Lab fully funds the pension, basic life and AD&D, business travel accident, tuition reimbursement and severance plans. Employees share in the cost of the medical, dental, and disability plans. Employees fully fund the voluntary supplemental retirement accounts, supplemental and dependent life insurance, flexible spending accounts, and long-term care insurance.

The two benefits that employees consider the most valuable are medical benefits and the pension plan. We offer the employees three medical insurance plans to select from: Cigna PPO, Cigna POS and Blue Cross/Blue Shield HMO IL. A contribution is made for qualified participants in the pension plan in an amount equal to 10% of their base pay per month. These monies are put into a qualified defined contribution money purchase pension plan.

This office is also responsible for ensuring that the Lab is in compliance with the laws and regulations of the Employment Retirement Income Security Act (ERISA), Health Insurance and Portability and

Accounting Act (HIPAA), Consolidated Omnibus Budget Reconciliation Act (COBRA), and Family and Medical Leave Act (FMLA).

Plan changes to the benefits plans and changes in implementation of laws and regulation are communicated to employees through interoffice mail and are also posted on the Benefits office web page. If the issue is very complex, employee meetings are scheduled to address questions and concerns.

On a day-to-day basis, the resolution of eligibility issues and claims problems, payments of insurance premiums, and the interpretation of the Summary Plan Descriptions, Insurance Certificates and Personnel Policy Guide are an important function that we provide for the Lab. By resolving these concerns for Lab employees, we allow them to focus on their job duties and this in turn helps the Lab to accomplish its mission.

Accomplishments

- Automation of HMO Illinois - A major accomplishment for this year was the implementation of the automation of the Blue Cross/Blue Shield HMO IL online transmission. This has helped to streamline the volume of paperwork we were submitting to the insurance carrier for processing. We have now shortened the time period it takes to process the addition or termination of enrollments.
- Writing procedures - The lack of written documentation of the responsibilities and procedures for the staff personnel was problematic. Because of this, there was no consistency in how we handled processes. For some complex issues that only arise periodically, we found we were always "reinventing the wheel." This year, one of the goals of each staff member was to document in detail procedures of his/her job functions and responsibilities. Once a year, they will review their procedures and make any necessary changes.
- Insurance renewals - Our initial insurance renewals came in around 30%. We negotiated with the carriers and made plan design changes that resulted in a 13% increase to medical insurance and 7% to dental. This saved money for the Lab and for our employees. According to Chicago's HR Association the average increase for medical plans was 16-18% and the average increase for dental plans was 10%.
- HIPPA - We implemented the new HIPPA Privacy Regulations. We did this to meet legal requirements. These new procedures safeguard the privacy of medical information for our employees.

Audits, Reviews and Evaluations

This year our Internal Audit group reviewed some of the Benefits processes. Some of the actions we are taking as a result of the audit include obtaining reports from the insurance carriers to determine if we have deceased insureds on the rosters. We will also implement automatic deduction payments for retirees and those on leaves of absence.

Improvement Opportunities

Government regulations continue to require us to update our documents and forms. We will conduct a review of our plan documents, Summary Plan Documents and corresponding forms to ensure that they are in current compliance.

We have not updated our life insurance program in many years. In addition our employees have not been able to make any changes to their supplemental life plans because of the premium holiday we have had over the last two years as a result of a DOL audit. As the holiday ends, we would like to improve the choices available to our employees.

Education Office

Introduction

The Education Office positions the Laboratory as a partner to schools and school districts in the national effort to reform K-12 science and mathematics education. Our work supports the DOE effort in workforce development and is one way Fermilab provides service to the community. In return the Laboratory receives increased community support from families and friends of the students and teachers who participate in our programs.

Accomplishments

- Ask-A-Scientist Tour Program - This year we began a new Ask-a-Scientist Tour Program to replace what used to be self-guided tours and the Ask-a-Scientist Program. The new program was necessary to accommodate visitors within the current limited site-access policies. Once a month on a Sunday afternoon, we offer a special behind-the-scenes tour of our facilities with physicists on hand to answer questions. In FY03 we offered tours to CDF, DZero, the Linear Accelerator Building, Mini BooNE, the Magnet Facility, New Muon and Antiproton Source. We can take 80 visitors on each tour. With pre-registration we are able to provide visitor passes for our participants. The tours are very popular with more requests than we can accommodate. Our visitors tell us they appreciate the chance to see the technical areas and have their science questions answered by a scientist.
- QuarkNet - QuarkNet is a program that seeks to improve the quality of science teaching by sponsoring interactions between physicists and teachers. The interactions include workshops and meetings and the opportunity for teachers to work on physics experiments. This year QuarkNet is involved in an exciting partnership with grid computing initiatives to develop a QuarkNet Grid website that will allow high school students across the country to conduct cosmic ray studies with student data. This initiative means that high school students using a school-based detector designed and built by Fermilab staff could send cosmic ray data to a central computer. Then students anywhere could ask, say, for all the data from the Boston area for a certain week and perform a particular analysis. All they will need is a browser, no complicated software! They will be able to compare their results with those of other student researchers. One powerful analysis they will be able to do is cosmic ray shower studies, and this is real research that can contribute to the scientific understanding of these showers.
- Awards Program - This year in partnership with Fermilab Friends for Science Education, we initiated an awards program to recognize the accomplishments of outstanding high school students in Kane and DuPage counties. Fifty-six students from twenty-eight high schools received the first annual Fermilab Science Award. Students received recognition at their school's awards ceremony and two books, *"Unsolved Mysteries of Science"* and *"Quarks Unbound,"* and a certificate.
- Field Trips – FY2003 was a busy year for the Lederman Science Center. We had a 5% increase in the number of students who visited the Lab. During the fall we had between one and three school visits to the prairie nearly every day from mid-September to early November. Our physics field trips and tours were more popular this year with a steady flow of students throughout the school year. Our Science Adventure classes remain popular among students in kindergarten through seventh grade, and our scout program expanded rapidly, particularly those programs for girls.

Audits, Reviews and Evaluations

- Jean Young and Associates evaluate the QuarkNet program. The methodology used for evaluation is participant and leader feedback, surveys and observations. The reviews take place annually and are episodic, which means the reviewer evaluates milestone events and activities. The evaluations are

formative and are used to make mid-course program corrections. During FY2003, it was determined through observations and feedback that some of the participants did not have strong physics backgrounds, making it challenging for the teachers to fully participate in activities and research. The leaders corrected this problem by providing additional one-on-one assistance and tutoring to teachers with knowledge gaps. The ongoing program evaluation will confirm whether this strategy was successful.

Improvement Opportunities

- Computer security – In order to comply with the Fermilab computer security plan, we have developed and implemented a plan to move our Macintosh computers into the strengthened realm. Computers in the strengthened realm are those on which users may be authenticated for access to systems on the Fermilab network by a Fermilab kerberos key server. This year we have completed major computer upgrades and migrated our files so that we work in more secure domains. Our web servers and some files have moved to AFS space, and other files have moved from an NT to a Windows2000 server. This has been a complex process that involved everything from buying new computers, to upgrading memory and purchasing new system software. After a lengthy test period, we are working smoothly in our new environment. We will continue to address problems as operating systems and software are upgraded.
- Exhibit upgrade - We have undertaken an extensive effort to upgrade the exhibits at the Lederman Science Center. The Center is ten years old, and while the exhibits received necessary repairs, we have not had the funding to do a much-needed systemic review and upgrade. With support from DOE HEP and an anonymous donor to Fermilab Friends for Science Education, we largely completed that work which was based on recommendations from a needs assessment workshop attended by teachers and scientists. Additional work remains to be completed during FY2004.

Employment

Introduction

The Employment Office recruits and hires for all non-scientific positions at the Laboratory, conducts new employee orientation, facilitates relocation for new hires and conducts all exit interviews. The office is also responsible for attending job fairs and off-site recruiting.

Accomplishments

- Revitalization of co-op program - The Cooperative Education Program was revitalized. The results have been a doubling in participation and diversity representation in addition to academic relations and ancillary service improvements.
- Diversity career fairs - The Employment Office attended the career fairs associated with the national conferences of the Society of Women Engineers, the National Society of Black Engineers and the Society of Hispanic Professional Engineers to assure that the Laboratory could maintain its name recognition, even if the job openings were limited. It is important for us to maintain relationships with these organizations for future hiring opportunities.
- Statistics for the Employment Office for FY2003 are as follows:

Regular Full-time Hires	29
Guest Scientists	56
Summer Hires	142 (includes special programs)

For other employment statistics see the results in the Balanced Scorecard Section.

Audits, Reviews and Evaluations

No internal or external reviews were conducted in this area this year.

Improvement Opportunities

Projected hiring for FY04 continues to be very low. We will assist the groups in the Lab to transfer people as needed. We will also review our advertising strategies to position ourselves to attract the most desirable candidates when hiring requirements increase.

Equal Opportunity and Counseling

Introduction

The Equal Opportunity Office is responsible for the administration of Federal Regulations and monitoring employment practices to ensure compliance with State and Federal laws. Additionally, the office provides linkages to organizations that can identify and refer qualified diverse candidates for employment at the Laboratory. It also recommends to management policies and procedures that ensure fair and equitable treatment of employees and applicants. This office provides an avenue for employees to address problems in the workplace, both personal and professional. The EOO also manages discrimination complaints and charges and coordinates summer internships for minority students. The counseling function is primarily administered through a formal Employee Assistance Program (EAP) which is a confidential, professional service providing counseling for personal problems. The program offers professional assessment, referral, and short-term assistance to employees. The Equal Opportunity Office has consistently provided advice and counsel to Laboratory personnel. It has also facilitated conflict resolution and provided training on critical workplace issues.

Accomplishments

- Internal complaints – We promptly investigated all internally filed complaints. As a result, the Laboratory has only one discrimination charge filed with an enforcement agency and one lawsuit in the area of workplace discrimination.
- Government required documents and reports - We meet filing deadlines for the Affirmative Action Programs (one plan for minorities and women, another covering persons with disabilities, Vietnam Era Veterans, and disabled Veterans), the EEO1, and the VETS 100 Report. In FY 2002, the Laboratory received a letter of compliance after an on-site OFCCP review. The OFCCP is the Office of Federal Contract Compliance Programs and is one of the enforcement agencies under the auspices of the US DOL.
- Award received – We received an Employer Recognition Award from the Illinois Department of Rehabilitative Services for our efforts in assisting Lab employees with hearing disabilities and in providing a quadriplegic undergraduate with a summer internship experience.
- EAP improvements - In the area of counseling, the EAP Administrator has completed the process of coding client files using a system that will maintain client confidentiality. The office has also begun developing a system to track the reasons for employee contact of the EAP. This will be useful in doing trend analysis and tailoring services to needs.

Audits, Reviews and Evaluations

No internal or external reviews were conducted in this area this year.

Improvement Opportunities

There continues to be a need to develop sources for diversity candidates. We plan to expand our outreach efforts. One of our targets this year will be the National Society for Black Physicists.

HR Services

Introduction

The H.R. Services Group provides the Laboratory with services and support in the areas of Compensation, HR Information Systems and Records, and Visa Administration. Each of these functions is staffed by employees who are specialists in their fields and who are dedicated to furthering the Laboratory's mission by providing exceptional service in their specialty. Each of these functions, in addition to providing ongoing daily service, has met significant objectives during the past year.

Accomplishments

- Annual salary increases - The Compensation Group reviewed the Laboratory's pay position to various labor markets and enabled the timely submission of the salary management fund request to DOE for FY 2004. As in recent years, it was clearly shown that the Laboratory maintains a competitive posture in the labor market by providing average pay rates that meet the DOE measure of +/- 5% of market.
- Revised annual increase procedures - The Compensation Group successfully installed changes in the salary review procedures to enable effective and timely introduction of the new performance appraisal based pay increase distribution method.
- Job evaluations -The Compensation Group exceeded our goal of reviewing 20% of our current job evaluations using methods that have been very well received by our customers.
- PeopleSoft upgrade - The Systems and Records function played a critical role in planning and upgrading their portion of the Laboratory's HR/Payroll database system. The introduction of PeopleSoft version 8.0, a web-based system, required significant change in numerous procedures and reports to ensure accuracy in data transfer and consistency of results in report generation.
- Visa changes -The area of Visa Administration has coped with a plethora of new laws, regulations, and procedural changes and imposed additional requirements during the past year. The creation of the new Department of Homeland Security reassigned many long-standing responsibilities; new laws required tracking of students and Exchange Visitors (initially through the ISEAS system and then through the SEVIS database system) and special registration of visitors/residents from certain countries; changes in visa application, processing for security checks and most recently expansion of direct applicant interview requirements – all of these have lengthened and complicated the required planning time for all visa related activities and added the need for education and frequent communication with our non-U.S. citizen population. Additionally, new DOE Interim Guidance on site access control required a review of the entire visa/status record of every non-U.S. citizen employee and visitor. Despite this environment, we have maintained our record – we have lost no foreign employee or visitor for reasons attributable to the Visa Office.

Audits, Reviews and Evaluations

No internal or external reviews were conducted in this area this year.

Improvement Opportunities

There have been significant changes in the market to the way computer science and engineering positions are classified and compensated. We have not reviewed these job families for a significant period of time. We will review and reevaluate both of these job families.

In order to save time for both Human Resources and our employees and to offer better customer service, we would like to offer self service options for data base items like name and address changes and read only benefits screens.

Because of the significant changes in visa law and procedures, we believe our supervisors and administrative support staff need an update in current practice. Therefore, we will complete and offer a series of short seminars on these issues.

Information Resources

Introduction

The Information Resources Department, which includes the Library and Technical Publications Office, manages and facilitates the exchange of scientific and technical information for the Fermilab community.

Accomplishments

Metric U.1.1.1.1 – Outstanding

- OSTI Submissions - The Fermilab Information Resources Department is required to send the Office of Scientific and Technical Information (OSTI) 100% of Fermilab publications in electronic format. We have done this since 1995.
- Library automation - We migrated to the SPIRES database system for our Library automation system. The system manages all Library materials functions including catalog management, circulation control, serial control, patron services and online public access. This was a year-long project carried out by Library staff. This project was necessary because the company (Data Research Associates) that provided our automation system since 1990 was sold. The cost to migrate to a new proprietary system was \$75,000 for the system license, an additional \$75,000 for customization, approximately \$30,000 for training and an annual maintenance fee of about \$14,000. The SPIRES system costs \$6,000 a year and allows us control over changes and upgrades to the system. It also provides a system tailored to the needs of a special technical library. Most off-the-shelf systems are developed around the work processes of large public libraries.
- HEP Jobs - We established the HEP job database, which allows laboratories, universities and other organizations worldwide to post and view job openings in the field of high-energy physics. The job database is part of SPIRES HEP and is maintained by the Fermilab and SLAC libraries. Because SPIRES HEP receives thousands of searches per day from particle physicists around the world, it is a logical place to post physics job openings. The jobs database has been available since September 2003. In that time, the job list has grown to nearly 300 advertised job opportunities and the database is receiving over 1,500 hits per day.
- Astrophysics database - We increased the coverage of astrophysics papers in the SPIRES HEP database. High-energy physics and astrophysics are becoming ever more closely related. Those working on the border between the two disciplines were encountering the problem of having to use three separate databases (SPIRES HEP, Harvard's ADS, and the astro-ph eprint archive) to do their literature searches. Because Fermilab has a strong presence in astrophysics, it made sense for the Fermilab library to ensure the SPIRES HEP database would provide sufficient coverage for those particle physicists who are working in astrophysics. It was decided that this could be achieved by downloading all astro-ph eprints into SPIRES. These eprints were previously added to SPIRES on a

case-by-case basis, but the growing overlap between HEP and astrophysics was making this approach less and less efficient. The Fermilab Library processes the astro-ph eprints in the HEP database (adding author affiliations, any experimental tags and discovering journal publication information in Harvard's ADS database). We pay particular attention to eprints from Fermilab and SLAC.

- Streaming video database - Online streaming video of scientific talks are currently scattered about the web, with no central place to search for them. We have created SPIRES-VIDEO to fill this gap and downloaded so far all presentations from Fermilab. We plan to add presentations from other laboratories in FY2004.

Audits, Reviews and Evaluations

No internal or external reviews were conducted in this area this year.

Improvement Opportunities

Fermilab authors are required by our DOE contract to obtain a report number for all technical papers they write and to submit the full-text of the finished paper to the Technical Publications Office for patent, peer review and submission to the Office of Scientific and Technical Information (OSTI). Although the Technical Publications Office adheres to all requirements of DOE O 241.1A, we suspect that some authors do not comply with the submission requirements. To improve upon this we began searching for papers that have bypassed our regular publication procedures. When we find them, they are assigned a Fermilab report number and sent to OSTI.

This project has been aided by our adoption of the SPIRES HEP database as the preferred place for cataloging our publications. The SPIRES HEP database receives over 20,000 searches per day from particle physicists around the world. Having all Fermilab scientific documents with links to full-text in this database greatly increases their visibility and accessibility. We have downloaded all astro-ph eprints from <http://arXiv.org> into the SPIRES-HEP database and in doing so have found an additional 250 Fermilab papers from the theoretical and experimental astrophysics groups, and also increased the number of citations of Fermilab astrophysics papers by 50% (with the average citation per paper rising from 31 to 32). We also worked very closely with the experimental collaborations to ensure all Fermilab Ph.D. theses are recorded in the SPIRES HEP database, and where possible provided links to online full-text. We have so far identified over 1,200 theses and have been told by members of the scientific community that the information contained in these theses is often available nowhere else. Along with actively searching for Fermilab papers that were not submitted to the Technical Publications Office, we have also begun to periodically publish notices in Fermilab Today, the Laboratory's daily online newsletter. In the notices we remind authors of their obligation to submit reports and include a link to submission instructions and a contact name for assistance.

Training and Development

Introduction

The Training and Development Department (TAD) is responsible for providing employees with ongoing learning and development opportunities that assist them in performing their jobs more effectively and prepares them for future career opportunities. This centralized employee development function has only been in existence for three years. In its first two years, we focused on meeting the need for computer skills. Over the past year we have begun to address a broader base of needs.

The department uses a training model that incorporates needs assessment, design, development and delivery. This model is being used as the foundation for developing a lab-wide curriculum. Training is developed internally when topics are unique to the lab; otherwise, training consultants are used as resources for cross-functional training (i.e., computer, communication skills, etc.) that can be easily customized to lab needs.

Accomplishments

- Performance management training – We developed and taught courses that support the new performance management system including Goal Setting for Supervisors, Goal Setting for Employees, Accomplishment Report Writing and Performance Appraisal Discussion.
- Supervisory Development – We supported the performance management process by identifying training for managers and supervisors that will help them to develop the interactive skills necessary for coaching for success, coaching for improvement, and managing performance problems. A pilot, approved by the Directorate, will be conducted in the fall of FY04.
- Training needs assessment – We conducted a training needs assessment in the Laboratory Services Section. Results are being used as a blueprint for developing all section employees and improving performance.
- Curriculum development – We initiated a lab-wide curriculum that includes courses in the areas of Management and Supervision, Computer Skills, Professional Development and Technical Skills.
- Tuition reimbursement – We completed a benchmarking study using data from other DOE laboratories and area businesses on tuition assistance programs and presented recommendations to the Directorate for changes to the existing lab policy.

Audits, Reviews and Evaluations

No internal or external reviews were conducted in this area this year.

Improvement Opportunities

- After the completion of the supervisory development pilot, we will need to analyze the feedback from the participants, make recommended course changes and develop a plan for offering the program across the Lab.
- We need to implement the changes in the tuition reimbursement program that were approved by the Directorate.

Visual Media Services

Introduction

Visual Media Services supports the communication needs of Fermilab by providing vital services to Lab employees and users by: producing professional-quality, cost-effective communications media programs, products and documents that meet the Laboratory's communication and training needs; documenting, archiving and cataloguing images of the activities and milestones and providing multi-media support and services for meetings, events and conferences. The department also duplicates large volume documents.

Accomplishment

VMS has successfully provided professional communication services to almost every division and section within the laboratory and our user community. All of the projects taken on by VMS have been recognized as valuable and have been successfully completed within deadline. There have been numerous written

commendations directed at the staff of VMS for their efforts. A customer survey was completed 1.5 years ago that verified this assessment. During FY2003 VMS:

- Super Computer 2002 - Produced Super Computer 2002 display designs used by computing professionals from Fermilab and SLAC at an international conference on high performance computing.
- Poster design - Designed over 35 posters for conferences, meetings and art series presentations. Many of these were posted throughout the HEP community worldwide and used to create awareness about these important meetings.
- Lepton Photon support - Planned, designed and staffed three poster sessions as part of the Lepton Photon 03 Conference.
- Training video - Produced ES&H training video about waste and recycling efforts at the lab and public outreach videos on the Prairie Project and Minos/CDMS experiments.
- Streaming video - Recorded and streamed 290 lectures this past year that include 47 Lepton Photon 03 lectures, HEPAP meetings and LHC conference. These streams were made available on the Spires Database for HEP dissemination. Also provided live streaming of over 25 different scientific meetings to hundreds of scientists and users worldwide.
- Duplicating - Duplicated such documents as all employee mailings for benefits and management "All hands communications" and arranged for large volume duplication of WPAS and LHC/US Project Status.
- Meeting support - Set up and coordinated the operation of audio visual/speaker support equipment for all meetings taking place in Wilson Hall including five week-long conferences over the past year.
- Digital images - Provided hundreds of digital images to HEP community world wide through use of photo image database.
- Large format printing - Cost effectively introduced the use of large format printing for displays.

Audits, Reviews and Evaluations

No internal or external reviews were conducted in this area this year.

Improvement Opportunities

- After analysis of our photography and digital imaging output we learned that we missed deadlines on 12% of our jobs. We made it a goal to reduce the number of late jobs. This year we reduced the number of late projects to <2%. We achieved this by more closely monitoring projects and deadlines, setting priorities, better aligning work distribution and negotiating realistic deadlines with customers. We will continue to monitor output in FY2004 and work to further reduce the number of missed deadlines.
- Over the last two years we have moved from producing less print photography to producing more digital images. Digital photography is cost effective in terms of processing, but was more time consuming for our production staff. We assigned the file transfer duties of the digital images to administrative support thereby increasing production time for production staff. This has been in place for six months and is now a normal operating practice.

Diversity

Metric T.1.1.1.1 The percent increase in offers to women in the Professional Job Groups - **Outstanding**

Year-to-date for FY2003, there were ten women hired in the Professionals job group. There were 62 hires in total in these groups, resulting in a 16.1% rate for women.

Metric T.1.1.1.2 The percent increase in offers to underrepresented minorities in the Professionals Job groups - **Marginal**

Year-to-date, there were two underrepresented minority hired in the Professionals job group. There were 62 hires total in these groups, resulting in a 3.2% rate for underrepresented minorities.

Laboratory employment activity has been severely curtailed in FY2003. The majority of our hires were Research Associates including post-docs, guest scientists, and associate scientists. These are all term assignments and are appointees through the Directorate. In FY2002, a more normal year for hiring activity, there were 135 hires in the Professionals job group, 98 of them in the Research Associates job group. However, in that year, we had openings in the Engineering and Computer Professionals category and we were able to attract more underrepresented minorities as candidates for employment. FY2003 year to date, there have been 62 hires, 55 of them being Research Associates.

We continued our outreach recruiting activities for women and targeted minorities in spite of the limited opportunities at the Laboratory. The Employment Office attended job fairs at the national conferences of the Society of Women Engineers (SWE), the National Society of Black Engineers (NSBE), and the Society of Hispanic Professional Engineers. We also have kept our commitments for advertising in the national publications of these organizations. We need to maintain name recognition for future recruiting opportunities.

We also maintained our commitment to pipeline programs to increase the number of future candidates for our Lab or for other national labs. These included the GEM (Graduate Degrees in Engineering and Science) program where we provide summer internships for minority graduate students and our summer programs for minority science and engineering focused high school and undergraduate students.

Metric R.1.1.1.1 Human Resources Balanced Scorecard - **Excellent**

Overall we did an excellent job with our goals despite some difficulties. Since we set the goals there have been two events largely out of our control that significantly impact our goals. The first is the almost complete hiring freeze at the Lab; the second are the foreign visitor requirements that the Lab was required to meet in a short time frame. We met 11 of our goals thus resulting in a grade of Excellent.

1. Recruiting cost < \$2,600

The recruiting cost year-to-date for FY2003 is an average of \$635 per hire. While this result looks excellent it should be noted that the following factors contributed to the low numbers. The primary one is the current employment market. It is easy to attract candidates through very low cost methods. Also beginning this fiscal year we are tracking specific costs associated with posted openings to arrive at the average. It would be difficult to predict an accurate cost per hire for next year until we understand the recruiting market.

2. Market ratio of salaries + 5%

This goal was met. This metric is inherent in the annual pay to market study that is completed as a basis for the Laboratory's submission to DOE on recommended levels of pay and pay structure increase for the coming fiscal year. The recommendation was submitted to DOE by May 1, 2003.

Summary tables of the Laboratory's average pay rates for all positions matched on a job-by-job basis against scaled pay information from broad-based local and national pay surveys showed that, on average, our pay rates conform very closely to the labor market as a whole. For FLSA exempt positions the ratios showed a relative position to market of approximately 99.5%; for non-exempt positions this ratio

was approximately 98.0%. In terms of commonly accepted compensation practice/perspective it could be argued that such a relationship to the pay market is almost perfect.

Since the Laboratory's scientific population is not easily matched to an external population covered by the job-based surveys used for the majority of our employees, it is compared on a "maturity" basis (i.e. pay rate vs. years since BS or PhD) to information gathered through the Laboratory's annual "High Energy Physics pay data exchange". Comparative analyses of the Laboratory's physicist population to that covered by the HEP exchange also shows a very close relationship of our average pay rates to those of the defined market – on a net negative basis our relationship is approximately 98% while on a gross basis our position is approximately 104.4%.

3. Rewrite the Long Term Disability, Travel, Severance, Medical and Dental Summary Plan Descriptions by 1/15/03

This goal has been met. The Summary Plan Descriptions were rewritten for Long-Term Disability, Travel, Severance, Medical, and Dental by the deadline. However, the review process extended beyond that date because the Long-Term Disability and Travel SPDs had to be reviewed by two insurance carriers for necessary legal language. The revised SPDs are available on the Web.

4. Revise the Personnel Policy Guide by 8/31/03

We have entirely reformatted the Personnel Policy Guide. First we decided to change over to a web based system. We will no longer distribute hard copies. However, we will have master copies available in Human Resources and in the library for any one who does not have access to computers. We have taken three resources, the Personnel Policy Guide, the Employee Handbook and the SPDs and merged them into our new Working at Fermilab Website. The website will consist of a policy guide, a supervisor's toolkit, an employee's toolkit, a glossary and the SPDs. The policy piece is written, is on the Web and is currently being tested.

5. Review and decide whether we are able to implement education savings program for children of employees for college tuition by 4/30/03

The Benefits group reviewed a number of different programs and met with representatives of the companies. A decision was made by 4/30 to proceed with the program and the company has been chosen. We are planning a FY2004 implementation for this new benefit.

6. Hold lunchtime brown bag HR Q&A sessions twice per FY2003

The first Brown Bag was held May 16. Although attendance was moderate, the questions were good and the participants were complimentary of the new format. The second was held September 30.

7. Time to hire from requisition posting date to acceptance date < 150 days

FY2003 year-to-date time to hire is 51 days. First quarter activity average was 40 days; second quarter activity average was 55 days. Third quarter activity average was 62. So far fourth quarter follows a similar pattern so the final number should not deviate much.

8. Acceptance rate for hiring > 93%

The acceptance rate for FY2003 year-to-date is 85%. First quarter we had a 100% acceptance rate. In the second quarter our acceptance rate was 75% due to the fact that we made three unsuccessful offers for the Occupational Health Nurse before we got an acceptance from the fourth candidate. The declines

were primarily due to salary. Our budget would only allow a certain salary level, and this is a position currently in high demand. Third quarter our acceptance rate was 100%. Our current hiring situation makes this metric difficult because we are filling so few positions; one decline makes a big difference in the statistics.

9. Test and implement PeopleSoft 8 by 5/30/03

PeopleSoft 8 was thoroughly tested and implemented by 5/30/03.

10. Explore self-serve personnel information change system with implementation of PeopleSoft 8 by 9/30/03

This was completed by August. Implementation is dependent on the schedules of the IT professionals who support us.

11. Automate HMO Illinois eligibility process by 6/30/03

The data integrity verification process was completed by May 10. The final testing for this process was completed during the week of June 23rd and the system was ready for automated transmissions by June 30, 2003.

12. Review of job descriptions for current accuracy, Markey competitiveness and internal equity > 20%

We reviewed 54 job descriptions exceeding our goal of 53.

13. Develop and implement informational sessions regarding visa administration for supervisors and primary users by 4/30/03

The vast volume of administrative change in this area of activity prompted this objective and, at the time the target date of 4/30/03 was set for implementation, it seemed reasonable. In the interim, the 1.25 employee FTE devoted to visa administration were unexpectedly required to implement the Interim Student & Exchange Visitor Authentication System (ISEAS), the subsequent introduction by the Departments of Justice and State of the Student & Exchange Visitor Information System (SEVIS) for J-visa holders by 1/31/2003, and implementation of the DOE Interim Guidelines on Foreign Visits & Assignments and required entry of all changed information on non-U.S. employees into the DOE FACTS database by 4/4/2003, all required significant effort in addition to the daily need to administer existing obligations for non-U.S. employees.

These issues aside, the Visa Office developed an initial outline of the training, but it has not been implemented.

14. Implement interviewing training – first class by 11/30/02

The Training and Development Department and the Employment Office assessed training needs and evaluated commercial training programs that fit the labs training needs. A vendor for the training was selected. Materials were evaluated and purchased. A member of the Employment Office was selected to become a certified trainer. Certification training has been scheduled. An outside trainer has been identified to train the Employment Office and other HR staff. This training is scheduled to be completed this spring. Participants for a lab-wide pilot training have been identified.

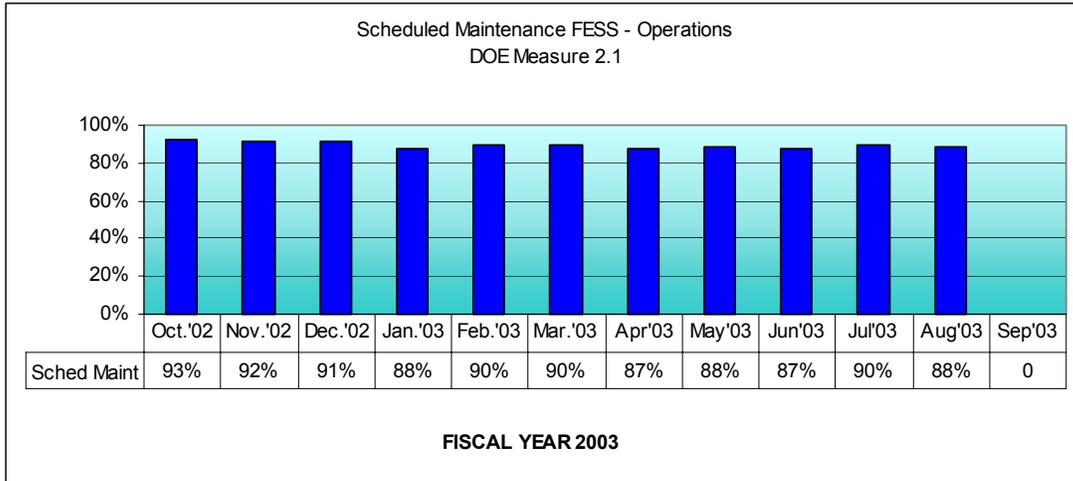
The original completion date for the lab wide roll out of interviewing training was November 30, 2002. The roll out was postponed because the lab conducted a budget review. In FY2003 there were very few

employment openings and nearly all hiring activities were suspended. The Employment Office is ready to start the training and the program will be rolled out to the lab when resumes normal hiring activity.

Mission support

Metric D.1.1.1.1 – Outstanding

The period from October 2002 through July 2003 has ranged from 87% to 93% with >75% being Outstanding for Scheduled versus Actual maintenance.



Score >75% - **Outstanding**

Metric D.1.2.1.1 is rated Outstanding

The following summarizes our year-end FY'03 performance (October 1 to September 30) relative to GPP and Line Item projects managed by FESS, either for FESS or for other Divisions / Sections. Although the URA contract uses a metric of “number of projects completed/number of projects planned”, FESS continues to track the performance to all milestones listed on the construction directive.

<u>Project</u>	<u>Status</u>	<u>Milestones</u>	<u>on</u>
<u>Schedule</u>			
Shield Block Storage Shed	Engineering Complete	Yes	
Village Gas Valves Upgrades	Engineering Complete	Yes	
Village Power Pole Replacement	Construction Complete Engineering Complete	Yes Yes	
Footprint Area Electrical Upgrades	Construction Complete Engineering Complete	Yes Yes	
Well 4 Upgrades	Construction Complete	Yes	
FCC Exterior Improvements	Construction Complete	Yes	
Ramsey Auditorium Lighting	Construction Complete	Yes	

Lab BEG Connection	Engineering Complete	Yes
Electrical & Cooling Upgrade	Engineering Complete	Yes

Based on the above information for FY2003 Year-End, the rating is 100%, "**Outstanding**".

Measure D. 1.3.1.1 Energy requirements accomplished during this period - **Outstanding**

In addition to this contract measure that resulted in over 95% of the plan being accomplished and a grade of Outstanding, DOE required a separate agreement for energy Performance Based Objectives and Measures. Measure 1 is the same as the contract Metric; that is Energy accomplishments per plan during this period resulted in greater than 95% of the plan being accomplished and a gradient of Far exceeds expectations. Measure 2 is Energy use Reduction that also achieved a gradient of far exceeds expectations by reducing building energy by more than 4% based on the CEMP requirement for this year. Measure 3 is the purchase of low standby power devices and by implementing this into the procurement process by 7/31/03 achieved a gradient of far exceeds expectations. Measure 4 is application of sustainable design principles that are reported as part of the Engineering Group's self-assessment report that identified completion of one base line LEED assessment and a grade of meets expectations.

Metric D.2.1.1.1 is rated **Outstanding**

Completed construction subcontracts priced at \$100,000 or greater have been evaluated by a cross functional team of interested parties during the year. A self-assessment shows 100% compliance. Construction safety continues to be in the forefront of construction activity as a whole. This was very apparent during the "Director's Safety Panel Review" on which Procurement was represented. The message that Fermilab means business when safety is at issue was effectively transmitted to subcontractor personnel. It was amplified by the fact that a major construction subcontract included a monetary safety incentive. An incentive was also effectively utilized to help ensure that a critical milestone was met during the accelerator shutdown period.

Division Assessments

Beams Division

- Provides the expertise to reliably and cost effectively deliver particle beams to qualified researchers conducting basic research at the frontiers of high-energy physics and related disciplines.
- Operates, maintains and improves the existing Fermilab accelerator complex and beam lines.
- Conducts particle beam physics research.
- Develops, designs and builds the accelerators and subsystems required to advance the field.

The Beams Division organization is responsible for the over all coordination of the Administrative, Financial, Operational, Environment Safety & Health, and Procurement functions. This document will look at the various processes used to meet the mission goals for the Beams Division and ultimately how it satisfies the laboratory mission

Administrative Support

Finance

The responsibility for the financial operation of the Division begins with the Division Head. The Division Head establishes the goals and priorities for the Division in concert with the Associate Director for Accelerators and passes this information to the Department Heads for budget preparation. The Department Heads, with the help of department members, develop a budget request that is passed to the Division Head. The Division Head, in conjunction with the Deputy Division Head, develop a budget plan using the information obtained from the System and Support Departments. This budget proposal is then presented to the laboratory Director in a budget review meeting attended by all Division and Section Heads. When the Department of Energy issues the actual budget guidance, iteration occurs where Department Heads are asked what items will have to be deferred and what items can go ahead for the coming year. This process undergoes continued refinement until a scope of work and supporting budget are defined.

This iterative budget process can be time consuming and inefficient since it forces the redistribution of funds and necessitates priority decisions to be made often at a time when the projects have not advanced to a point of complete understanding. While this is a difficulty, this method has been used since the earliest days of the laboratory and, given the budget process in Congress, not much else could be contemplated.

Once the budget has been issued, the Field Financial Officer oversees the task of establishing appropriate work order numbers to track expenditures. The FFO also supplies projections for budget expenditures based on both historical and actual purchases reported through the laboratory Business Services Financial Accounting System. The budget information is distributed monthly to Department Heads to allow the tracking of the budgets for their departments. It is also presented at the bi-weekly Department Heads Meeting. Budget adjustments are made through out the year with appropriate scope and goal redefinitions as needed.

The ultimate test of the financial process is shown in the accomplishments of the Beams Division with respect to meeting the Laboratory established mission. To this end, the present year FY2003 has

demonstrated the successful conclusion of the goals as established by the Department of Energy and the Laboratory Director.

Human Resources

Line management assisted by Administrative Support personnel handles the Human Resources support in the Division. These activities encompass a number of areas, including the staffing level, the performance appraisal system, annual salary adjustments, merit increases, discipline and other typical HR functions.

The appropriate staffing levels needed to support the Division's mission is established both in a Top-down and Bottoms-up fashion. The individual Department Heads determine the staffing levels needed to accomplish the level of work to support and ensure the Divisions Goals. Personnel Requisitions are prepared and passed through the line management for concurrence, ultimately being submitted to the Division Head. The Division Head must then assure the required level of salary funding is available to support a new person, and with the aid of the Senior Administrative Specialist, check that the division is under the staffing cap as set by the Deputy Laboratory Director.

If the Division is within the staffing cap, the requisition is handed off to the laboratory Human Resources Department in the Laboratory Services Section for posting, interview scheduling, and other associated tasks.

If the Division is not within the currently assigned staffing cap, the requisition is passed from the Division Head to the Associate Director for his concurrence and then to the Deputy Laboratory Director for approval.

The system works although it is sometimes difficult to track down the exact location of a particular requisition without making a number of phone calls. The posting of the job position also takes a variable amount of time due to the workload of the HR staff. The largest difficulty with the present system is the amount of time taken by the interviewers in returning the evaluation to the HR staff. It would seem this process is ripe for overhaul and update. The HR staff has looked at a number of options but limited finances have prevented any significant upgrade.

The Senior Administrative Specialist who is a member of Headquarters leads the Administrative Support group. It is the job of the SAS to coordinate all department support personnel. The job responsibilities of this group are diverse and range from collecting weekly timesheets to tracking maintenance activities scheduled for facility shutdowns or arranging travel for department members. Individual support members have widely varying tasks that are tailored to meet the needs of the departments they support.

One of the support tasks handled at the department level is the routing of purchase requisitions. This task includes logging the requisitions for tracking and forwarding the requisitions to the next signatory level. In general, the individual requiring the purchase completes the purchase requisition. It is then routed with-in the department to the supervisory level that holds signature authority for the level of funds being spent. The administrative personnel then send the requisition to the procurement group, if sufficient approval has been obtained, or to higher levels of management in the line organization. With some administrative specialists handling over one hundred people in their departments, this can be a very time consuming task.

Another job, which has a short duration but large amount of work, is the Personnel Performance Management System. This system requires multiple passes through the department administrative specialist. The dissemination of the correct forms, communication of deadlines for submission, the scheduling of meetings for the review with the employees and the collection of the documents fall on the

administrative specialist. The administrative specialist must also route the documents to the appropriate places in the department and in the division line management for additional review and signatures.

There has been an expression of difficulty with the new system. These difficulties expose some of the weaknesses with regard to non-homogeneous work forces, and small work groups. The laboratory is planning an implementation review early in the next fiscal year to address some of these issues.

The local administrative specialists also handle travel for Division personnel. The individual usually tells his or her administrative specialist when they are planning to travel, where they are going, for how long and any other stops that have to be made. The administrative specialist then fills out the appropriate travel forms for authorization by the line managers and in some cases, the Department of Energy. After receiving the concurrence of line management, the administrative specialist books the lodging and any transportation required. If a travel advance is requested, the administrative specialist sends the request to the laboratory accounting department. Upon completion of the trip, the administrative specialist reconciles the travel receipts and completes the travel authorization form so the traveler or the laboratory is reimbursed as appropriate.

The administrative specialists are the backbone of the business side of the laboratory and Division. The daily tasks that are handled without intervention from senior department or Division management are a testament to the efficiency and dedication of this group of people.

Security

In a scientific community with multinational collaborations, remote computer access is essential. In an era of cyber attacks, this is a double-edged sword. The very openness needed by collaborations also opens the laboratory to external hackers. The Beams Division has worked with the laboratory Computing Division to formulate an effective security model. The heart of the accelerator computer systems, called the "Critical Systems" resides inside a firewall. Network segregation has been adopted that allows multi-stage isolation in the event of a cyber attack. The networks outside the laboratory are connected to the Computing Division routers as a first level of screening. Next, a single port to the Beams Division allows isolation of the Beams Division from not only the outside networks but also from the general user community at the laboratory in case of cyber attack. The Beams Division general user community is further isolated by the firewalls from the Critical Systems.

This multi-tier approach has allowed the machine to continue to function during site scans from foreign machines, that is, machines outside the laboratory.

The proof of this multi-tier approach can be seen in the successful operation of the complex even in the face of the so called "Blaster" worm and other similar viruses and worms.

The Beams Division has also adopted a managed approach to our computer systems. Through a central core group in the Accelerator Controls Department, all Beams Division computers are managed by a network of local administrators whose job it is to ensure the security and currency of the system components. Again referring to the Blaster outbreak that crippled numerous agencies including State and Federal agencies, the Beams Division had a handful of problems and these were ultimately traced to machines that were not part of our managed domain. Absolutely no machines inside the Beams Critical System Domain were affected. This fact speaks volumes to the dedication and efficiency of the PC Support Group. There are over 600 users in the Beams Division and many times that number computers used to control the accelerator complex. This again is a success story for the PC Support Group.

Property Protection

The Beams Division works closely with the laboratory Property Management Office in the Business Services Section. All capital equipment is tracked and assigned to individual employees. A yearly audit is conducted to ensure the safe keeping of the equipment and spot checks are made to verify equipment location. The "Missing" property value is reported weekly in the laboratory-scheduling meeting. Any property not accounted for is reported to the site Security Office and efforts are made to locate the property. The critical areas for Security in the Beams Division have been determined to be the Main Control Room and the Computer Rooms. These rooms now have electronic locks attached, which require the use of RF ID cards to gain entry. All service buildings, used to house equipment, are kept locked and cored with a key that is unique to the Beams Division key system. Keys are only issued to personnel after the Division processes a key request form.

Environment Safety & Health

The importance of Environmental, Safety and Health at the laboratory can be recognized from the Directors statement in the ES&H Manual.

"Welcome to Fermilab, a U.S. Department of Energy research laboratory. Fermilab management has no higher priority than to perform research in a safe and healthful manner. We insist that every worker, experimenter, and sub-contractor make job safety and health a top priority as well."

The Senior Safety Officer manages the Beams Division ES&H Department. This department reports directly to the Division Head. The ES&H Department is responsible for the day-to-day safety of the Division and work in concert with the laboratory ES&H Section. The Beams Division ES&H Department monitors the work activities of all departments in the division. They cover OSHA, Radiation Safety, and Electrical Safety activities. Within the ES&H Department, specialists are trained to handle the particular hazards that are associated with operating and maintaining an accelerator complex.

The ES&H Department is charged with the monitoring of required training for division personnel. Additionally, the ES&H Department offers training classes for issues that are unique to the accelerators. Training status notifications are sent to supervisors indicating the training status of their employees. The ES&H Department has done a superb job in keeping the Division training current.

Safety holds a number one priority for the Beams Division and safety incidents for the division and laboratory are reported at a bi-weekly department heads meeting. Often times these 'lessons learned' have been beneficial at looking how we do tasks in the division.

In the event of an accident or incident, the Division Head will meet with those affected to understand how to prevent future occurrences. These incidents or accidents are then covered at the laboratory-scheduling meeting that is held every Tuesday morning. These reviews of accidents or incidents allow a 'lessons learned' report to be brought to the attention of other division or section heads

The ES&H Department works in close concert with the laboratory ES&H Section to allow the rapid response to any situations that may have broader impact to the laboratory. Equipment safety recalls are one of many areas where the ES&H Section works closely with the ES&H Department. This year a notice of faulty relays, discovered at other laboratories, was sent through the ES&H Department to the appropriate Division departments. Additionally, there was a safety recall notice for a commonly used voltage test set. The ES&H Department coordinated the Beams Division effort to ensure no such equipment existed in the division

The ES&H Department has proven very effective in handling all matters that have been brought to their attention or that they have uncovered in their monitoring of activities. The professionalism and

willingness to work with everyone to help them accomplish their tasks in a safe and efficient manner has been beneficial to the division and it's employees.

Engineering

The Engineering Support Departments form the design, development, construction and maintenance arm of the Division. These departments provide equipment needed for the accelerator complex. Each of the departments in the ESD is formed along traditional engineering specialties. In addition, the ESD group provides task management functions for construction, mechanical, and electrical projects. These task managers work with external trades people and provide the liaison between the laboratory and the trades. The Associate Division Head for Engineering leads this group and reports to the Division Head

In addition to the normal administrative tasks, the Associate Division Head for Engineering is responsible for tracking the reliability and availabilities of equipment provided by his departments.

One member of the ESD is designated as the Operations Liaison. This person works with the Operations Department to identify problems that may have an impact on the physics program. This individual works with various support sections at the laboratory to bring a satisfactory resolution to problems.

The Associate Division Head for Engineering provides weekly reports and follow-ups on problems from the previous week. When appropriate, this information is presented at meetings attended by members of the Directorate

A Vulnerabilities study was completed that uncovered aging infrastructure equipment that would have a significant negative impact on the accelerator complex. The information from this study was then prioritized and submitted to the Department of Energy to request additional infrastructure funding. A long-range plan has been put in place that will allow these vulnerabilities to be addressed

Various members of the departments in Engineering Support have participated in design studies for future accelerators. Most notably the US Linear Collider Steering Group. Experts in Cryogenics, Power Distribution, Controls, and Reliability have contributed to the report being prepared by the USLCSG.

Another task supported by members of the Engineering Support Departments is the participation in external reviews at other facilities. Members have participated in reviews at the Spallation Neutron Source, Los Alamos, and Jefferson Laboratory.

The future accelerators will need to be multi-national collaborations due to the size and cost of these proposed facilities. Members of the ESD have participated in workshops on Global Accelerator Networks, a means to develop the technology to allow remote operation of a facility from anywhere in the world safely and efficiently. A concept for a "traveling control room", where different countries would be responsible for the operation of the facility at a given time, has been developed and test studies are being proposed.

All of the work being done in the areas of USLCSG, GAN, International Collaboration on Future Accelerators, and reliability is leading to improvements both in the Fermilab accelerator complex and in the understanding of systems for future machines. The following sections will discuss the member departments of the Engineering Support Departments.

Accelerator Controls Department

The Accelerator Controls Department is responsible for the networks, computer systems, cyber security, desktop support, and control room computers. The ACD provides the control computers that allow the

operation of the accelerator complex. A recent examination of the controls database indicated over 100,000 devices with over 300,000 parameters. The PC Support Group of the ACD supports over 600 desktop computers and provides data backup services, managed anti-virus software, operating system upgrades and patches. The ACD supports over 50 front-end computers, 320 CAMAC equipment crates, and over 6000 modules.

In addition to the physical hardware, the ACD provides the console applications that support the operation of the accelerator complex. Since the complex runs 24/7 the controls system must be up and highly reliable. Changes to the system must be evolutionary and not revolutionary. The ACD is in the process of migrating the control software to a Java language base and commodity computing hardware. This is in response to the changing face of Information Technology.

Given the .gov extension to the Fermilab site url, the laboratory computer systems are under constant scanning from outside sources. It is the job of the ACD to provide the cyber security for the division. The PC Support group works with the laboratory Computing Division to secure our networks and prevent outside intrusion. The Accelerator Controls Network is effectively isolated from the outside world and even the general Beams Division users by an effective perimeter firewall. Over the past year, a number of major worms or viruses have been released into the Internet. The Beams Division Control Network has been immune to these attacks due to the efforts of the PC Support Group in the Accelerator Controls Department.

Cryogenics Department

The Tevatron is the highest energy, superconducting accelerator in the world. The main dipole and quadrupole magnets must be cooled to approximately 4°K in order to operate. This requires the operation of a large cryogenic plant. The Cryogenics Department is responsible for the safe, efficient, and reliable operation of the following:

- 40 Compressors totaling 27,500 HP
- 24 Satellite refrigerators
- 2 Liquefiers
- 24KW of refrigeration @ 4° K
- World's largest and second largest helium liquefiers
- 4.5-mile liquid helium and liquid nitrogen transfer lines
- 5,000 control and monitoring points
- 40,000 liquid liters of helium being circulated
- 100,000 liquid liters of helium storage capacity
- 15 – 30,000 gallon warm gas storage tanks
- 83 pieces of rotating equipment operating at a time, 54 w/o installed spares.

This equipment must be operational 24/7 to meet the needs of the accelerator complex.

In addition to the design, and maintenance aspects, the department has participated in the review of the TESLA linear collider and has had significant input to the USLCSG regarding any future cold linear collider option.

The Cryogenics Department has provided design help with other R&D projects one of which is the Mu-Cool experiment using a liquid hydrogen absorber. This group of talented professionals has represented the laboratory at numerous international reviews, and conferences. They are recognized not only by the High Energy Physics community but by also the Mechanical Engineering community for their technical excellence.

Electrical Engineering Support

EES is charged with the design and maintenance of high power DC power systems, pulsed magnet systems, and pulsed AC power distribution systems for the accelerator complex. Some of the equipment they are responsible for is included in appendix 1. They additionally support the high voltage and vacuum control systems. The Department Head is part of the line organization shown in Fig. 1. Bi-weekly meetings are held with the Division Head, the Associate Division Head for Engineering and the EES Department Head to establish priorities discuss funding issues and cover general managerial issues. The department head also represents his department at the bi-weekly Department Heads meeting. In this meeting, issues ranging from budget to ES&H issues are covered. The Division Head covers items that may be coming up in the near term and covers priorities.

The EES Department works with other departments in the Division to cover procurement, personnel actions, ES&H and other administrative needs.

Instrumentation Department

The Instrumentation Department was formed approximately one year ago by separating the former RF&I departments into two groups. The reason for the formation of a separate department was the need to emphasize the nature of the work being done by each group and to ensure adequate manpower was available for each effort. The combination of the two groups led to confusion between workloads for each and caused a dynamic tension for resources. With an increased emphasis on the instrumentation needs for the Tevatron and Recycler, it was decided to split the groups and staff each to a level appropriate to their job responsibilities.

The new department is functioning well and is fully integrated into the Division line management. All support and management functions mirror the existing departments in the Engineering Support Department.

Mechanical Support Department

The Mechanical Support Department is the largest department in the Engineering Support Departments. The MSD provides mechanical design, construction, installation, and maintenance functions for the equipment used in, and to support the operation of, the accelerator complex. This department specializes in highly diverse areas from ultra high vacuum systems, to cryogenic magnet interconnections. The MSD is the most heavily taxed groups during shutdown periods and it is often a difficult task to find a balance for staffing size. One of the functions served by this department is the coordination of manpower for jobs scheduled in shutdown periods. To accomplish this task, the department works across divisional lines to get help from across the laboratory. The success of the January shutdown and the smooth recovery from the shutdown is a testament to the management job provided by this department.

One weakness in the department is the number of formal reviews that are held for significant jobs. There have been two occasions this year where errors caused mechanical rework to be needed to finish mechanical installation jobs. The Associate Head for Engineering has been working with the MSD Department Head to re-enforce the importance of these internal reviews and to establish a graded approach to the review process.

R.F. Department

The RF Department is responsible for the RF power generation for the Booster, Main Injector, and Tevatron accelerators. The coordination of particle transfers between machines is handled by the low

level RF group which is one of the groups in the RFD. The low level RF group must coordinate transfers with an accuracy of billionths of a second

The RF Department is charged with the design, construction and maintenance of the low level and high level systems. RFD is integrated into the Engineering Support Department as previously discussed. An increased effort is being made to bring young engineering talent into this critical department. It is the concern of the department head and all of those above him in the management chain, that there is a slow erosion of available talent. It is also true that the availability of high power RF engineers in industry and in schools has been slowly declining. A concentrated effort is being made to ensure the future of the RF Department and with it the future of the laboratory.

NuMI

The NuMI Department (Neutrinos at the Main Injector) is a department charged with the construction of the NuMI project. This department has Division Headquarters representation due to the size and impact of the project. The NuMI Department Head reports to the Division Head and is responsible for the continued advancement of the project leading to an "on time" turn on for the MINOS experiment. This department cross cuts numerous departments in the division and additionally must work with other division and sections at the laboratory. The NuMI Department has been in place for a number of years and has undergone a few changes in leadership to build a responsive and cohesive project office. NuMI is now in the installation phase and works closely with Beams Division management to coordinate their effort. Their current work requires the close cooperation with the Recycler Department to minimize interferences in the beamline enclosures during installation activities.

Coordination meetings are held routinely and reports are presented at a meeting that is held three times per week, which is attended by all Beams Division department management. The installation task manager for the project is the former Associate Division Head for Engineering and, as such, has a detailed knowledge of the accelerator complex and many of the people supporting it. The NuMI project has received enthusiastic support from the many reviews they have had and continue to have. It is clear they have their project well understood and look to be installed and running on schedule.

Accelerator Complex

The accelerator complex is comprised of five accelerators, and one storage ring, run by five departments. The Proton Source Department, responsible for the Linac and Booster accelerators. The Main Injector Department, responsible for the Main Injector, the replacement for the former Main Ring. The Recycler Department, responsible for the permanent magnet Recycler storage ring. The Tevatron Department, responsible for the Tevatron. The Antiproton Source Department is responsible for the generation and storage of the Antiprotons used in the Tevatron for the collider program.

These departments are collectively known as the Systems Departments and report to the Division Head through the Associate Division Head for Accelerator Systems. (see fig. 1.)

The financial and administrative processes are identical to the Engineering Support Departments. This two "wing" organizational approach has served well for a number of years and has been demonstrated to be effective.

The current fiscal year has seen the achievement of the luminosity goals set last year. The success of this program is clearly a demonstration of the abilities of these departments to overcome the unknown variables in science. The task is made even harder when one considers the two particles types reside in the same machine (Tevatron). The generation of high luminosity particle beams for the experiments has

uncovered the difficulties in operating a machine of this complexity in a region previously unexplored by any machine.

In order for the laboratories research goals to be met, the accelerator complex must perform at a high level. The coordination of beam generation, acceleration, and transfer must be synchronized across an accelerator complex that occupies several miles of real estate. This synchronization requires transfer timing measured in billionths of a second.

The Engineering Support Departments provide the hardware, software, and controls for the accelerators, the Systems Departments provide the physics understanding to improve the machines and to increase the ability to deliver high luminosity.

The Proton Source Department is charged with the generation and initial acceleration of the proton beams. A particularly difficult task is maintaining the RF systems for the Linac due to the decreasing availability of power tube manufacturers in the world. The Associate Division Head for Engineering and the Linac Department Head have been working with other laboratories that also rely on this power tube. The performance of the vendor has improved and alternate schemes are being investigated to ensure the ability to support the laboratories mission.

The Proton Source Department has set record levels of intensity from the Linac and the Booster in support of the Collider Run II program and the MiniBooNE experiment

The Main Injector has been built to replace the Main Ring and provide higher intensity protons for the production of anti-protons and to support the Fixed Target Experiments. The Main Injector has been successfully commissioned and has met or exceeded the performance goals set for it. The present activity in the Main Injector is the incorporation of new, novel, slip-stacking techniques that will allow even higher intensities of protons.

The Booster and Main Injector work in concert to provide protons to various users. The critical user for Run II is the Antiproton Source, which is charged with the responsibility of generating and providing a large number of antiprotons to the Tevatron for use in the collider program. The Antiproton Source Department maintains and improves the Pbar Accumulator and Debuncher used in the production of the antiprotons (Pbars). The Antiproton Source Department has broken a number of records this year, some of which date back to its construction during the Tevatron construction era approximately 17 years ago.

The Antiproton Source Department has met or exceeded all of its goals for this year and continues to support the Collider Run II program. Difficult physics hurdles continue to be understood and dealt with.

The Tevatron is the ultimate recipient of particles from the Main Injector and Antiproton Sources. This machine, now twenty years old, is the largest machine in the world and will remain so until the Large Hadron Collider comes on-line at CERN (projected for 2007).

Because Run II is pushing luminosity to ever increasing levels, the Tevatron has shown just how finicky it can be. The Tevatron Department is responsible for working with the Engineering Support Departments and other systems departments to optimize the delivered luminosity and ultimately to meet the mission goals set by the laboratory and the division.

The Operations Department becomes the focal point for all of the accelerators and the support departments. It is through Operations that the complex is scheduled for operations or maintenance, and all control and monitoring functions are provided. The Operations Main Control Room is staffed 24/7 year round. The MCR is the front line in operational responsibility and works through the Associate Division

Head for Accelerator Systems to set priorities to meet the physics goals. This department also provides many of the experts that eventually move into the Systems Departments.

In summary, the Beams Division has functioned well this fiscal year and has proven its ability to meet the goals established by the Laboratory Director and the Department of Energy. The Division had been under intense scrutiny from outside the laboratory due mostly to the new more realistic projections for integrated luminosity to be delivered for Run II. The Division was forced into a series of course corrections in an effort to recover from misquoted or misunderstood luminosity estimates. The Division's management team rose to the occasion and has the Run II program and the Beams Division performance on sound footing.

Technical Division

The Technical Division maintains a diverse work force that has a very wide range of core competencies. In support of R&D the Division has experts in the fields of engineering, fabrication, tooling, machining/welding, procurement, calibration, testing, operations, maintenance, QA/QC and systems integration. The Division also provides services in project management, project planning, resource management and scheduling. The Technical Division is heavily involved in the work of repairing and refurbishing existing devices, as well the design, fabrication and project management of a wide variety of next generation High Energy Physics (HEP) projects, including evolving particle accelerators, detectors, and astrophysics experiments.

Technical Division Mission Statement:

“The development, design, fabrication or procurement, and testing of accelerator and detector components.”

Division Structure:

The Technical Division is organized into projects and departments. Projects are organized by task and departments are organized by function. By in large, the departments interact through doing project related work. At present, the Technical Division has 233 employees.

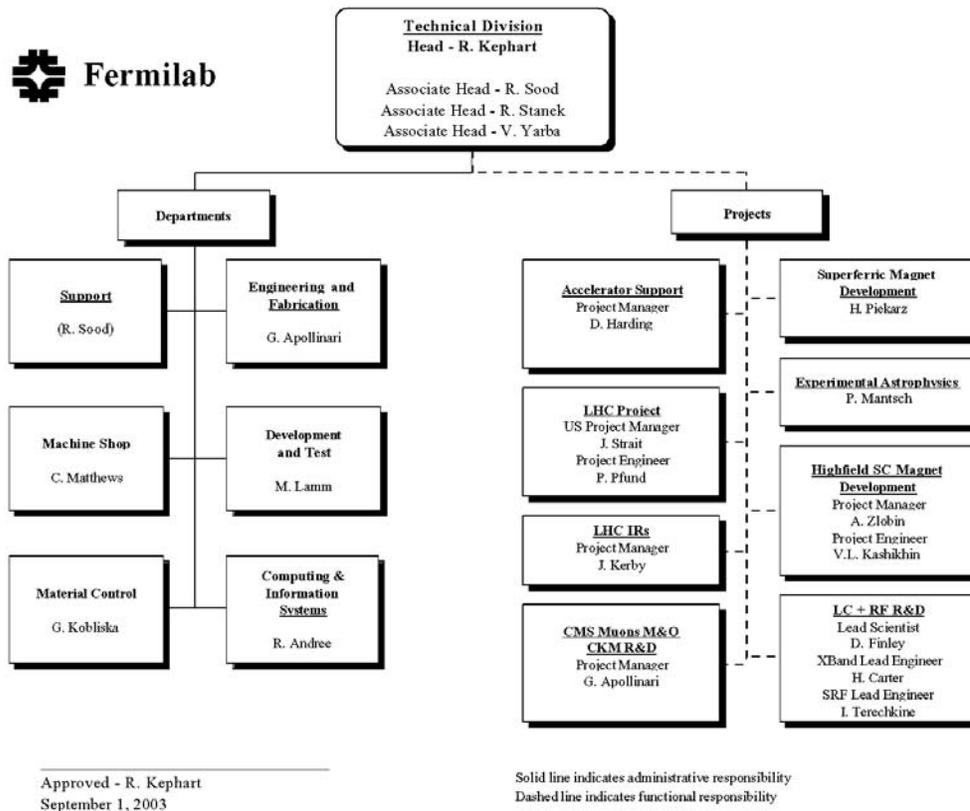


Figure 1 – Technical Division Organization

As can be seen in Figure 1, the Technical Division is organized into the following major projects:

- LHC Project (overall project management for US-LHC)
- LHC Interaction Region (IR quadrupoles design and fabrication)
- US-CMS
- CKM
- Linear Collider and Radio Frequency R&D
- Experimental Astrophysics (specifically the Pierre Auger project)
- Superferric Magnet Development
- High-field Superconducting Magnet Development
- Accelerator Support (this is the support function for the Beams Division)

As can be seen in Figure 1, the Technical Division is organized into the following departments:

- Headquarters (10 employees)
- Development & Test (54 employees)
- Engineering & Fabrication (92 employees)
- Computing and Information Systems (6 employees)
- Machine Shop (47 employees)
- Material Control (18 employees)
- Support (Facility Management and ES&H) (6 employees)

Like the Laboratory as a whole, the Technical Division departments are organized to either lead research (i.e. lead the projects) or support research. The Development & Test and Engineering & Fabrication departments primarily lead the research, and the other departments primarily support these efforts. It is also understood that the 'support' departments also conduct research on their own to support the projects. For example, the Material Control Department is instrumental in exploring developing the techniques used to fabricate the various components for the HEP projects through consultation with suppliers and manufacturers (e.g. the technique to fabricate and measure the disks for a room temperature linear collider requires developing state-of-the-art methods).

TD Headquarters:

The overall Quality Management Program is documented in Division Policy TD-2010¹. Quality is assured in TD is through the extensive use of peer reviews and through incorporating sound principles into the work processes at the department and group levels. Self-Assessments are also part of the overall quality and safety systems in the Technical Division. The Division's policies and practices for self-assessments are documented in Division Policy TD-2020². In addition, the Division has an "Operational Readiness Clearance Policy TD-1140"³. The purpose of this policy is to conduct an in-depth safety review of new and modified installations processes, equipment, and systems before commencing full operation.

Included in the self-assessment program are Division Head Assessments. These assessments are high-level reviews of each Department, with a focus on safety, quality, and programmatic issues. In FY03 Division Head Assessments were completed on the Development & Test, Material Control, Computing & Information Systems, and Support Departments.

¹ Policy can be found at <http://tdserver1.fnal.gov/hq/policies/TD-2010.pdf>

² Policy can be found at <http://tdserver1.fnal.gov/hq/policies/TD-2020.pdf>

³ Policy can be found at <http://tdserver1.fnal.gov/hq/policies/TD-1140.pdf>

During FY2002 14 quality self-assessments were completed, resulting in 32 improvement items. To date, 29 of these items have been addressed and are closed. The three open issues (two on the topic of records management and one on project management) require further investigation before closing them out.

During FY2003, four quality self-assessments were completed, resulting in 25 improvement items. To date, nine of these items have had changes effected and are closed. The 16 open issues require further investigation before closing them out.

Under the Operational Readiness Clearance (ORC) program, the Technical Division conducted two ORC reviews in FY2003.

1. Short Sample Facility in Industrial Center Building, December 16, 2002.
2. Test Stand B in Industrial Building 1, September 02, 2003.

The ORC Supporting documents are available from the Development & Test Department; those responsible for these systems.

Administrative Support, Finance, Human Resources, Procurement, and Travel aspects are managed under the Laboratory policies & procedures and those charged with direct responsibility. These programs are audited and reviewed throughout the year to check compliance.

The Cyber Security is managed in combination of Fermilab Computing Division and Technical Division CIS Department.

Fermilab ES&H Section Security Department is responsible controlling access to the Laboratory. The Technical Division Buildings are under Lock & Key during the off hours. The Security Department personnel routinely patrol and check building door locks to prevent unauthorized entry into the buildings.

The Fermilab Support Sections responsible for the Finance, Human Resources, Procurement, and Site Security are expected to provide relevant details information outlining the SA program.

Development and Test:

The mission of the Development and Test (D&T):

To lead research and development projects for the Division, particularly for superconducting magnets, prototype detector components and assemblies, and other advanced accelerator components. The D&T department also provides a wide range of performance testing services for conventional and cryogenic magnets and related devices, for both completed prototype and production devices.

Introduction

The TD/D&T department operates the Fermilab Magnet Test Facility, and is responsible for developing, testing performance, measuring and analyzing the properties of accelerator components, primarily magnets. The Magnet Test Facility (MTF) is over 20 years old, and progress continues on making widespread modernization and system upgrades that began in 1996, while conducting vigorous conventional and cryogenic magnet test programs. The D&T Department continually monitors and assesses the performance of the Magnet Test Facility and its cryogenic subsystems. Over the past year,

it has made improvements, which have produced greater quality assurance. Below are some key examples:

Facility Maintenance and Upgrades:

Helium Refrigerator

The cryogenic test program at MTF is heavily utilized, and now runs almost continuously for studies of Tevatron Magnets, production tests of LHC magnets, and development of High Field Magnets for future applications (including Tevatron and LHC). We focused on making improvements in areas that limit our operation and in improving efficiency of the operation in FY2003. Thus, we have increased the gas management Buffer Tank storage capacity, and procured new oil storage vessels to reduce maintenance down periods from water contamination in the oil.

Power Systems

Every test area in MTF utilizes Low Conductivity Water (LCW) for magnet power testing. The LCW infrastructure at MTF has not kept up with other power system modernization and improvements, and LCW availability is now a limiting resource for operations, and inadequate interlocks in some areas posed a safety concern. Thus we launched a focused effort to upgrade the LCW system in MTF with improved sensors, measurements of performance, and documentation. We plan additional improvements and modernization over the next year.

Some progress was also made in completing the power system upgrade from 20kA to 30kA for the VMTF power system; the final two (of 6) power supplies are commissioned and will be connected to the system during the next year. Also, an upgrade in one conventional test area power supply was made to extend the reach in achievable current and ramp rate for warm electromagnets. Finally, documentation and design work have begun to modernize the interlocks, controls, and switchyard of our Tevatron Test Stand Power System.

Instrumentation and Controls Systems

Our Instrumentation group continues to expand its use of Labview as a tool for special tests, calibrations, and test stand electrical checkout resulting in greater flexibility, ease of use, and faster turnaround and efficiency in conducting tests. Many in-house electronics developments are still required for special applications in MTF. This year we deployed new VME current distribution modules that provide precise noise free power supply current signals to remote scan and magnetic measurement system clients. We also completed specification and design, and began prototyping new VME Analog Quench Detection (AQD) module to replace the twenty-year-old devices that now serve as the critical element of magnet quench protection in MTF. Responding to the needs of magnet development community, we developed a new Capacitive Strain Gauge Readout System. We also refined the interface between the production and test organizations by putting into place new methods, materials, and procedures for magnet preparation and instrumentation checkout.

Networks and Computing Systems

The MTF computing systems are presently based upon Sun Microsystems Unix "host" computers which communicate with VME "data acquisition" computers. The Sun machines are approaching or exceeding their useful lifetime. A major effort is underway to migrate our products (especially database and online systems) to the Linux operating system running on Pentium platforms. The migration to a new operating system and new platforms is complicated by many security issues and by a shortage of MTF computer administration personnel. It is expected to continue for several years.

Magnetic Measurement Systems

Magnetic measurement systems must also migrate to new hardware and software. Older, difficult to maintain measurement systems are being converted to a newer, more flexible and extensible data acquisition system (EMS). Magnetic measurement is one of our core competencies. The needs of the Fermilab accelerators require that the systems be usable continuously during the upgrade. The migration is expected to continue for several years as computer systems and data archives are systematically upgraded.

This year in response to Collider Run II issues, a new magnetic measurements program was quickly brought into operation by adapting the “production” LHC harmonics measurement system to the Tevatron test stands. A “survey” of Tevatron magnets to characterize their behavior is in progress and will continue; Design of a dedicated “z-scan Drive System” to better understand magnetic details of these magnets is well advanced and construction will soon take place. Associated with studying Tevatron magnet behavior on fast time scales and providing feed back to the accelerator, significant progress was made in the development of a new magnetic measurement data acquisition system based upon a DSP computing engine. This system will be the heart of a new Tevatron “Reference Measurement System” in MTF, the design of which is approaching completion and construction will soon begin.

The MTF Conventional Magnet Measurement Area was, as always, a very busy area – with no sign of slowing down. Improvements to measurement capabilities there include the use of Labview for thermal tests, and the upgrade of one power supply system. The Single Stretched Wire (SSW) system for alignment and magnetic field measurements is in high demand. We are duplicating the data acquisition cart to meet these needs.

Cryogenic Test Stands

Early this fiscal year, we commissioned a new cryogenic test stand (Stand 3) for production LHC HTS Leads testing. Production testing is now routine, and 8 (of 20) pairs of leads have been qualified for installation in the LBNL-procured feedboxes for LHC.

Tevatron test stands are also heavily utilized. In recent years the demand for testing and requirements for resources in other areas (such as building/commissioning the LHC test stands) have meant deferring much needed Tevatron stand upgrades. This year we launched a focused documentation and design effort to upgrade the data acquisition and controls systems for the two Tevatron test stands. We will complete the upgrade to our “standard architecture” early in the next fiscal year.

Test Operations:

Conventional Magnet Measurements

We tested approximately 100 conventional magnets in FY2003 in support of experiment beamlines (MiniBooNE, NuMI, and E907) and the accelerator complex (Booster, p-bar Accumulator, Recycler, Tevatron, and transfer lines). Testing consisted mainly of magnetic measurements, but also a significant amount of thermal testing as well. A major upgrade this year was the installation of a 240 kW PEI power supply, which can be tapped up to 800 V, allowing us to do, e.g., high-current (100 A) studies of 3Q120 magnets. The conventional test stands were heavily used; a scan of the measurement database reveals that over 700 separate measurement activities (e.g., rotating coil, stretched wire, or Hall probe measurements) were performed and 26 new checklists (automated test procedures) developed in the past year. We managed to keep up with demand in spite of limited manpower.

Reference Magnet Calibration Facility

Many “customers” from around Fermilab for calibrations and tests use our Helmholtz coil magnet. Among them were researchers from CDF who used this facility extensively to understand mechanical resonance problems with their Silicon detector electronics.

Superconducting Magnets

Support of Run II and production LHC device testing top the list of cryogenic test priorities and activity in MTF. Approximately 50% of our cryogenic test time was spent studying Tevatron magnet issues, which included quench performance tests to qualify spares, but mostly studying issues associated with magnetic field behavior in Collider Run II, such as dynamic effects, field uniformity, change in harmonics over time, and alignment.

Production Testing of Fermilab produced LHC LQXB magnets is well underway; the first production magnet LQXB01 test was prolonged by the need to perform special studies on the first magnet, and to complete investigation of some problems achieving the high voltage (“Hi-pot”) requirement (which we solved). The second production magnet test was recently completed, and our work process is refined for efficient preparation and testing. Also well underway are production tests of LHC HTS Leads, with tests of 8 of 20 pairs completed.

When time and resources allow, R&D testing of Nb₃Sn High Field Model magnets continues. During this year, we conducted tests on three “mirror” magnets to study behavior of splices and superconductor (hfdm02, hfda03a, hfda03b), tested a third “racetrack” magnet (hfdb03), and tested the first common coil magnet design (hfdc01).

High Field Magnet Program:

The aim of this program is to develop high field magnet for future accelerator applications. Such magnets must be designed for high field, excellent field quality, manufacturability and low cost. The program is focused on building 10-12 T Nb₃Sn dipoles as well as high gradient large aperture Nb₃Sn Quadrupole for a future LHC IR upgrade. This program is studying all aspects of these technologically challenging magnets, from magnetic and mechanical design, strand and cable design and manufacturing procedures. As is often the case in cutting edge research, the project has encountered some unexpected challenges. While the problems of quench performance have not yet been solved, it has been the focus of considerable effort involving the talents and resources of other DOE research groups working in coordination with us. As shown in the “superconducting magnet testing” several magnets have been built and tested which in turn have lead to design improvements for future magnets designs.

Conductor (strand and cable) is an important driver in this program. Numerous strand tests have been performed in the Superconducting R&D laboratory (which is administered through this program), and have given important insight into the magnet development program.

Miscellaneous Developments:

Flying Wire Systems

The MTF Instrumentation and Controls group provided extensive support of design, assembly, and calibration activities associated with Flying Wire systems for both the Tevatron and Recycler.

SCRF

In addition to the major effort undertaken by the TD-E&F Department, the D&T, MTF Instrumentation and Controls group is contributing to the two R&D efforts on the CKM superconducting RF project: Fast Thermometry of the RF cavities in Superfluid Helium, and Fast Feed-Forward Microphonics Detuning Compensation.

LHC DFBX Feedboxes

Experienced Development & Test Engineering and Design staff provided assistance on the design and continues to provide oversight on the procurement of LBNL Feedboxes for the LHC interaction region magnet strings. Also, Instrumentation and Controls personnel are assembling and testing the Feedbox instrumentation and wiring harnesses for these feedboxes.

Engineering and Fabrication:

The mission of the Engineering and Fabrication department (EF):

To design, manufacture, and repair conventional iron and copper magnets, superconducting magnets, supporting hardware and tooling, detector components, and other related devices. The EF department also provides engineering, design, and technical services, which conform to appropriate safety and design standards, applicable state and national codes, and DOE contract requirements.

At present the projects being lead by the EF department include:

- All engineering & fabrication related projects in support of the Fermilab accelerator complex (i.e. Accelerator Support)
- Cathode-strip chambers design and fabrication for the End-cap Muon portion of US-CMS
- LHC IR quadrupole design and fabrication for US-LHC
- Conventional and superconducting versions of a next generation linear collider
- Next generation superconducting technology for both the second generation LHC IR quadrupoles and a possible Very Large Hadron Collider

Much of the focus for FY2003 was to improve our support of the accelerator complex. To this end we have defined and documented our methodology for managing accelerator support projects. In accord with our overall QA strategy, we use design and production readiness reviews to ensure that we are assuring quality in every way. During this past year the E&F department has conducted 31 design reviews and 28 production readiness reviews in support of the accelerator complex.

In addition to conducting these reviews, the department is also now reviewing active fabrication projects on a monthly basis. These reviews are done to compare actual time spent on a project with the estimates, as well as to update the estimates for remaining work. This methodology has been used by TD for large fabrication projects, but is new for tracking small projects. Over the last year we have seen improvements in our methodology, but acknowledge that there are still improvements to be made in assuring our estimates are consistently accurate and reliable. Figure 2 below shows the variations from baseline estimates on a monthly basis (the differences in June and July are in large part due to design and process changes on two larger projects, and a revised baseline will be completed early FY2004).

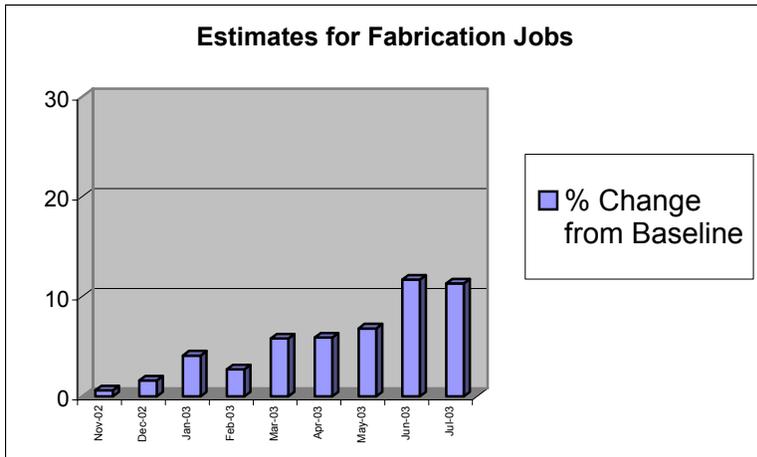


Figure 2

In addition to providing technicians, engineers and physicists in support of BD-led projects, the EF Department offered to manage various accelerator improvement projects during the recent extended shutdown. Specifically, TD managed the work of replacing Tevatron dipole stands, upgrading correction coil lead stacks on Tevatron spool boxes, and reshimming 106 of the 772 full-length Tevatron dipoles.

Tevatron magnet stand replacement

Over the 20 years in which the Tevatron has operated, many of the magnet stands have corroded causing the position of the magnets to change. This resulted in the need to replace stands while the magnets remained installed. BD procured the new stands, and developed the overall process for doing the replacements. The process involves jacking the magnets up just enough to remove the old stands and install the new ones, and using feeler gauges to ensure the magnet comes back to the same position after the stands were replaced. A critical component is that the magnets cannot be moved so far as to damage the interconnects with adjacent magnets. With the overall process defined, TD then, with BD assistance, refined the process and successfully replaced the stands on 52 dipoles.

Correction coil lead stack upgrades

Most Tevatron spool pieces contain, among other things, either one or two packages of three nested coils designed to provide correcting magnetic fields of various degrees and orientations. These three or six correctors have six or twelve leads that must be connected from the cryogenic temperatures inside to room temperature outside.

The original feed through design used a ceramic tube as the electrical insulator. The ceramic was brazed to a collar, which was in turn welded to the stainless steel vacuum box. Fairly soon after the Tevatron started operation it was discovered that the silver in the braze material was leaching out under the influence of the powering voltage, leaving a trail across the ceramic that caused a ground fault and leaving a void in the joint that allowed helium to escape.

When the source of the leaks and shorts was identified, all leads were cleaned and coated with red RTV to prevent the conduction that leached the silver. This has successfully stabilized the situation to the point that few failures now occur. There remains a danger that some seals have been weakened to the point that a helium pressure surge associated with a quench might cause a dramatic breach. The brittle ceramic remains vulnerable to mechanical damage. Repairs are difficult in the tunnel because the spool

must be brought to room temperature, and, as we know from extensive experience, there is a great risk of a blob of solder falling into a spool during a repair and causing a short.

To address all these problems, a new feedthrough design was developed which uses a Torlon® insulator sealed with compression fittings. The upgrade must be made at room temperature, but afterward an insulator can be replaced without soldering and with the magnet still cold, though the helium pressure must be lowered locally.

Prior to the recent shutdown, TD had performed in situ upgrades to 92 of the 208 installed spools. By the end of this recent shutdown another 26 spools will have been upgraded.

Tevatron dipole reshimming

The position of coils relative to their iron yokes has a direct impact on the magnetic field harmonics of each magnet. In dipole magnets, a change in the vertical position of the coil results in a change in the skew quadrupole harmonic. During the fabrication of the Tevatron dipoles each magnet was measured and custom 'shimmed' to minimize the skew quadrupole. In addition, Tevatron spool boxes contain coils that correct for skew quadrupole harmonics. Over the life of the Tevatron, it is believed that the operating current of these correction coils has continued to increase (i.e. when the machine was first turned on the skew quadrupole harmonic correction circuit required only a nominal current, whereas today the circuit requires substantial current).

In the spring of 2003 TD made "lift" measurements on a sample of installed dipoles. As indicators of coil position, these measurements were compared to the lift measurements recorded in the original fabrication records (i.e. "Travelers"). The conclusion was that the coils, on average, have dropped approximately 4 mils relative to their iron yolks (due to "creep" in G10 support pieces). This was a remarkable finding, as it accounted for the change in the skew quadrupole as seen by the BD. The "fix" for this was to reshim the magnets in the same fashion as was done during the original fabrication. The difficulty in this was the work needed to be done while the magnets remained installed in the tunnel.

The Technical Division took on the design and implementation of this project. A critical component of the project was the automated "lift" inspection data collection, and the extraction of all the legacy data from the original travelers. These data served as the quality control check for each magnet shimmed. The result was that TD successfully reshimmed 106 dipoles in the allotted time frame. This was a very difficult and high profile project, and its success is evidence that the quality systems in place in the Technical Division are effective.

Another service provided by the E&F department is the controlling of all fabrication records. Recently work began to automate this process, and this year that work has been completed. Through the use of an off-the-shelf document management system and relational database, documents (called production 'travelers') are now issued completely electronically. As a result, all related data is tracked and is highly reliable. These documents are also printed with bar codes, which are later used for automating the scanning and indexing of the records. Through the use of the new databases and bar codes, this process is now completely automated, thus greatly reducing the chance of error and notably improving data reliability. Figure 3 below shows the number of documents scanned and archived, as well as the number of documents issued to production by month (note the electronic issuing system went into production in March). In FY2003 there were 2823 documents scanned and indexed (totaling 62088 pages), and 916 travelers issued to production through the new system.

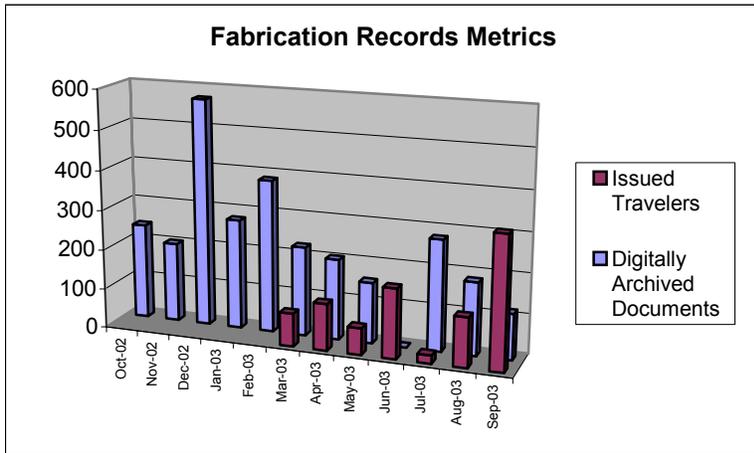


Figure 3

The E&F department has also completed major milestones in the US-LHC and US-CMS projects. During FY2003, the first LHC Q2 quadrupole was fabricated and successfully measured in the Magnet Test Facility. The quench performance was much better than anticipated, and CERN has recently signed off to receive the magnet. Also during FY2003, the Technical Division successfully completed the fabrication of the last cathode strip chamber for the US-CMS project. This project was completed on time, and within budget. Figure 4 shows the final production data.

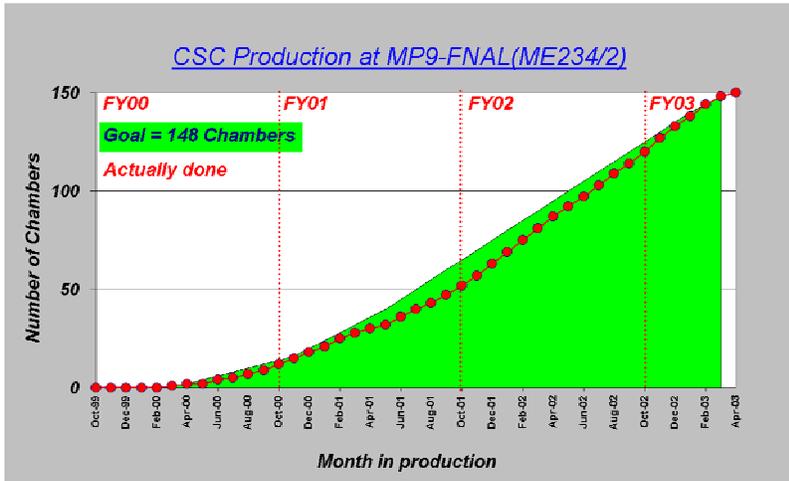


Figure 4

Computing and Information Systems:

The mission of the Computing and Information Systems department (CIS):

To provide support to the Division for computer needs and services. CIS is responsible for the set-up and ongoing maintenance for the information systems requirements of the Technical Division (which includes training of TD personnel), and works with the Computing Division as necessary to ensure compatibility with lab-wide systems. CIS is also responsible for the security of the TD network and servers.

In recent times, much of the CIS department resources have been spent on cyber security. Here is an example of a hacker attack and how the CD & TD-CIS responded to the challenge:

The worm that exploited the MS Windows OS vulnerability (RPC) affected a significant number of TD systems. The behavior of the worm was to infect a machine via the RPC hole and then execute a program to scan for other vulnerable systems. The majority of laboratory machines that were infected occurred within an extremely short period, less than 1 hour. Other machines, which were turned off due to vacation etc., became infected when they were powered up.

Two major factors contributed to the rapid spread of this exploit. One was the ineffective application, or complete absence of a patch, which fixed this vulnerability. The other was absence of up to date virus definitions. The patch prevents the infection and the anti-virus protection prevents the malicious program from executing. Ironically, the patch was pushed to almost all TD systems but a reboot was required to finish the installation. This was not understood when the patches were installed on the machines. The latency with the virus definitions was a matter of too much time between scheduled updates and a need for improved monitoring.

Many improvements have been implemented to mitigate these problems. The Laboratory's General Computers Security Coordinator has assumed the responsibility for data integrity on TD systems. These functions include firewalls, antivirus mechanisms, patch management and archival. The antivirus delivery system has been reconfigured to scan local machines regularly and make virus definition updates more frequent. The patch management tool has been used for subsequent patches deemed critical by FCIRT and the patch was installed on 95% of TD systems within 24 hours. Subsequent vulnerability scans of the laboratory networks showed that TD was the most successful in its patching effort.

Other notable accomplishments for FY2003 include a major upgrade to the legacy system "TDcharge." TDcharge is a program that allows gathering of effort report and charge back data from the individual groups within TD and then creates specific reports that are used by Fermilab Accounting and management in TD. The conversion of TDcharge from the Unix based Fortran program to the PC based MS Access program has not been merely a conversion but a major enhancement. There are many features found in the MS Access program that either did not exist or were difficult to use in the Fortran program. (1) Error checking has been added that enables 100% error free data to be created and compiled into reports sent to Accounting. (2) All reports have the ability to be exported to MS Excel directly making the creating of custom reports by management much easier and more error free than retyping the data. (3) The speed of the program operations is much faster with the MS access program. Reports that used to take hours to complete on the Fortran version now take only a few seconds. (4) A one button effort report and charge back summary can now be generated by our accounting personnel that requires very little manual manipulation before it can be directly reported to Fermilab Accounting. The new program allows for much less time to be spent by the TD Administrative Support to perform the data entry and final report preparation for not only Fermilab Accounting but also individual members inside the TD organization, allowing for more a efficient and streamlined operation.

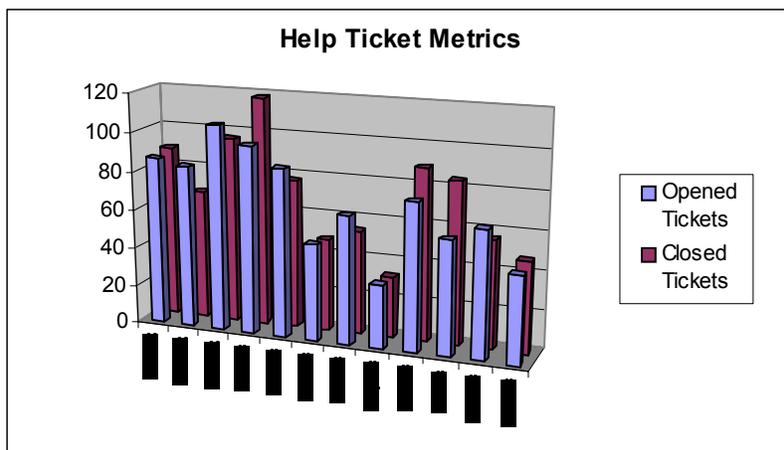


Figure 5

As a result of an employee satisfaction survey completed in the Division in 1999, the CIS Department implemented a help desk in 2000. Since then, the help desk has been used to keep track of the numerous help requests of the Division computer users. Figure 5 shows the number of help tickets issued and closed by month for FY2003. It should be noted that this data is not all-inclusive, as many help requests are “drop ins” and are fixed immediately without getting logged into the system. In FY2003 there were a total of 856 help tickets opened, and 856 help tickets closed.

Machine Shop:

The mission of the Machine Shop department (MS):

To provide prototyping R&D and precisely machined and welded items to the division, and to other organizations laboratory-wide, in conformance with customer specifications. The MS also provides machine tool repair services to the division and makes these services available to other laboratory organizations.

The Fermilab Machine Shops are comprised of one main shop (15 Machinists), one large satellite shop (7 Machinists) and five small satellite shops ranging from one to two Machinists in each shop. The Machine Shop Department also employs 10 Welders. The Machine Shop provides services to the entire Laboratory, and so the list of projects supported is too long to include in this report. Customers of the satellite shops are not tracked, but for the two large shops, for FY2003 64% of the jobs were for Beams Division, 25% were for Technical Division, 9% were for the Particle Physics Division, and 2% were miscellaneous.

One major accomplishment for the Machine Shop is the graduation of two Machinists from the 5-year apprentice program. In October 2003, two people (one male and one female) will graduate. Another major accomplishment is the design and development of a customer satisfaction survey. This new survey will be used to gauge satisfaction of Machine Shop customers after the jobs have been completed and delivered. At present the final changes are being made to the system (this will be an electronic system), and it will be rolled out in Q1 of FY2004.

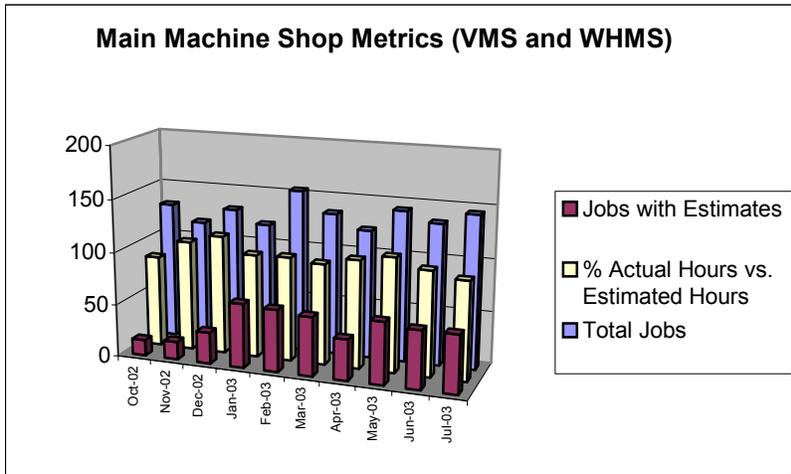


Figure 6

Beginning in September 2002, the Machine Shop started tracking user and job estimate data for the two main shops. This was done to better understand who is using the shops, and how the shops are doing when it comes to meeting job estimates. User data was presented earlier, and the job estimate data are presented in figure 6. Through July, there were 1330 jobs processed in the two large shops, 446 of which had estimates for how long they would take. For the jobs that were estimated, they were completed in an average of 99.7% of the estimated hours (i.e. on average, jobs are being completed within the estimated time).

Material Control:

The mission of the Material Control department (MC):

To procure, inspect, and store parts, tooling, and non-office supplies necessary for the operation of the division. The MC department also manages the warehousing of spare magnets and related devices. It provides metrology and QC services to the division and offers such services to other organizations of the laboratory. The MC department also provides expertise in developing processes for the fabrication of purchased components.

The Material Control Department supports every project within the Technical Division, as well as some projects outside of the Division. As a result, the list of projects supported in FY2003 is too numerous to list here.

The Department is organized into three functions: Acquisition (5 employees), Inspection (5 employees) and Magnet & Component Storage (5 employees). Figure 7 below shows the number of orders placed and inspected, by month, for FY2003. In all of FY2003, the Material Control Department placed 2488 orders, and inspected 1703 orders. Of the 2488 orders placed, 66% were placed using ProCards, 26% were placed using the Materials Management System, and 8% went through the Machine Shop Department.

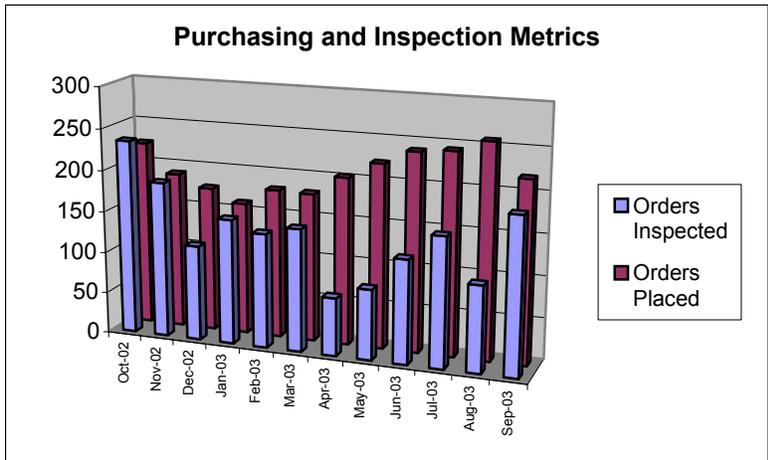


Figure 7

During FY2003 there were several accomplishments that stand out. In addition to the core service we provide to the Division and the Laboratory in general, here are examples of some of the FY 2003 accomplishments:

We completed our changeover to a new operating system for our Coordinate Measuring Machines (CMMs) that are called PcDmis. All of our QC Inspectors have been trained in its use and this has improved the overall efficiency of the Inspection group.

Our Laser Tracker became operational during the Fiscal Year and several of our technicians have received training on its use. Because of this we can now do some of the things, which normally would have been done by the Alignment group, and we are keeping MTF going while Alignment is working in the tunnel.

We have also written a specification and identified an ultra high accuracy coordinate measuring machine (CMM), which would be used to support R+D at the Laboratory.

Last but not least, we continued to extend our outstanding record of not having a lost work time accident for over 8 years (3,042 days).

Support:

The mission of the Support department:

The Support department provides the necessary resources to support the division with Environment, Safety, and Health services, as well as Facilities Management.

Environment Safety & Health (ES&H) Group:

Major Systems Implemented

The Technical Division implemented a full-scale paper and cardboard recycling program during FY2003. Prior to this TD had a recycling program limited in scope and in the buildings covered by the program. The program consist of the following key elements:

- All TD occupied buildings are included in the program.

- Small recycling bins were purchased and distributed to employees.
- Larger collection containers (23 and 60 gallon) were purchased and placed at central collection points on each floor of occupied TD buildings.
- Cardboard dumpsters have been placed in strategic locations around occupied buildings.
- Personnel from the Material Control Department empty the central collection containers as needed.
- An electric mechanical dumping device was purchased to empty the large 60 gallon collection containers into the large recycling dumpster.

Major Accomplishments

(1) Milestones reached by TD departments for number of years worked since the last time an employee suffered a DART (days away, restricted or transferred) injury:

- Material Control Department: 8 years
- Computing & Information Services: 6 years
- Development & Test: 1 year
- Support Department: has not had a DART injury since its inception on 1/1/97
- Engineering & Fabrication: 340 days

(2) The injury statistics for FY 2003 have been greatly reduced in comparison to the injury statistics for FY 2002. Refer to the table below:

	FY 03	FY 02
LWCR	0.99	1.86
TRCR	1.99	5.12
Cost Index	17.14	3.06

LWCR = Lost Workday Case Rate
 TRCR = Total Recordable Case Rate
 Cost Index = cents lost / hour worked

Statistics / Data

1. The number of inspections and walk through audits are summarized in the table below:

Inspections By HQ*	Inspections By Dept. Heads*	ES&H Group Walk Through Audits*	OSHA SAP Inspections*
9	64	32	38

*An inspection/walk through audit may encompass multiple buildings.

2. The activity in ESHTRK, which is used by TD to track its inspections and walk through audits and the findings resulting from them, for FY2003 is as follows:

- 29 findings open as of 10/1/02
- 202 findings opened
- 227 findings closed
- 4 open findings as of 9/30/03

Tripartite Self-Assessment Program

The Department of Energy, Fermi Area Office, Fermilab ES&H Section, and Technical Division as a host participated and conducted a Tripartite Assessment of "Safe Use and Operation of Forklifts at Fermilab" in May & June of 2003. The Technical Division was found to be in full compliance with the Fermilab ES&H Manual (FESHM) Chapter 5023, and all other OSHA and ASME applicable codes. The Tripartite Assessment of Safe Use and Operation of Forklifts Report⁴ dated June 11, 2003, is available for reference.

Facilities Management Group:

The Facilities Management Group is responsible for maintaining the structural integrities of the Technical Division building complex, which consists of 38 buildings and structures. All small infrastructure improvements & construction projects are planned, coordinated, and executed by this Group in accordance to the Laboratory construction policy and the applicable codes.

The Department Of Energy, Fermi Area Office, ES&H Section, and the Fermilab Divisions and Sections representatives conducted a Tripartite Assessment of Construction Safety at the end of FY 2002. The Technical Division construction projects were also reviewed, and all aspects of the construction safety in the division were determined to be in order and in full compliance. The Tripartite Assessment of Construction Safety Report⁵ dated September 7, 2002 is available for reference.

⁴ Report can be found at http://www-esh.fnal.gov:8001/TSA/TD_Forklifts.pdf

⁵ Report can be found at http://www-esh.fnal.gov:8001/TSA/Const_Safety_02.pdf

Computing Division

Mission

“The Computing Division’s mission is to play a full part in the mission of the laboratory and in particular to proudly develop, innovate, and support excellent and forefront computing solutions and services, recognizing the essential role of cooperation and respect in all interactions between ourselves and with the people and organizations that we work with and serve.”

Direct support of experiments

The mission of the CDF and D0 departments is to provide extensive computing support for the two Run II experiments, CDF and D0. Each department includes scientific staff, computer professionals and system administrators to support this mission. The departments have responsibility for the administration and operation of experiment specific hardware such as the analysis clusters, server machines and desktops. Software applications are also produced in these groups and include: database applications, experiment specific data handling, and the GRID tool known as Sequential Access via Metadata (SAM). In addition, members of the departments participate in configuration management issues, experiment user support and in doing production farm processing. The scientific staff contribute to the above activities as well as participating in the scientific life of the experiment by contributing to physics analysis working groups and presenting results at international conferences. The activities of the Run II computing projects was recently evaluated by a FNAL Director’s review, and the preliminary close-out found both groups to be very effective in meeting the mission need.

In addition to the direct support through the CDF and D0 departments, the Computing Division also supports the Run II experiment from other departments. The central farms are operated and administered by a highly capable group, and that group also conducts the evaluation of vendors. Database application support and database design, with an emphasis on Oracle, is provided by the division, and are essential services for the experiments. The CD also provides storage services, with development, integration, evaluation and operation services provided. In the close out of the recent director’s review, the storage systems dCache and enstore were called out for special congratulations. Network design and installation services are also provided, with high operational efficiency. The FNAL CD also is responsible for computer security for the laboratory, and those policies and decisions affect the Run II experiments. Both experiments rely on central services such as the operators and helpdesk facility and the equipment pool. The high-level Run II support goals and assessments follow below.

Goal: Directly support experiments by running central services and systems.

Assessment: The CDF and D0 Departments are highly effective in running the experiment specific analysis systems. Within the rest of the computing division, approximately 15 FTE support is supplied to each experiment. That effort is used to supply common services such computing farms, robotic storage, networks, facilities support and customer services. The quality and level of the support is generally very good, and several of the groups supply excellent service.

Goal: Explore commonalities between CDF and D0 to leverage resources and stay in close contact with user requirements.

Assessment:

There have been several successful joint projects between the experiments and the CD. These include SAM, Enstore and dCache, and the ZOOM class library and support for software infrastructure for products such as ROOT, C++ compilers, debuggers and development tools. In the coming year we do need to improve the rate of integration of the SAM project between CDF and D0. Next year the CD will also explore ways of combining hardware support as well.

Goal: Oversee the needs assessment and planning for computing resources for the two experiments.

Assessment

The CD implements Directorate reviews of Run II computing at which CDF and D0 are required to submit budget plans for the next year with supporting needs-based documentation. The preparation for and feedback from the review has been quite beneficial to the experiments and the laboratory.

Goal: The Computing Division will contribute to electronics design, development, and testing projects for both experiments.

Assessment:

This support effort has been excellent, with contributions to the trigger and luminosity systems for D0 and to the silicon systems for CDF and D0. These projects are often undertaken to support university groups, and usually involve time pressure as both experiments are in data collection mode.

Collaboration with the BEAMS Division:

About a year ago the Directorate charged the Computing Division to expand its mission to more directly aid the Beams Division (BD) to improve delivered Run II luminosity. This additional mission is supported primarily through the "CEPA" department in the Computing Division. Further support is provided from the CCF and CSS departments. Although CEPA predominantly serves the experimental program, expertise in accelerator physics (through SIDAC initiatives), analysis tools, and instrumentation are directly applicable to the Run II luminosity challenge. The high-level goals and assessment of this mission are listed below.

Goal: Analysis of Accelerator Complex Performance.

Assessment:

The Shot Data Analysis (<http://www-bd.fnal.gov/sda/>) project consists of a set of Java-based analysis tools for store analysis. Data from the Sequenced Data Acquisition system as well as from the periodic data sets can be analyzed. For instance, we showed that the antiproton beam lifetime at 150 GeV in the Tevatron was not only affected by beam-beam effects but also by the somewhat restricted dynamical aperture of this large and complex synchrotron. Such conclusions have been reached after numerous analyses, discussions with our colleagues from Accelerator Integration Dept (BD) and from the Tevatron group, and on-going computer simulation done at Fermilab and Berkeley. Members of the CCF-CD Dept also joined this analysis effort. The SDA system comprises the automatic generation of various summary tables, easy to use data browser and an API for more in-depths analysis of the data from various instruments (Current Wall Monitors, Flying Wires, Beam Position Monitors, Synchrotron Light Detectors, etc.).

We wrote a prototype-fitting package for a fully automated Tevatron Betatron Tune Meter. For a beam of relatively small longitudinal emittance the system is able to automatically report betatron tune values to a fraction of one Hz. This tune fitter is partly based on fitting tools developed in HEP. Its current implementation is based on the ROOT software. For more details, see (<http://www-bd.fnal.gov/tevtune>). This new instrument has recently been used to provide accurate and automated measurement of the chromaticity and of the beta

function at selected locations. As usual, this work has been done in close collaboration with the Beams Division staff. We plan to rebuild the system to provide enhanced maintenance and better performance.

We designed, developed and deployed a snapshot monitor for aiding in monitoring and diagnosing the state of the Booster Accelerator. The tool is working well and is currently in use. While developed specifically for the Booster, this tool was designed from the beginning with the idea it could be useful in other accelerators throughout the laboratory. These analysis tools were effectively used to advance the understanding of the Accelerator Complex.

Goal: Modeling of the Accelerator complex:

Assessment:

CEPA staff that are members of the SciDAC funded Advanced Accelerator Modeling team, have worked on developing Synergia, a 3D parallel code suite for beam dynamics simulations. These tools were used to model the FNAL Booster, with the objective to understand Booster losses and study approaches to minimize them. Both the DOE and Fermilab management have recognized this work as essential for the success of the FNAL program. During the last year development of the space-charge code needed to model collective beam effects early in the Booster cycle was completed. Experiments at the Booster to compare these models with data were performed. In the process of making these measurements, we developed and implemented calibration technique for the Booster's Ionization Profile Monitor. Our results were presented at the ICAP and PAC conferences; we have submitted a paper at PRSTAB. Overall, our effort was successful both in developing and in applying our simulation tools to the Booster. We also ported our code to both commodity PC clusters and specialized parallel machines in addition to developing a build system and web based documentation, thus providing the infrastructure for a broader use of our tools. This suite of modeling tools made important contributions to the understanding of the accelerator complex.

Goal: Automation and Upgrade of Measurement and Control Systems:

Assessment:

We also participated in an investigation of the BD Vax Migration effort and evaluation of the related new Java Based Data Acquisition subsystem. For instance, we wrote a small D.A. application targeted for specific Tevatron studies, where the experiment results can be cleanly expressed as a set of tables of actuators values and corresponding beam property measurements. This work is solely based on this new Java-based D.A. In the course of developing the SDA system, the Tune Fitter and other applications, the performance of the new D.A. has been studied. We have had valuable discussions with members of the Controls Dept on possible improvements.

We wrote a data acquisition system for the Flying Wire instrument for the Recycler. However, as we made good progress on this LabView based software, we learned that the first installation of the instrument hardware in the recycler during the January shutdown failed because of vacuum problems. Final resolution of this problem, via a thorough vacuum certification process, is still pending. Unfortunately, these setbacks have cast a shadow on the ultimate usefulness of this work. It is hoped that this work will serve as a base for an update to other flying wire installations in the other machines.

This year (FY2003) the Beam Position Monitor system for the Recycler Ring was installed and commissioned. The CEPA and CSS departments played a major role in the design through commissioning phases of the project, and particularly the calibration system. This project was successfully executed in FY2003.

Late in FY2003 the Computing Division took on the major challenge of leading the effort to upgrade the Tevatron Beam Position Monitor system. External reviews have noted this upgrade as critical to future success of the Tevatron. The resources to realize this system primarily reside in the CEPA department, with important contributions throughout the Division. Work in FY2003 focused on generating detailed requirements. Progress on this project in FY2003 was adequate. In summary good progress has been made in advancing the instrumentation of the accelerator complex, with the exception of the flying-wire readout system that has yet to be deployed. Once the detector issues are resolved in FY2004 the flying-wire readout system will then be implemented.

LHC support – CMS

The CMS department of the Computing Division is central to support for the US-CMS Software and Computing Project. The department is involved with all aspects of computing from the deployment of basic hardware components and system services, to the integration of those facilities into a grid-enabled distributed computing infrastructure, and finally to developing the applications that run in the environment. The activities of the department can be divided into four equally important activities: developing CMS core software, providing computing resources to US and international CMS, developing computing infrastructure and supporting the US Tier-2 centers, and developing and supporting analysis activities for physics. We will briefly describe this year's progress and challenges in each of them.

Goal: Contribute to the development of CMS core software

Assessment:

Fermilab has made a significant contribution to the development of CMS core software, due mainly to the quality of the people hired. This year a Fermilab developer was responsible for changing persistency mechanisms used by the CMS core software framework, COBRA. This was one of the most important software tasks of the year. It is also central to the operations of international CMS and relies heavily on packages developed at CERN. Fermilab developers were also responsible for developing the tools that provide binary distribution of CMS software for all simulated event production and the development of the tools used to specify and submit production jobs at all processing sites. Despite the geographic separation, Fermilab-based software developers have remained well integrated in the software development effort. US CMS has a funded but unfilled software engineering position at Fermilab. This position needs to be filled or a new person hired as soon as possible. There are several important, high profile tasks that US CMS would be capable of performing, if the position were filled. CMS has a need for software development to modify the CMS core software to perform more efficiently in a grid environment, including application level monitoring, resource prediction, and check pointing. Additionally, CMS needs to develop expertise to interface the CMS metadata to developing distributed analysis environments. These tasks are a natural fit to Fermilab due to our existing activities in core framework and production and knowledge systems.

Goal: Provide computing resources to the CMS collaboration

Assessment:

The second responsibility of the CMS department is to meet US CMS obligations to the experiment by providing computing resources. Those expectations are generally met. We performed a large procurement of processors, storage devices, and network switches this year to bring the Tier1 facility in line with CMS expectations for computing this year. In an ideal world we would have had the resources commissioned before the start of simulated event production, which began in August. However, due to new personnel coming up to speed and the length of the procurement process we expect systems on the floor by October. The new procurements significantly increase the number of systems to be managed. The Rocks configuration management software, which was deployed last fall, helps with operations, but does not

eliminate the need for operational support. We have been operating with 1.5FTE of operations support, but this has been a struggle. With the additional systems we estimate we need 2 FTE for operations this year.

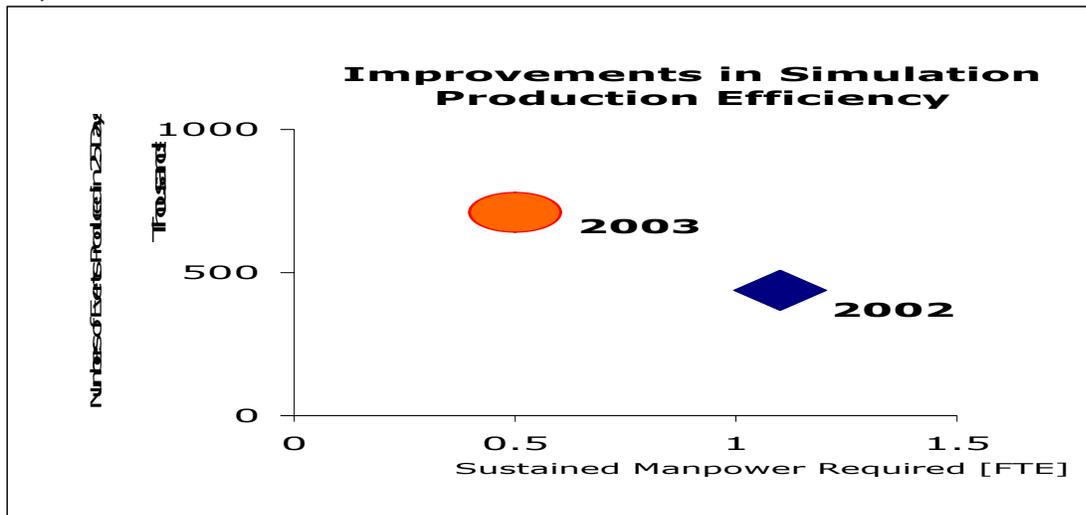
	2002	2003
CPU	75	200
Storage	10 TB	34 TB
Throughput	200 MB/s	700 MB/s

Goal: Develop the grid computing infrastructure necessary for support of Tier 2 centers in the US working with the Tier 1 center at Fermilab

Assessment:

The grid computing infrastructure development has progressed well. We have deployed a basic grid enabled system for generating simulated production at the prototype Tier 1 and Tier 2 centers. We have reduced the effort required to run production. We have a project to extend the functionality of the system to manage Virtual Organizations (VO) on the grid, and we are deploying a multi-VO environment called Grid2003 in coordination with US ATLAS, SDSS, and LIGO.

While there has been interesting progress, it is difficult to maintain with the current manpower. Again, the US CMS project has budgeted additional positions, which have not been realized so far. The need to succeed with Grid2003 has introduced a number of external constraints, which are further stressing the available people.



Goal: Develop and support analysis capabilities in the U.S.

Assessment:

We are providing and developing services to facilitate analysis. The current farm and storage capacity are small, but improving with new procurements. The number of active users is also small. We've been working to determine if there are not a lot of analysis users currently working in CMS, if we haven't advertised sufficiently, or if we are not providing attractive services.

We believe that our analysis facilities are becoming rather advanced. The interface to mass storage over dCache is transparent and works well with the CMS core software; there is good user access to temporary storage and the new procurements will provide large, reliably, and long lived user space; and there is sufficient user processing capacity including access to (legacy) Objectivity data. Until recently the CMS software releases were difficult to keep synchronized with CERN, due to the frequency of releases. A technique was recently employed to allow the CERN distributions to be visible and usable at the Tier 1 over afs. This should improve the situation considerably by giving transparent access to all releases and pre-releases as soon as they are published at CERN.

We were not able to provide test beam users with the level of service we had hoped this summer. Some of the test beam computing requirements were small and could be satisfied with local desktop support, leading users not to make requests for central support. Also, we did not have sufficient effort to provide all the services we were interested in. These small time critical analysis activities, like test beams, should be a very good test of our analysis services. We hope to have more success in the future. We expect the number of analysis users will increase significantly as the physics groups prepare for the technical design report. In order to offer reasonable services the CMS group is going to need to devote more effort to user analysis. While this is one of the primary goals of the CMS Tier 1, it will further stress our available people.

Astrophysics support

The mission of the Experimental Astrophysics Group within the Computing Division participates in particle astrophysics experiments that require a significant computing capability. Currently the group works on E885 (Sloan Digital Sky Survey), which is entering its 4th year out of a planned 5 years of operation. The experimental facilities are located at the Apache Point Observatory (APO) in New Mexico, while data processing is all done at Fermilab.

Goal: Continue to support the data acquisition system, software development, survey planning, data processing, and data distribution to the SDSS collaboration and to the public at large

Assessment:

The group receives some support from CCF for assistance with the data acquisition system and from CSS for system support of computing machines located in FCC. Other institutions in the SDSS collaboration provide much of the data analysis software. Data processing and handling make extensive use of the fixed target farms and the Enstore tape storage systems. Certain aspects of data processing are time critical because of the need to support operations at APO; in particular, imaging data must sometimes be processed and used to design "plug plates" on a month time-scale.

The data acquisition system is in a maintenance mode, with only occasional bug fixes and small feature enhancements being provided. The system is old and not entirely reliable, but at the moment it is not a major source of lost time. Concerns remain for the longer term future, however.

The essential aspects of data processing are working well. The median time to turn around imaging data has been reduced from 20 days a year ago to about 5 days this year. Other smaller datasets are also being

turned around well within the needed timescale of the experiment. These gains have been achieved by making processing highest priority, by focusing on improving the data processing infrastructure, and by benefiting from a "Moore's law" increase in processing power, disk storage capacity, and network speed. A complete reprocessing of all data has recently been completed as well. The areas of quality assurance diagnostics and regression testing of software code are less satisfactory since their development has had lower priority. These are expected to be addressed in the coming year.

With the advent of inexpensive terabyte-sized file servers and the maturing of the Enstore tape robot systems, data management has become much easier. All processed data, including an average of two reprocessings, are kept online and are available to the collaboration. Raw data tapes are copied into the tape robot as they are delivered from APO and are also available to the collaboration with a bit of effort. Older raw data tapes from early in the experiment are not yet in the robot, and accessing them is difficult, although they are seldom used.

Data distribution has two components: flat files and a database. The database (called the Catalog Archive Server [CAS]) contains object catalogs that are also available in the flat files but organized for efficient queries. To first order data distribution is successful: all files are available to the collaboration, and subsets of the files are available via web and rsync interfaces to the public. (It should be noted that unlike particle physics data, astronomical data have utility and legacy value to the astronomical community at large.) There is a web interface with good documentation. The CAS has been a mixed success. It is being developed by another SDSS institution and has suffered from feature creep and a switch in database technology. At present there is a CAS version that contains the subset of data catalogs that have been released to the public, but not the full processed data. In fact, for the most recent public data release, an independent CAS with limited features was developed at Fermilab to provide backend support for the public data web site. To improve the situation, a more formal project management approach is being used to monitor the database development and deployment at Fermilab.

Future experiments support

This area covers the computing support for the Fermilab experiments other than CDF, D0, CMS and SDSS. There are currently four projects in this category, MINOS, MiniBOONE, BTeV and CKM. These four experiments are supported out of the Experimental Support Department.

Goal: Provide support for computing of the MINOS experiment

Assessment:

The construction of the MINOS Far Detector at Soudan, Minnesota was completed in June 2003 and the magnet was energized on the second supermodule. The experiment is now taking physics quality data with the Far Detector and data analysis of cosmic ray data from is underway. MINOS is using the central computing resources at Fermilab, namely the STKEN tape robot, STKEN DCache, FNALU/AFS cluster and the "Fixed Target" production farm. The CSS and CCF departments provide support of these facilities and they have responded promptly to the experiment's requests over the last year. The department provides direct support for MINOS computing with one scientist and three computing professionals. They are responsible for user consulting, some of the offline software development, data handling, Control Room Logbook support, Linux support and equipment purchases to name a few. There were some personnel changes in this group in the last year, which have resulted in a better distribution of the necessary skills needed for MINOS support. One of the main focuses of MINOS support in the next year will be design, procurement and deployment of an analysis system and deployment of the SAM (Sequential Access with Metadata) data handling system in use at CDF and D0.

Goal: Participate in and provide support for the MiniBooNE experiment.

Assessment:

The MiniBooNE experiment has one scientist in the department. They are using some of the central facilities, namely the STKEN tape robot and AFS but also have their own Linux cluster that is supported by the experiment.

Goal: Provide support for research and development activities aimed at preparing the proposal for the BTeV experiment for external review.

Assessment:

The direct support for BTeV computing consists of one scientist and one computing professional. This is currently a fairly modest effort that will clearly need to ramp up significantly once the experiment is approved. The group has been working on various projects included the design of the interface between the offline software and the Real Time Embedded Systems (RTES) project with members of the CEPA department, which will control the trigger/offline farm on which the offline software will run. The reuse of the trigger farm for offline processing is a novel feature of BTeV. They have worked on Tutorials to educate BTeV physicists on the use of the software suite and to smooth the transition to C++ for those who have yet to make it. The group has also been supporting the test beam effort for the EM calorimeter at Protvino.

Goal: Provide a small amount of support for activities related to potential future experiments at Fermilab, such as CKM and Off-axis neutrino experiments.

Assessment:

Only has one scientist in the department. Like BTeV support needs will ramp up if the experiment is approved. They are also making use of the STKEN tape robot. They also are working on development of the packaging of the TDCs and ADCs on PCI cards in conjunction with the CEPA department.

Computing and Engineering for Physics Applications

The Computing and Engineering for Physics Application (CEPA) department has a diverse mission and has been charged to create and support core components for physics applications. These components can be software, both online and offline, or hardware (electronics). We serve the experiments and have been recently to work with the Beams Division.

This assessment document is divided into parts that align with the sections inside the department. At the end there is an assessment of several activities that cross the boundaries including the work with the Beams Division and the work on Outreach.

Engineering and Engineering Support

Goal: Support ongoing HEP experiments by providing diagnostic, repair, and upgrade support. Recently the section has been called on to design and produce instrumentation for the Tevatron and the Recycler.

Assessment

The group has provided supported for a large number of projects this year including the following:

- At CDF: Silicon Vertex Detector DAQ and CDF DAQ Event Builder system. The experiment is efficiently collecting data and the hardware is operating reliably.
- At D0: Trigger Distribution and Serial Control System, Central Fiber Tracker (CFT) Mixer system, VRB Controller module, and Level 2 Trigger Alpha and Beta processors. The experiment is collecting data and the above hardware is operating reliably with the exception of the VRBC. The VRBC has been orphaned by the previous designer and lacks the documentation that would facilitate problem diagnosis.
- At the Fixed Target lines: E907 engineering consultation and the BTeV pixel tests at the Meson Test Beam Facility. For the BTeV effort the hardware is tested and awaiting beam.

It was overall a successful and productive year. Support for the Run II experiments was a primary focus. However, there were a few setbacks year. Two engineers from the group moved to positions elsewhere and it has not yet been possible to replace them. The number of projects has not decreased, and the rest of the group has responded well to fill in the gaps.

The ESE section contributed to several upgrades projects at the collider experiments and the Accelerator complex including CDF DAQ, D0 L2 trigger, D0 L1 Luminosity firmware and the Recycler and Tevatron Beam Position Monitor (BPM) upgrades. Most of these projects are still active and making acceptable progress. The hardware for Recycler BPM project was completed and installed this summer and is being tested as the accelerator schedule permits. The work for this project was completed on schedule. The Tevatron BPM project is just getting started and involves collaboration with Beams division that is going well.

Applied Physics Software

Goal: To develop and support a body of common HEP library software, including ZOOM and CLHEP; to assist Run II and other experiments with offline software development and to support the experiments in the areas of database and information systems related software.

Assessment:

We have developed a strong team of experienced C++ experts in the Software Library Development (SLD) whose expertise is in high demand at the experiments. They are responsible for a body of library software, including ZOOM and CLHEP. While this was originally as a responsibility to Run II, we are presently moving the focus substantially toward making this software more valuable to other HEP users such as CMS as well. We are in the completion stage of a repackaging aimed at the world of scientists who choose not to depend on SRT. Because this inherently requires satisfying a global spectrum of preferences, we found this task technically challenging with no single "best" solution; we have succeeded in evolving technically a sound solution that meets all the vital criteria. Related to this is the job of providing C++ expertise, advice, and focus for FNAL developers. A very important component of that is our participation in the J16 C++ Standards committee, which is beginning to pay off for the entire HEP community. We have not only introduced improvements which will be important to the scientific community, but also have reversed a trend of the C++ committee de-emphasizing the needs of the scientific community. The reason for this success is the hard work and high motivation of two FNAL representatives.

Goal: Develop and support database and information systems related software.

Assessment:

The use of databases is expanding at the laboratory and the group could use at least one more database design expert to keep up with the growing demands.

Database applications include many aspects of data management calibration, trigger, luminosity, and configuration database development and support. The tasks include building and maintaining middle tier servers including those for SAM and general-purpose read-only database information. SAM is the data management system being employed for D0 and CDF or Run II. The group has several additional responsibilities in the SAM project, in particular dealing with the user interfaces and some operational aspects. The degree of success of SAM support is indicated by the fact that CDF has committed to use this software and the group has made modifications needed to satisfy CDF's requirements.

In addition the group works closely with the experiments to provide documentation and code for client applications that use the database information. Work has largely centered on Oracle applications, but the goal is to provide general interfaces that allow for multiple commercial and freeware database solutions as well. The group also provides a monitoring framework and tools that allow the database delivery systems to be alarmed, monitored for performance, and diagnosed for problems. This set of tools came about because of realization by several people across the whole section that multiple efforts to improve monitoring could benefit from a reasoned, coherent shared effort. The monitoring tools came to fruition in less than a year, and are paying dividends. For example, there is now daily identification of each experiment's most heavy users; by working with them to reduce inefficiencies, we have brought database crises under control.

Recently, the group has been helping to review parameter databases being used in the beams division to track magnet and other information for Tevatron operation. This appears to be a project that will continue for the next several weeks and we hope will play an important role in improving the operation of the accelerator. We are currently making recommendations concerning moving some of their existing data to a new, more maintainable database, unifying into one modern database product such as SYbase, PostgreSQL, or Oracle. This database would be prepared for the influx of new survey data starting in mid-fall.

Physics Simulation and Modeling

Goal: To support the experiments, the accelerator and the theory group by providing support for tools used in the simulation of physics events, in the simulation of detector effects, for the simulation of beams effects and for calculations on the lattice.

Assessment:

This group is not large, but is able to successfully make contributions in a wide range of activities. The group would be stronger given more resources. The group acquired additional expertise on the use of the Geant4 simulation package through work on. Developing a full Geant4/OSCAR simulation of the CMS hadronic calorimeter test-beam experiment. As one of the main contributors to the Geant4/OSCAR validation effort, the group was able to make an importance contribution both to the CMS physics analysis and to the Geant4 development and make the Geant4 library available to the FNAL users. In addition, work continued to maintain the Geant4 based beam simulation tools developed by our group for Ionization Cooling Modeling. This support allowed the MICE and MUCOOL collaborations to continue their design work using our tools.

The group is responsible for maintaining and testing the physics generators and related utilities needed for collider physics analysis, for Run II and beyond. The expertise provided by the group is a valuable asset to the experiments and helps to ensure the fidelity of the Run II physics simulations.

A series of meetings with the experiments were organized and as a result a database of "blessed" Monte Carlo sets together with their generating parameters was implemented. This effort could be strengthened with some additional manpower, perhaps from guest scientists or a post-doc. Member of the group were primary contributors to the international effort to systematize comparisons of different physics generators and acted as consultants for related issues for LHC study groups. The focus on generators in the computing group at Fermilab is somewhat unique and we feel essential.

The group provides well-tested libraries of common generators for distribution in the FNAL environment. The libraries are supported through mailing lists and members of the group act as the interface to the original authors. The users (including Run II experiments) appear satisfied.

The group also plays a leading role in providing infrastructure and support for the FNAL Lattice QCD facility as well as acts as one of the main users of the facility. The resulting simulations of the Charmonium states produced precision results that were presented at the Lattice and Lepton Photon conferences, and were submitted to PRL.

The group is also a member of the SciDAC funded Advanced Accelerator Modeling team. Through this collaboration, they have developed Synergia, a 3D parallel code suite for beam dynamics simulations. This code has been successfully used in the evaluation of space charge in the Booster and will provide a most useful tool for future accelerator studies. The group, though small, has been very successful and productive. This is the area that would profit most from more resources so that the accelerator modeling can proceed in a timely fashion for Run II.

Online and Analysis Applications

Goal: To develop and support real-time and analysis software for the experimental community and for projects oriented towards improving the Tevatron's performance.

Assessment:

Our responsibilities to the Run II experiments have proceeded well. We've been heavily involved in performance monitoring and integration efforts on the online system at D0. This proactive approach has helped to minimize downtime over problems that spring from hardware failures and the occasional problem with software upgrades. We successfully deployed an enhancement request to increase the number of L3 trigger bits. We have been comfortable enough with the software to move the support load to a more junior member of the department, freeing up expertise to work on other projects. Needed changes to CEPA developed software for CDF have been minimal and timely, and we have added some additional responsibilities in building front-end kernels specific to CDF. The front-end support at both experiments (CAMAC, VxWorks) has been extremely stable.

For non-Run II experiments, we worked on these projects as resources were available. The work that we've provided here is well received and appreciated, but we are behind on some of our goals because of lack of resources. Over the past year, we have been actively involved in the BTeV approval process, making sure all necessary project scheduling and documentation is available for upcoming reviews. We spent time in evaluating software that could be used in the upcoming DA system and some effort in defining the requirements, as people-time is available. For CMS, we have (co)developed and supported the data acquisition system used by HCAL and EMCAL with the end goal of a successful HCAL test beam effort this summer at CERN. We helped E907 develop and deploy a data acquisition system that is currently in use at the experiment. We have filled in gaps for experiments in the test beam effort including providing a test beam facility DAQ (in progress) and OS support of the DA machines. We continued to support the electronic logbook (CRL) for D0, MinibooNE, and Minos. We deployed it at CMS this year as well. Two major criticisms of the CRL logbook were addressed this year by improving the installation procedure and a web based interface for adding new entries that will be deployed next month.

Our support of the physics analysis software tools has been very successful. The Run II experiments have elected to rely on tools that are widely used in the physics community but created at other labs. By providing a strong local support for those tools, we have been able to achieve a very high turn-around rate on bug fixes and we also have been able to insure that features that were needed by the Run II experiments were implemented in a timely fashion.

We also have been providing support for 3D data visualization. In particular, we have been collaborating with MiniBooNE to develop their Event Display. This work has been somewhat delayed due to the load of planning and preparation for SC2003.

Core Support Services

The Core Support Services (CSS) Department within the Computing Division has many major missions for the Laboratory and Division. It is involved in operations of almost all services the Division provides and provides many core services and support functions directly. These responsibilities include:

- Base support and vendor liaison for all the supported operating systems;
- Global infrastructure support for the supported operating systems (e.g. Windows domain controllers, license servers, boot servers, etc.);
- Lab-wide core services (e.g. email gateways and IMAP servers, printer service, AFS global file service, software product distribution, etc.);
- Centrally-managed web servers, including the main site web server;
- Shared access computing facilities (batch and interactive) for scientific and technical analysis and development (e.g. FNALU, etc.);
- Dedicated computing facilities for production analysis of physics data (e.g. farms);
- Standardized software applications for distribution to FNAL machines and offsite collaborators;
- Recommended configurations for secure and reliable system operation;
- UNIX and Windows workgroup support and administration as described by negotiated MOU with client organizations within FNAL;
- Computing support for conferences sponsored by and/or at FNAL;
- Consulting services on system configuration, hardware procurement, computer security, and system administration training/hiring;
- Operation of the Computing Division's HelpDesk, including development, support and administration of HelpDesk applications and databases, and tools to assist in the automation of the Division's operations and monitoring.
- Development and support of database design and management tools;
- Development, support and administration of bookkeeping databases and catalogs for experiments (CDF, DZero, CMS, Auger, MINOS) and other laboratory clients using Oracle and open source MySQL or PostgreSQL databases;
- Development and support for the Computing Division MISCOMP information management systems and other Division infrastructure;
- Repair, diagnostic, calibration and advisory services on a wide range of specialized high-energy physics instrumentation, electronic modules, computing equipment and computing peripherals, especially when vendor repair is not available or is limited or costly;
- Management and tracking of over 40,000 electronic modules and more than 20,000 individual pieces of computing equipment in the Physics Research Equipment Pool (PREP) equipment pool;
- Administration of Lab-wide maintenance contracts for computing hardware and software and tracking of software licenses through the equipment database;
- Administration of the FermiTools software technology transfer program.

Goal: Provide efficient and reliable core computing and equipment services

Assessment:

The Department continually monitors and assesses performance in these functional areas, based on both client feedback and "hard" metrics, which are used in our on-going program to make improvements.

Organizational and process changes, and new technology, have been used where appropriate to accomplish these improvements. The new organization of the Department has greatly contributed to the ability to flexibly bring together resources from anywhere in the Department to address problems or undertake new projects.

A measurable success has been the Department's contributions to the success of the Run II experiment's data-taking and analysis in the areas of database administration and production farms processing. Another success has been our contributions to the Run II luminosity upgrades through support for the hardware modifications for the beam position monitors.

One current area of focus is reliability and maintainability of commodity hardware for large computing clusters, where we continue to improve our processes for evaluation of hardware and certification of vendors. We are also working with vendors to improve overall uptime through more robust hardware and software and lower time-to-repair.

Computation and Communication Fabrics

Overview

Computing for the physics programs of the laboratory as well as for the technical and administrative work of the laboratory relies on certain core capabilities that are provided for everyone. This computing fabric provides a campus-wide network and many computational facilities.

Computer Security Team (CST)

The Computer Security team provides a dedicated technical organization to support the Computer Security Executive, and assist line management in maintaining computer security at Fermilab. This is done under the governance of the Fermilab Computer Security Program Plan (CSPP). The CSPP articulates the Lab's Approach to Computer Security. The CST provides (among other items) training of System Administrators, a strong authentication infrastructure providing Kerberos 5 and X.509, network-based scanning and monitoring of network activity, a framework for incident response, a framework for identifying critical vulnerabilities and determining the labs response in mitigating them.

The Computer Security Team also tracks and contributes to computer security technology developments, and attempts to play an appropriate role coordinating computer security among significant HEP facilities, so as to reduce the impact of various security measures on the collaborative and increasingly inter-operating world wide HEP collaborations.

Goal: Provide a conceptual framework for the lab's computer security activities, based on the Fermilab Computer Security Program Plan (CSPP)

Assessment:

A rich framework exists, and is very well grounded in the prose and spirit of the Fermilab CSPP.

Goal: Provide central technical infrastructure as apropos, for example, a Kerberos key distribution center (KDC).

Assessment:

An appropriate technical infrastructure exists. Because most of the work is "collaboratively open", and because the nature of the lab's scientific program requires extensive collaboration with many other institutions, a significant amount of this infrastructure is realized as scripts built upon publicly available tools. The apparent path forward has the CST depending on a significant amount of in-house software. The Team needs a plan and direction for this effort. The CCF Department is seeking to augment the group for a person with suitable potential to address this issue.

Goal: Provide business process apropos to a central group (e.g. exception processing, training, awareness program)

Assessment:

Business processes exist, and were reviewed in the self-assessment. It has been noted that the group has been suffering from a lack of available manpower, with an impact in turn around, and limiting the expansion of process. This is being investigated.

Goal: Bi-annually conduct a peer review and self assessment.

Assessment:

This has been done, with the results incorporated into the Team's work plan.

Goal: Understand and steer relevant technologies where appropriate.

Assessment:

Staff of the team is working in several areas, including participation in the Global Grid Forum and involvement in software engineering, contributions to the MIT Kerberos Distribution, and participating in various inter-lab forums.

Networks

The Computing Division supplies the scientific program with networking for its Data Intensive Science, and provides general networks for a considerable fraction of the site.

Because of the collaborative, multi-institutional nature of High Energy Physics, special attention is paid to off-site connectivity, with a focus on the remote-site data needs of experimenters and theorists, supporting a large number of visitors with laptops (inducing the need for good support for registration, network analysis and incident response).

Ethernet is the basis for almost all of the lab's very considerable scientific computing infrastructure. The design of data-intensive networks has been and remains a very important contribution to the lab's physical infrastructure.

Goal: Furnish a centrally-managed campus network, continuously evolved to meet modern usability expectations, having a configuration allowing for central management, and low operational costs.

Assessment:

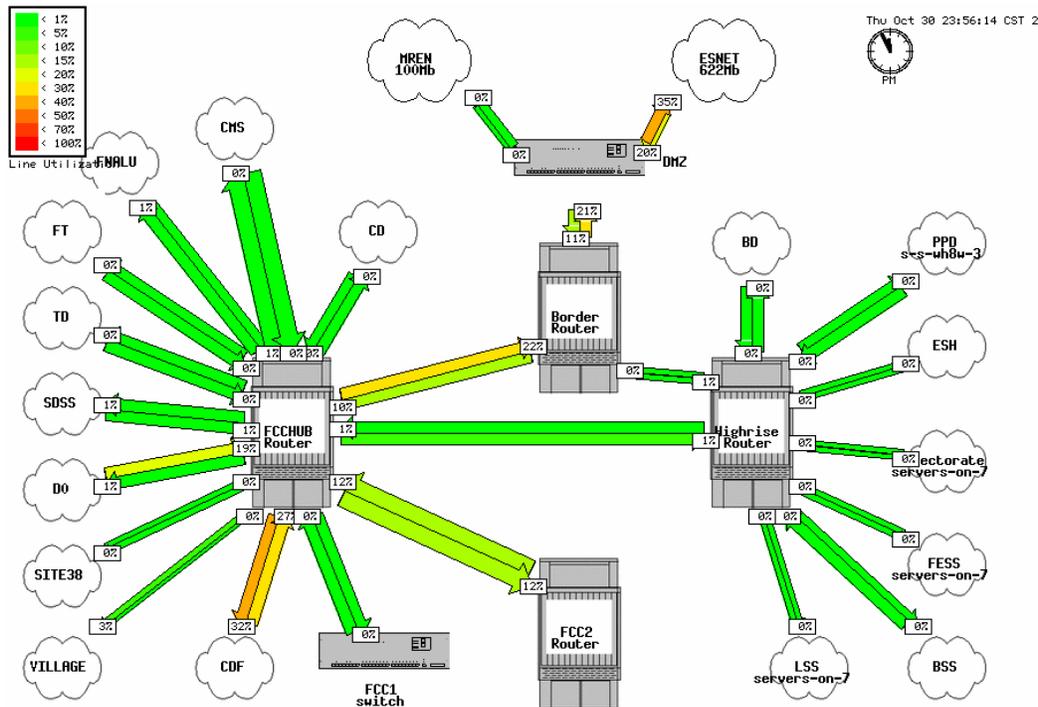
Such a high-quality managed network exists, and has the requisite properties. Challenges of adequate management were met in relevant areas, including management software enforcing elements of proper use (autoblocker), increased Netflow support , migration of monitoring to HP OpenView, tracking core use and

advocating 10 GB modules as apropos, and extensions of the inter-building fiber plant. The Core Network Computer Security Plan was revised.

Goal: Furnish a designed network for the lab's data-intensive computing, including Network-based storage systems, network-based analysis clusters, and production farms.

Assessment:

This has been an outstanding success. Such networks are now deployed or planned to be deployed in every appropriate area. A depiction of the network follows:



Goal: Furnish off-site connectivity apropos for the production needs of the lab's current experiments, and for inter-lab systems development and demonstration needs.

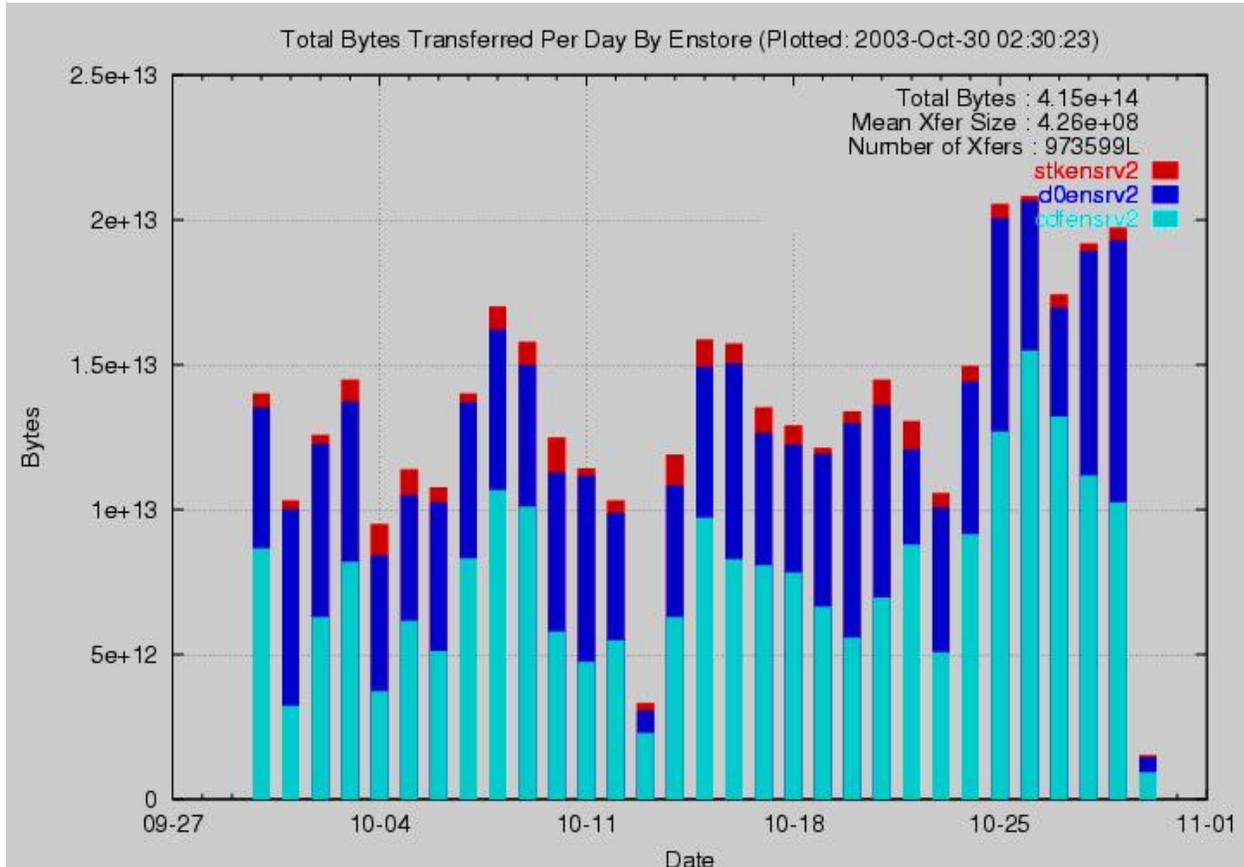
Assessment:

Production traffic is to be handled by ESNet. An OC-12 upgrade was obtained in time to support the lab's production traffic. A Fiber RTU to the Starlight Optical interchange facility is in process, but is proceeding more slowly than hoped for. This RTU will allow the Lab to connect to research and production networks with novel technologies and at very high bandwidths.

Storage and Data Movement Facilities and Infrastructure.

The CCF department builds and operates facilities for permanent automated storage of designated scientific data sets and providing for access to the data with appropriate performance. Currently, these facilities are

implemented as automated tape libraries operated by the department, and disk caching software run on (typically) experiment-furnished and administered disk-full computers. The tape systems hold over 1 Petabyte of data, with more than 10 TB of data being transferred to or from tape each day. Experiments implement approximately 100 TB of disk. The disk systems typically transfer over 20 TB/day to a more chaotic physics analysis system. All data move over an Ethernet data Network. The graph below depicts the daily movement of data.



Goal: Maintain capacity and functionality to satisfy the FNAL experimental program.

Assessment:

Capacity and throughput have met experiment's needs very well. This was confirmed in the Director's review of Run II computing. Success of the FY2003 program has engendered more desired data for FY2004.

Goal: Maintain the operational characteristics of the permanent store (tape system).

Assessment:

The tape system has very good availability in the face of a very large increase in capacity, the introduction of a new tape drive technology, and the expansion of the systems to ~70 tape drives. The state of the system, including many operational parameters is monitored continuously by a "primary" system administrator and reviewed in a meeting that includes storage system administrators, software developers, and department management.

However, experience from running the deployed systems and external requirements have changed and extended the notion of a solid operational foundation. The Department is investigating the following items and regards them as important in FY2004.

- a) Increased verification of the integrity of tape meta data backups.
- b) Moving from an "iterated install" method to a boot image method.
- c) Examining the physical computer plant for unwarranted diversity.
- d) Fully implement using the tape write-protect tab for reasons of safety and security.

Goal: Expand the designated data sets supported by the systems to legacy data set with substantial active interest.

Assessment:

This requirement emerged late in FY2003. A technical proposal exists and work is under way.

Lattice Gauge Computational Facility.

The FNAL Lattice theory program compliments the FNAL experimental program. A basic tool of lattice theorists is simulation. Practical simulations require coherent calculations over many processors, with a requirement for low latency communications. This is unlike the requirements for the FNAL experimental program, where calculations are more farmed out to individual computers and can proceed independently.

Goal: Provide a facility adequate for the FNAL theory program, and appropriate to the lab's role in the SciDAC lattice collaboration.

Assessment:

CCF has outstanding expertise in the area of clustered computing. It has extended the lattice computational facility. Anticipating use in the context of the SciDAC collaboration, it has begun collaborative activities to form a data grid to handle Lattice data sets.

Project Capability

The department's project capability is substantially located in two groups, the Middleware Applications (MAP) Group, and the Fabric Technology Projects (FTP) group. These groups participate in projects associated with the groups and facilities mentioned in this section of the self-assessment. The groups' staff work in the context of the Computing Division Matrixed projects, where their expertise is salient, or where work and expertise gained in the project helps inform the department's own technical program, or simply where there is a need.

To illustrate with examples, the department works in the area of Virtual Organization (VOX), Grid site security (SAZ), Grid Job Scheduling (JIM), systems concepts underlying data center facilities expansion (blade computing investigations), and assistance to the Beams division (Debugging SDA, Emittance Class)

Goal: Effective project formulation, including effective check points, mitigating the risk of perpetual involvement, while making sure that projects are delivered and put into production.

Assessment:

Very good motion. The MAP group leader has been able to insert herself to assist the formal project manager when indicated (SAM JIM). Long running projects, with fuzzy deliverables are now thought to be a program of projects, with projects held to short term milestones tied to a production goal.

Goal: Development of the staff, with an emphasis on technologies and soft skills important to collaborative work. Ensuring a project environment apropos for CCF staff.

Assessment:

Very good motion in a year. Staff that had worked in in-house Python projects now work in Java, and web services which seems preferred for grid collaboration and beams work.

Operations

Operations refer to providing computer operators for the computers and peripheral devices located in the Feynman Computing Center. Computer operators also do ancillary work, due to their familiarity with the data center and their presence in the center beyond working hours.

This group was moved into the CCF department in August and we are still evaluating its goals and assessing its performance.

Division and facility infrastructure

Goal: To consolidate services and to leverage similar expertise for broader applicability across projects.

Assessment:

The number of departments was substantially reduced and people were moved into these departments according to functional affiliations. The results of these moves have been very encouraging. Personnel allocation to projects has become easier and has allowed flexibility in adjustment. There are fewer points of contact for operational issues and communication flow is more efficient. We believe that we are on the right track and are now in fine tuning mode.

Goal: Provide oversight, recommendations and tracking for various division wide operational activities. Manage office and computer space, building utilities and safety programs.

Assessment:

Personnel relocations to different offices were handled efficiently and with minimal interruption to work.

In FY2003 we provided the necessary physical infrastructure for the addition of 750 computers for CDF, D0 and CMS experiment computing needs. We are now in the process of planning computer room space for the next several years. We have introduced the first phase of computer room automation which will allow unmanned operation for at least 1 non-prime shift per day. We are in the planning phase for a web-based facility management system for computer room equipment, space and power management.

In FY2003 we achieved greater than 95% of ES&H training throughout the division. We have averaged two departmental ES&H walkthroughs per month. CD has zero lost workday injuries for greater than one year. We

have assessed ergonomics throughout one-third of the division and implemented corrections where needed. We have developed a total integrated safety management (ISM) program.

Goal: Manage and track computing equipment and instrumentation in a manner that supports the rest of the division's mission and works in concert with the laboratory's property tracking systems.

Assessment:

The division collects property information and tracks property to support several mission functions that include the PREP equipment pool (support of the experimental program), administration of hardware and software maintenance contracts for the entire laboratory, tracking of all systems on the network and support for computer security. It is common to track the property through its entire life cycle...receiving, deployment to project, repair, off-site loans, on-site storage and retirement. The division is not required to track property to any DOE requirements when using the property information to support the above functions. The division is required to participate in property tracking processes for property that is stored at Site 38, property designated a sensitive item/capital equipment or property that is taken off-site.

The division takes actions required to track property information to the extent necessary to fulfill the division's mission. The division meets the requirements for property tracking as stated by the Laboratory/BSS/DOE (Sensitive items, etc.). The division propagates information on how to use property safely.

- 1) Improvements could be made with compliance of property passes. A reasonable procedure and on-line tools would improve compliance.
- 2) The division could take a lead role to develop on-line property transfer tools. This would greatly reduce the anguish each January as the inventory lists are sent out (in fact could eliminate the need for the paper lists).
- 3) The division could also develop tools that would allow the Laboratory's data repository to be augmented with the division's data.
- 4) The change management process for the division's property information is somewhat weak when changes are made in the field.

Cyber Security

Fermilab conducted a successful Self-Assessment and Peer Review during FY 2003 of Fermilab's Computer Security Program. This was held on April 22-23, 2003. It should be noted that the Peer Review Committee believes that the (Fermilab's) combined Self-Assessment and Peer Review format "was very useful and the two functions should not be separated".

Metric V.1.2.1.1 - Pass

All Self-Assessment and Peer Review recommendations have been addressed with the Fermilab Area Office Manager in memorandum dated September 29, 2003. We have addressed all four of the Review Committee recommendations.

Metric V.1.2.2.1 - Pass

An independent cyber security review of the Business Services Critical System was combined with the Fermilab April 2003 Self-Assessment and Peer Review. Therefore, the April 2003 Review served a dual purpose in order to conserve resources.

Metric V.1.3.1.1 - Pass

Particle Physics Division

Security

Cyber Security

D0 Critical System

The D0 Experiment Online system encompasses the computing and network components necessary for the control and data acquisition operations of the D0 detector. During FY2003 the Online system operated within the guidelines of a Critical System Computer Security Plan. The plan stipulates system management responsibilities and rules governing network access to online systems, system and user account management, incident response, and disaster recovery. Line management is responsible for adherence to this plan. During FY2003 the plan was effectively executed, with no computer security incidents reported and hence no negative impact on experiment operations. This was achieved despite the emergence of numerous internet-wide computer security threats, and accommodated significant changes in the hardware, software, and user environments.

CDF Critical System

During FY2003 CDF did not have any major security incident. As part of the CDF disaster recovery plan, CDF outlined the recovery procedure if one of the online systems were to become corrupt. CDF verified that they are able to move processes to one of the other identical systems and reinstall the operating system if need be to ensure that the system is clean.

Access to the CDF online systems is restricted. The main computers used for data taking can only be accessed from the online network and from offsite one has to use one of the dedicated gateway nodes. This reduced visibility to the outside makes CDF less of a target. CDF is using Linux systems, which tend to be less susceptible to malicious attacks that tend to target Microsoft products. For the Windows PCs that are used in the online network CDF does not allow email access or web access to the outside. The network is also setup such that CDF can disconnect access to the rest of the lab and they have extensively tested that they can run in this mode. For the gateway computers that are visible to the outside CDF ensures that the most up to date security patches are applied in a timely fashion. These update alerts generally come from the Computing Division. CDF also actively monitors usage to check for something out of the ordinary that would indicate a compromised system. All the above actions, policies, and run modes are the responsibility of CDF line management. There is in general some confusion and frustration from the CDF university users who are not always familiar with the preferred way to log in and to forward connections.

CDF does have limited personal which sometimes makes it difficult to implement and test the recovery procedures to the extent they need to be while simultaneously trying to handle the daily maintenance needs. But in summary, the reduced visibility to the outside, the use of Linux over Microsoft Windows, the development of a disaster recovery plan and continual monitoring all helped to make the online system secure during FY03.

Desktop Cyber Security

The Computing Division – Data Network Group, controls the cyber security of the network infrastructure to the desktop computing device. The Particle Physics Division (PPD) Data Support Group is responsible for the cyber security of desktop Windows and Linux operating systems within the non-CDF and non-D0

parts of PPD. The primary mechanisms for performing this task fall into four (4) support categories: Network, Account Security, Patching, and Data Integrity.

For Windows and Linux Network security, all non-essential services are turned off. In addition, systems under the control of PPD-GCSC are scanned periodically for vulnerabilities. If a system is found to be vulnerable a support expert is dispatched to resolve the vulnerability.

Windows and Linux Account Security is controlled at the first level by removing all non-essential accounts. Essential user accounts are of type Kerberos, and tokenized passwords are transmitted. Strong password rules (age, complexity, reuse, length) are enforced on all accounts.

For Patching systems, the Computing Division maintains a site-wide Linux patching server called YUM. The YUM system checks for and automatically downloads and installs updated Linux packages. Patches are verified by reading log files and Administrators correct installation errors.

A similar Patching product for Windows Automatic downloads and installs is currently not available, and the PPD Data Support Group is currently researching a product. In the short-term, patching is performed by the end-user and notification is sent out via email when there are critical patches. Compliancy is verified in PPD through our Inventory Tracking System – TS.Census. Follow-up emails or support expert visit are used to bring systems into compliance.

Data Integrity in the Linux area is assured through backups. Data is backed up to provide a means of recovering important data, using industry standard procedures based on user need and available resources. Users have the option to copy data to their AFS home area. Their AFS home area is backed up nightly. Web server access is set to anonymous read or controlled AFS group membership.

Windows Users have the option to copy data to their home area or project area on the Windows file server. This file server is backed up nightly. Anti-Virus software - Network Associates – McAfee Virus Scan desktop software and ePolicy Orchestrator Server to Client software. The server schedules all Virus Scan Desktop activities, develops compliance reports, and distributes anti-virus software updates. Access to network servers is restricted to domain membership. Web server access is set to anonymous read only with web data areas setup for on-site only or full world read.

Desktop cyber security incidents have continued to grow over the years as viruses and worms become more entrenched in desktop operating system functionality. Generally viruses and worms take advantage of software design errors that occur in operating system communication subsystems. These are typically related to a memory storage buffer that is not properly tested for size. Thus an overflow of this buffer could allow a program to be installed and then executed. Typically, these design error are patched by the vendor and released for distribution about every 10 to 20 days.

During August 2003, desktop cyber security incidents (desktop infected with a virus or worm) exploded with nearly 70% of all PPD supported desktops needing at least one operating system patch. The patches were considered critical by Computer Security and were required to be installed on all vulnerable systems immediately. In the days and weeks that followed, the PPD Data Support Group collectively spent 92 man-days working through this incident. It was apparent from the onset that pure manpower is not the way to continue to resolve these types of incidents. As a result of this incident and our need to work within our staffing limits, we are once again looking into affordable software tools that will give us the ability to remotely deploy software, and operating system patches or hot-fixes to the desktop without user intervention and within the time specification of our computer security policy for patching an operating system that is vulnerable.

Access Security (PPD)

Security is very important in Particle Physics Division. We plan security into our work much like we do safety. The Directorate has clearly communicated the expectations for security to all members of the laboratory. In response to those expectations, Particle Physics Division has done several things to make our areas and materials more secure.

Most notably are the collider detector assembly halls, CDF and D0. Both facilities have doors that are locked and access can only be granted to employees or users that possess a valid ID that will disengage the locks. At the High Intensity Lab, we have installed fencing with a locked gate inside the facility to protect the materials that our Cable TV group uses day to day. At 31/33 Blackhawk, we have installed a security system on the facility to protect the valuable survey and alignment equipment used by our Alignment and Metrology Group. At the Silicon Detector Facility, we have installed card readers at the entrance to each clean room. This will limit access to those individuals with a work related purpose and proper training. Recently, KTeV Hall was re-keyed to make it more secure.

At the ME7 Worm, we have secured all of our toxic materials. Specifically, the beryllium storage cabinets are all locked inside of the facility that is also kept locked. The lead that is stored in outdoor storage containers, have been chained and locked (future plans call for these lead containers to be stored at another location). Taking these measures will help to reduce the risk of theft and also ensures that those individuals without proper training cannot access the materials.

In addition to physically locking up buildings and materials that may be vulnerable, Particle Physics Division has taken additional steps to secure the materials we use so they cannot harm employees or members of the public. Examples include creating a shield block barricade around liquid nitrogen tank at CDF, locking the CDF gas shed, fencing around the liquid nitrogen tank at MiniBooNE, and eliminating outdoor storage of radioactive materials

ES&H (PPD)

The Particle Physics Division continued its commitment to the safety of its employees and the environment during FY2003. It is the policy of the division's senior management to integrate safety and environmental health into all activities in the division. Toward that end, an internal procedure PPD_OPER_004 was established in 1999 titled *PPD Implementation of Integrated Safety Management (ISM) and Fermilab ES&H Manual (FESHM) Chapter 2060*. This procedure was updated in 2003 and all supervisors are currently being trained on the contents of the new procedure. Within this operating procedure there is a chart that helps employees and users determine the level of hazard they are dealing with and when it is appropriate to write a hazard analysis. It also gives guidance on when a hazard analysis should be reviewed and by whom. Hazard analyses are completed whenever an employee is engaged in an activity that includes two low level hazards or one high level hazard. Hazard analyses are also completed for all construction activities involving contract employees. It is not the policy of this division to have ES&H personnel approve each HA, rather the supervisor in the line that is writing the HA is responsible for approval. ES&H remains available to provide guidance while writing the HA and oversight of the task. Periodically, the completed hazard analyses are reviewed for content by the ES&H department (usually as part of a tripartite audit).

The Particle Physics Division had an outstanding injury record during FY2003. In CY2002 the Injury Cost Index (ICI) for PPD was 8.46 and the Days Away, Restricted or Transferred (DART) rate was 0.59. For the first three quarters of CY2003, the ICI is 1.18 and the DART is 0.24. These numbers earn PPD an outstanding rating on the performance measure scale. Although our clock was recently reset, PPD still holds the Fermilab Division / Section record for the most hours worked without a DART case (1,500,459).

This hours worked total was three times the PPD previous record and is almost twice the level ever attained by any other Fermilab Division or Section.

The PPD Injury Case Management System requires a closeout meeting for most reportable injury or accident cases. The meeting includes the injured employee, their immediate supervisor, the department head, a member of the PPD ES&H group, and the PPD Head. The situation and corrective actions are discussed and any lessons learned are applied to similar operations throughout the division.

The Particle Physics Division has made significant strides in ES&H training in FY03. Since last October, our overall training completion rate went from 90% to 96.3%. ITNA completion went from below 90% to 99.5%. Specifically we were able to reduce training deficiencies in the area of Rad Worker, GERT, Cryogenic Safety, Pressure Safety, and Emergency Warden. In addition, our Training Coordinator was instrumental in getting several courses on the web, including Waste Minimization and DZero Hazard Awareness.

The following is the list and status of the Tripartite Assessments in PPD.

CY2002/2003

	1Q02	2Q02	3Q02	4Q02	1Q03	2Q03	3Q03	4Q03
Completion of Training	Complete							
Waste Min Efforts			Complete					
*ISM Implementation		Complete						
IH Assessment of SiDet			Complete					
Confined Space Program				Complete				
Forklifts					Complete			
Be and Lead Storage & Use						Cancelled		
ESHTRK Usage							Complete	
ORC Process								Planned
PPD Qty OSH	Complete	Complete	Complete	Complete	Complete	Complete	Complete	Planned

* PPD ISM Implementation was a performance measure.

Findings identified during the tripartite assessments are either abated immediately or entered into the ESHTRK database until they are abated. The tripartite assessment team usually consists of one member of the PPD ES&H Department, one member of the DOE Fermi Area Office, and one member of the ES&H Section.

There are several things that Particle Physics Division is doing to protect the environment by reducing waste and preventing pollution. Most recently, we did a process waste assessment of the plastic scintillator at Lab 5 and at the recommendation of one of our field technicians, explored the option of recycling the plastic. PPD worked with Business Services to locate a vendor that would take the plastic scintillator and we are now recycling all waste from that process. Other waste minimization, pollution prevention initiative in the division included recycling batteries at D0, inventorying every flammable liquid storage cabinet in the division to determine what is useful product (and what may be reused by other groups or organizations), removal of all exposed lead wool from the steel we store at the Railhead to reduce the likelihood of contamination In addition, and recognizing employees for their ideas on waste minimization/pollution prevention.

During the January 2003 and September 2003 acceleratory shutdowns, PPD supplied many technicians to help complete the tasks at hand. There is significant preparation that goes into planning for the safe work of those individuals. Two supervisors from PPD are given the responsibility to coordinate the effort. First, all potential candidates are reviewed for previous occupational and non-occupational injuries or illnesses that may exclude them from shutdown work. Second, supervisors strategically place each technician according to their capabilities (physical as well as technical). A lot of coordination between group leaders in PPD and between PPD and the Beams Division (BD) go into this! Examples include providing a buddy for one of our techs that is hearing impaired. In this case the supervisor worked with the medical department to get the employee ODH qualified with restrictions. Another example is BD personnel providing additional light for a PPD tech that suffers from an eye disease. A third example includes coordination between BD and PPD so that each crew has a BD leader and PPD helpers. No one crew is made up entirely of rookies. Past shutdown experience is reviewed and a significant effort is made to place PPD technicians in the areas they've worked before. Prior to the shutdowns, the PPD supervisors work with the Training Coordinator to review employee's training plans and training needs. This includes coordinating the training with the ES&H Section, providing just in time training courses, and working directly with the medical department to be sure ODH physicals are completed in time.

Before each shutdown the PPD Head meets with all involved technicians and their supervisors. The meetings stressed the importance of safety to senior lab management and particularly its importance to the PPD Head. People were urged to plan and work carefully whether they were in PD or BD spaces, BUT people going to BD were urged to be especially careful due the unfamiliar workplaces. People were urged to feel empowered to ask questions and rethink work if it could be done safer another way. In particular, the PPD Head asked employees who did not get satisfactory answers to their questions from their local BD supervisor to contact their normal PPD supervisor and raise the question again. The PPD Head stressed that safety is more important than schedule. Prior to the September 2003 shutdown, the meeting was a joint meeting with the Beams Division and both division heads reinforced safety at the same time.

Among other ES&H Initiatives, PPD audited our spaces monthly, and participated in the Lab's tripartite assessments, HPR assessments and DOE assessments.

With the help of Business Services, PPD un-stacked, inventoried, surveyed and restacked all of the NEVIS blocks in our NEVIS barn. This was a significant project with many hazards and it went very well. We are inventorying all of the lead we have in storage (a huge amount), wrapping it and will be storing it in the NEVIS barn, a more secure location. We are able to do this because additional room was created in the NEVIS barn when the blocks were restacked.

While using our internal Operational Readiness Clearance process for the extruder, we discovered that the valve on the nitrogen supply line was old and out of date. It was not rated properly. Consequently, we are replaced. This finding led to a larger review of old dewars that may have similar type valves.

We significantly reduced the number of outstanding exposure investigations and lost TLDs in the division.

We held an annual safety picnic to increase safety awareness and boost morale. At the picnic, safety (and this year environmental) improvement awards, in the form of merit money, is handed out to employees who have come up with ideas to improve ES&H at the Lab.

The Particle Physics Division is always looking for ways to keep the ES&H message out there. We will continue to audit our spaces, our training programs, and our first aid injuries to look for trends and new ways to get the employees involved in their own safety.

Experiments

CDF Experiment

A highlight during FY2003 was the Lepton-Photon 2003 conference, which was held at Fermilab during August 2003. Run II results from CDF were summarized in three (plenary) talks, covering “Top Quark Measurements at the Tevatron”, “Higgs and SUSY Searches” and “Mixings, Lifetimes, Spectroscopy and Production of b-quarks”.

Being a self-assessment of the FNAL/CDF group, this report focuses on the analysis work of the FNAL/CDF physicists. There are a total of about 60 FNAL physicists on the CDF author list. Organizationally, most of these are in the “CDF Department” and the “CDF Operations Department” of the Particle Physics Division and in the “CDF Computing and Analysis Department” of the Computing Division. The remainder can be found in Beams Division and in Technical Division. Altogether, the FNAL physicists number a little less than 10% of the full CDF Collaboration.

Fermilab-led analysis that were carried out and reported on during FY2003 include the following:

- A measurement of the inclusive J/ψ cross section
- A measurement of the b-hadron inclusive cross section using $b \rightarrow J/\psi X$
- A search for $B_s \rightarrow \mu^+ \mu^-$ decays
- A measurement of the $t\bar{t}$ cross section using the “tight lepton plus isolated track sample”
- A measurement of the $t\bar{t}$ cross section using kinematic variables
- A measurement of the inclusive jet cross section
- A measurement of the diphoton cross section
- A SUSY search using diphotons plus missing ET

The results from these analysis were reported by group members at a number of conferences, following reports and approval at internal CDF physics meetings. There are five internal CDF physics groups: Top, Electroweak, Bottom, Exotics and QCD, each led by two co-conveners. Of these ten conveners during FY03, three were from Fermilab.

D0 Experiment

In FY2003 the D0 Experiment published six papers in Physical Review Letters and Physical Review D on analyses using Run I data. They include multi-jet production, searches for SUSY particles and for evidence of large extra dimensions, and a comprehensive summary of top-quark pair production.

Run II results were presented at many international conferences during FY03. The results include more stringent limits on the masses of the lightest neutralino, first- and second-generation lepto-quarks, Z' , and the charged higgs, $\tilde{D}0$ limit on the existence of Large Extra Dimensions is the world’s most stringent to-date. With the start of Run II, DZero entered a new era of B physics with its silicon and fiber trackers and 2 Tesla solenoidal magnetic field that allow the identification of B_d , B_s , and B_b states, where new measurements of pico-second lifetimes have been determined. A new preliminary measurement of the top-pair production cross section at 1.96 TeV, which is a combination of 9 separate analyses, has been made for comparison with the Run I measurement at 1.8 TeV. New cross sections were also presented for inclusive jet and di-jet production, and W and Z production, where the bosons decay to muons or electrons.

A summary of the talks given at the winter conferences, in which D0 presented for the first time physics results from Run II ($\sim 50\text{pb}^{-1}$), is available at:

http://www-d0.fnal.gov/Run2Physics/winter_2003.html

A similar summary for the summer conferences, based on an integrated luminosity of $\sim 130 \text{ pb}^{-1}$ is given at: http://www-d0.fnal.gov/Run2Physics/summer_2003.html.

In FY2003 108 presentations were given at 34 meetings where the D0 Speaker's Bureau slated the speakers. The Run II D0 author list contains 539 physicists from more than 80 collaborating institutions from 19 countries. Forty-five (45) talks were given in the United States and sixty-three (63) were presented at meetings abroad. Among the 67 Fermilab scientists on the author list, six (6) made presentations in the US and thirteen (13) spoke abroad. In summary, Fermilab scientists represent 12% (67/539) of the collaboration authors and they gave 19% of the talks. The full list of slated talks is given at: <http://www-d0.fnal.gov/~d0conf/2002.html> and <http://www-d0.fnal.gov/~d0conf/2003.html>.

Members of D0 (and CDF) made a detailed study to understand the Higgs Sensitivity of the Tevatron. This was the very first time that new Run II data were used together with full-GEANT simulations of the detector. The results were presented to Ray Orbach, Head of the Office of Science in the DOE on June 24, 2003. The final report is available from

http://www-d0.fnal.gov/Run2Physics/higgs_sensitivity_study.html

(or directly at

http://www-d0.fnal.gov/Run2Physics/public/higgs/HSS_D0_CDF.pdf).

CMS Experiment

The CMS Experiment is not yet in a data taking mode, so this self assessment is somewhat premature. The Fermilab Group of US-CMS did participate in CERN test beam runs with hadron calorimeter apparatus during FY2003 and are analyzing that data for internal collaboration publication.

The US-CMS Construction Project did continue in FY2003 and that effort was extensively reviewed by the DOE via other means. The US-CMS M&O effort began in FY2003, but at such a small level that assessment is not yet appropriate.

Operations

CDF Experiment Operations

Similar to FY2002, CDF was off to a rocky start in FY2003. CDF experienced a number of sudden and unexpected terminations of stores that resulted in high losses in the CDF detector. This was caused by a number of problems, most notably the loss of tevatron RF or a "prefiring" of the tevatron abort kicker magnets. To date, there have been 5 separate inadvertent terminations of store that have resulted in as much as 200 rad (from a single incident) at the silicon detector. In total, 9 silicon ladders have been permanently damaged in two separate such incidents. In a joint partnership with Beams Div, we worked on solutions to minimize impact of these unexpected beam terminations on the silicon detectors. As an example, collimators at A11 and A48 were installed to scrape away beam, say from a kicker prefire, prior to its reaching and potentially damaging the CDF silicon detector. Furthermore, the CDF silicon experts are continually trying to reconfigure the way this detector is run to make it less susceptible to permanent damage when an incident does occur.

Throughout FY2003, CDF continuously improved the operation of its detector. 93% of the silicon detector is working routinely and is integrated for every store in which beam conditions allow. The dynamic prescaling of triggers was implemented in the trigger scheme to accommodate higher luminosities without incurring substantial dead time. Trigger algorithms were also improved to get higher purity and thus make better use of the overall DAQ bandwidth. Operationally, a myriad of small improvements were made such that by the end of the fiscal year, CDF was routinely recording data for individual stores with

greater than 90% efficiency (up from the low 70's in FY2002). Furthermore, detector reliability had improved substantially. The number of access requests had dropped substantially and were happy with ~1-2 hour/week for routine maintenance issues.

Beam related losses remained an outstanding issue for CDF. Our data taking efficiency could be higher if accelerator losses at the beginning of a store were better understood and under control. For ~80% of the stores, losses were acceptable and the silicon detectors were integrated immediately. However, for the remaining stores, CDF has had to wait as much as several hours before it can turn its silicon detectors on and integrate data with the entire system.

In FY2003, there were 2 substantial shutdowns – 3 weeks in January and 10 weeks beginning in early September 2003. In the January shutdown, CDF installed its shielding on the “A-side” of the collision hall low beta quad magnets. It also opened one of the two remaining ISL cooling lines with the laser, which had been blocked with epoxy during construction. Since the CDF detector had been operating extremely well throughout much of FY2003, much of the focus of the September shutdown was on reliability issues. Fans were replaced, filters changed, power supplies replaced etc in an effort to prevent failures once beam comes back. The shielding on the “B-side” low beta quad magnets will be installed in October, which will complete this shielding project. This shielding project started in FY2002 after radiation from the beam destroyed 11 power supplies. We hope that the completion of this shielding will not only help with radiation damage to hardware, but will further minimize problems from single event upsets (random changes in memory locations caused by radiation) in the digital electronics, lower the current draw in the muon chambers, and help with our missing energy distributions.

In addition, two COT wire planes were replaced *in situ* using a custom-stringing engine. In the future, if a COT wire breaks while taking data, we now have confidence that we can fix it efficiently while the “clock is running”. That procedure went very well, and the apparatus built to do this worked as planned.

There are several projects in progress at the end of FY2003 that will pay huge dividends for CDF in the future. CDF will resume taking data with a faster and more reliable level 3 trigger. We have replaced outdated hardware with equipment that is not only faster but hopefully more reliable. This will help us remain efficient as the accelerator continues to increase its luminosity. Secondly, we have modified the newly created level 2 test stand (PULSAR project) and so that it will now act as the level 2 muon trigger. With this new capability, CDF will be able to cut in level 2 on muon information for the first time in Run II. While this has not been a significant problem at low luminosities, it has started to impact our dead time at $4.0E31$ and would have been a greater problem as luminosities march upward.

In summary, CDF had a very good FY2003. We wrote 198 pb⁻¹ of data to tape and that ~84% of it was physics quality. The average data taking efficiency for the fiscal year was 85% and, as stated earlier, in the latter stages of FY2003 >90% data taking efficiency was getting routine.

CDF operated its detector in a very safe fashion. It did not have a single reportable incident and had zero lost work days.

D0 Experiment Operations

This is a summary of the major accomplishments in data collection for the D0 experiment over the 18-month period ending September 2003.

Completion of the fiber tracker commissioning in 2002 separates Run II D0 data taking into two distinct periods: commissioning and physics data taking. With a complex detector like DZero it was practically impossible to accomplish an abrupt transition from commissioning to data taking in a short period of time. Thus, over the last 1.5 years our major goal was to improve D0 data taking efficiency and data quality.

We define “efficiency” as the ratio of luminosity D0 recorded to tape divided by the luminosity the Tevatron delivered to the D0 interaction region. Periods of experiment down time with an inability to collect data reduce operating efficiency accordingly. The monthly plot of the D0 data taking efficiency is shown below.

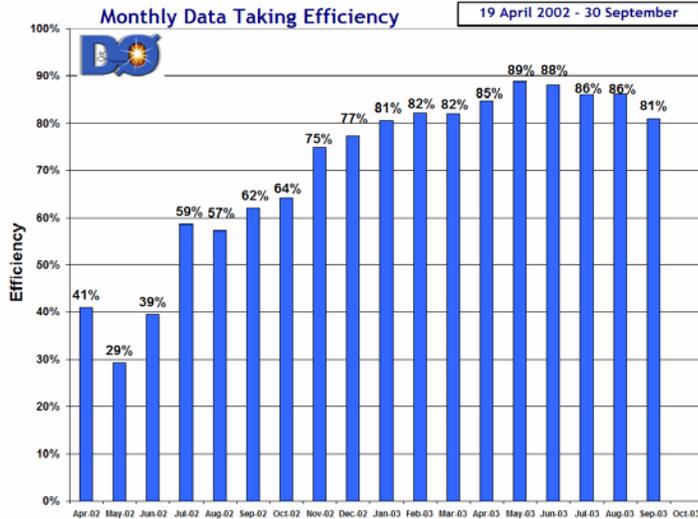


Fig. 1. D0 monthly data taking efficiency in 2002 and 2003.

As is clear from Fig. 1, efforts to improve our efficiency resulted in a steady increase from ~30% to ~90%. To achieve a high operational efficiency a large number of issues had to be confronted. Reliability of different detector systems was improved by: replacement of unreliable components, and changes in the operating conditions. Procedures for the physicists on shift were developed to avoid problems and resolve issues quickly. The DAQ system software received considerable attention and special software was invented, e.g. DAQ AI (artificial intelligence) to automatically detect and resolve problems before they became serious. In the spring of 2003 D0 reached a data taking efficiency of 87+-2%, which is a typical good number for large high energy physics experiments. It must also be said that the Operations Run Coordinators were frequently present and available for resolving operational problems.

Before the beginning of the September 2003 shutdown the following sources contributed to D0’s data taking inefficiency:

- Front-end busy in the tracking readout crates: ~4%
- Failures of different detector, trigger, DAQ components: ~7%
- Pauses in data taking at the beginning/end of the Tevatron stores, at the begin/end runs, etc.: ~2%

Item 1 is driven by the design of the SVX II chip and can’t be reduced. Analysis of item 2 demonstrates that failures are distributed over a wide range of systems. Reduction of the number of failures will require considerable effort, which includes the re-design of some major detector components. In summary, the DZero plan is to keep physics data taking efficiency at the ~90% level for the duration of Run II.

The net result of D0’s operational improvements is the accumulation of 214 pb⁻¹ of data to tape, which is almost twice the amount gathered in Run I. See Fig. 2 for the history of D0 Run II data taking.

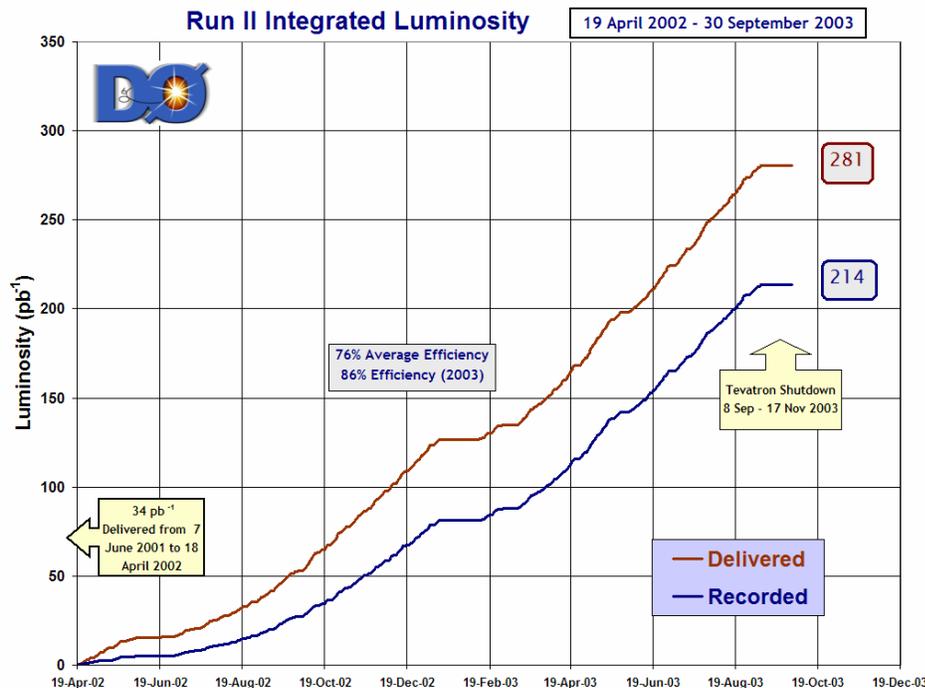


Fig. 2 D0 delivered and integrated luminosity in 2002 and 2003.

In addition to the amount of data written to tape, the quality of the data is also important. This concern has been addressed with the introduction of data quality monitoring tools that are used by the “Global Monitor” physicist on shift. During the past year improvements in different sub-systems have been developed and implemented. The central and forward pre-showers were commissioned; the forward proton detector has started to produce physics data; Level 2 and Level 3 trigger algorithms have been considerably improved; the new Level 2 trigger hardware (the “Beta” version) was successfully commissioned; calorimeter triggering has been improved, and fiber-tracker trigger was commissioned.

As with any large high-energy physics detector we continue to add new capabilities. In the next few months we expect the full integration of the forward proton detector in the D0 data and analysis streams, commissioning of the track-based displaced vertex trigger as well as multiple improvements in almost every D0 sub-system.

It is important to document that operations during this reporting period have been performed safely with no accidents involving personnel or detector components. This is due to efforts by everyone involved in the experiment operation, as well as constant efforts by the D0 Department and the experiment management.

In summary, the D0 detector has moved from commissioning to stable physics data taking with ~90% data taking efficiency. The 214 pb⁻¹ of accumulated data, at the world highest energy collider, are now available for physics analyses.

Electrical Engineering

A major effort during FY2003 in the PPD Electrical Engineering Department (EED) was our supreme effort to rotate people to projects in support of the Beams Division (BD) for increased Collider luminosity.

Three engineers and two technicians were permanently transferred from this PPD Department to the Beams Division as part of this redirection. Our department undertook several small BD projects. During the January 2003 and September 2003 accelerator shutdowns, ten technicians from Electrical Engineering were sent to the Beams Division to help.

Another major effort in the department during FY2003 was in Application Specific Integrated Circuit (ASIC) design. The SVX4 silicon readout chip was successfully completed during FY03 one prototype design cycle earlier than scheduled.

Following the Self-Assessment scheme from FY2002, the Electrical Engineering Department carried out two self-assessments as scheduled. Since the work was done, we report on it here even though the entire Self-Assessment procedure has now been changed.

Review of the EED CDF Support Group log

The EED CDF Support Group keeps a log of their activities in support of the experiment. This includes a database for electronics inventory and repairs. The review focused on the quality of the log.

The activities of the EED CDF Support Group are tracked in two fashions.

1) The CDF Support Group manages the CDF Equipment Database, which is used to track the status of thousands of pieces of electronics used in the experiment. Information available from the database includes the present location of the device, the repair history, the current disposition (functioning or in need of repair), symptoms (if repairs are called for), and whether the device is currently considered to be a spare.

Entries in the CDF Equipment Database were reviewed. It was observed that one person on behalf of the others has entered the majority of the entries for work performed by members of the CDF SUPPORT GROUP. Though it can be inferred (by the nature of the activity) who likely performed the work being reported on, the effectiveness of the tracking procedure would be enhanced if the entry were to be completed by the person actually performing the work rather than a coworker serving to keep the database up to date.

A recommendation was made to have the individual members of the CDF Support Group enter the information for the work each of them performs.

2) The second method of tracking the work performed by the EED CDF Support Group is with a log of work requests that is in the form of a computer file.

This file was reviewed and it was observed that, although the file effectively documents a variety of work being done by the group, there is inconsistency in recording the date when a work request is closed out.

A recommendation was made that for completeness, and for tracking the time it takes to perform tasks, the date when a work request is closed should consistently be recorded.

Review of the EED Job Request database

Jobs that go beyond the short term or daily activities of the Infrastructure group, Colliding Beams Experiments group, and Fixed target experiments group, are documented by means of job requests. The Job Request form/database includes entries for, Job Description, Job Requester, WBS code, Job Assignment, Expected Completion Date, Start Date and Completion Date.

Each new project must result in a job request being generated. These job requests are then entered into a database, which can be used to track the project. This assessment reviewed project cycle time and the job request form as represented by Job Request database.

Our assessment found the overall correct completion rate was 81% for the 7 database fields examined. The Date Required and WBS were the most frequently missing fields.

In all but two entries in the request database, the project was completed after the required date, as it was entered in the request. The most obvious explanation is that the date of completion was just an estimate and was not the result of a clear understanding of the project scope or requirements.

With more entries in the database we will be able to see more relevant trends. All indicators in this assessment show the Job Request Form/database is a good tool for tracking projects. The Job Request Form/Database has helped us manage our projects.

Mechanical Engineering

The PPD Mechanical Department is organized in groups according to technical specialization. The Department consists of four main engineering groups (Mechanical Engineering, Engineering Analysis, Process Engineering, Design & Drafting,) four technical support groups (Mechanical Support, Mechanical Installation, Experiment Support, and Vacuum & Instrumentation,) as well as two operations groups which provide operational support for the CDF and D0 collider experiments. The engineering and technical support group leaders are responsible for managing their stream of work requests from the labs projects and ensuring that our resources are optimally distributed based upon the labs priorities. The measure of success is our ability to move people or assignments to adapt to the changing needs of the projects. The CDF and D0 Operations Groups are by nature "single customer" enterprises. Here the measure of success is the continued smooth and safe operation of the collider detector support systems, and our ability to move personnel in and out of these areas according to the workload.

A major effort during FY2003 in the PPD Mechanical Department was our supreme effort to rotate people to projects in support of the Beams Division (BD) for increased Collider luminosity. Seven technicians were permanently transferred from this PPD Department to the Beams Division as part of this redirection. Several small BD projects were undertaken by our department. During the January 2003 and September 2003 accelerator shutdowns, sixteen technicians were sent to the Beams Division to help with shutdown activities.

Another significant activity in FY2003 was the shifting of resources between the NUMI project and the CDF/D0 Run IIb silicon upgrade effort. This was a sensitive issue because the NUMI project was of very high priority to the Lab and was in a critical phase nearing completion. The Run IIb projects were ramping up, but faced critical schedule pressure. From the Run IIb project managers we learned that they were having trouble in the design integration aspect of their projects. Run IIb needed stronger Design support. The NUMI project was employing some very stronger designers who were no longer using these skills on NUMI because was in the very last phases of design and in many areas had advanced to procurement or assembly, but these folks carried a considerable amount of knowledge of the project and were overseeing procurement and assembly QA. By shifting some very experienced engineering support to NUMI we were able to liberate some talented designers who were reassigned to the Run IIb silicon effort. We felt that this shifting of resources was very successful and provided a significant boost to Run IIb while maintaining (or slightly improving) the level of support for NUMI. Now we face a similar need to adjust resources in light of the cancellation of the Run IIb silicon project. During we will be shifting assignments in order to increase support for the BTeV project.

Our Technical Support Groups have maintained steady progress, primarily on the NUMI project but also providing considerable support for CDF and D0 when this is required. We have contributed personnel to the Beams Division in support of two major accelerator shutdown efforts in FY2003. Our Mechanical Support group in MAB has a long tradition of doing work in support of PPD as well as Beams Division activities. In FY2003 we have had considerable success in developing deeper relationships between our Vacuum and Instrumentation group and the Beams Division. V&I is currently working on a significant list of projects in support of BD activities. Our management model for the Tech Groups is to allow the Group Leader as much freedom as possible to respond to customer requests, and to work with the customers to help them understand the capabilities of our Tech Groups. We distribute resources to the Tech Groups in response to the needs as defined by customer requests. We are currently looking at expanding the high-vacuum capabilities of our V&I Group so that they can handle a broader spectrum of Beams Division tasks. We feel that this model is succeeding.

Our CDF and D0 Operations groups have been assessed through other processes, so additional detail here is not required. These efforts are mature and successful and PPD people are doing a fine job of keeping the two experiments up and running. We continuously evaluate the workload, and in FY2003 we were able to reassign one FTE of tech support away from operations, reflecting the decreasing workload and operations become smoother.