

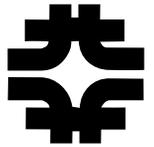
Laboratory Infrastructure

Ken Stanfield

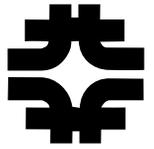
Fermilab

March 25, 2004

Fermilab Infrastructure



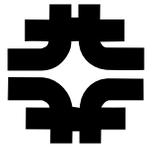
- Fermi site contains 6800 acres
- 343 buildings (2,287,245 square feet)
- 109 trailers (91,186 square feet)
- Electric system – power received at 345kV from utility grid at 2 primary substations, 280 secondary substations, 115 miles of cable (100 miles underground)
- Natural gas system – 14 miles of underground piping
- Pond water system – 16 ponds with return and supply channels
- Industrial cooling water – 21 miles of piping
- Sanitary system – 11 miles of sewer collection piping
- Domestic water system – 4 wells, treatment and distribution piping



Infrastructure Program Goals

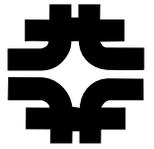
- Program led by FESS
- Support Fermilab's scientific program by providing a robust utility infrastructure with increased reliability and capacity
- Maintain the fire protection and detection systems across the site
- Provide preventive and corrective maintenance to buildings and utilities across the site
- 24 hours a day, 7 days a week

Infrastructure Program Goals

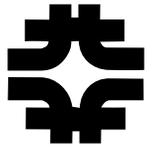


- Provide engineering disciplines to plan and design conventional construction of buildings and infrastructure from a life cycle sustainable design perspective
- Coordinate engineering activities contracted out to A&E firms
- Task manage or coordinate civil construction projects

Infrastructure Program Goals



- Maintain real property assets including roads and grounds
- Provide building condition assessments
- Provide janitorial services across the site
- Maintain the tall grass prairie and buffalo herd
- Provide T&M contractors for small projects
- Act as lead liaison with municipalities

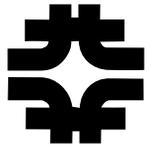


Infrastructure Program Goals

- Lead the infrastructure recapitalization program
- Provide a work environment that is environmentally sound and aesthetically pleasing

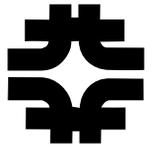
FY04 Infrastructure Budget

(fully burdened costs)



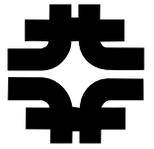
<u>TASK NUMBER</u>	<u>DESCRIPTION</u>	<u>FY04 \$K</u>
1.12.1	Buildings/Facilities	4,698
1.14.12	T&M Management	210
1.14.15	Roads and Grounds	1,268
1.14.18	Indirect Electrical Energy	2,147
1.14 Other	Buildings, Facilities Maintenance & Management	14,137
1.15.1	GPP	4,250
1.15.2	UIP	6,650
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Total Infrastructure		33,360

Infrastructure Risks (mitigated)



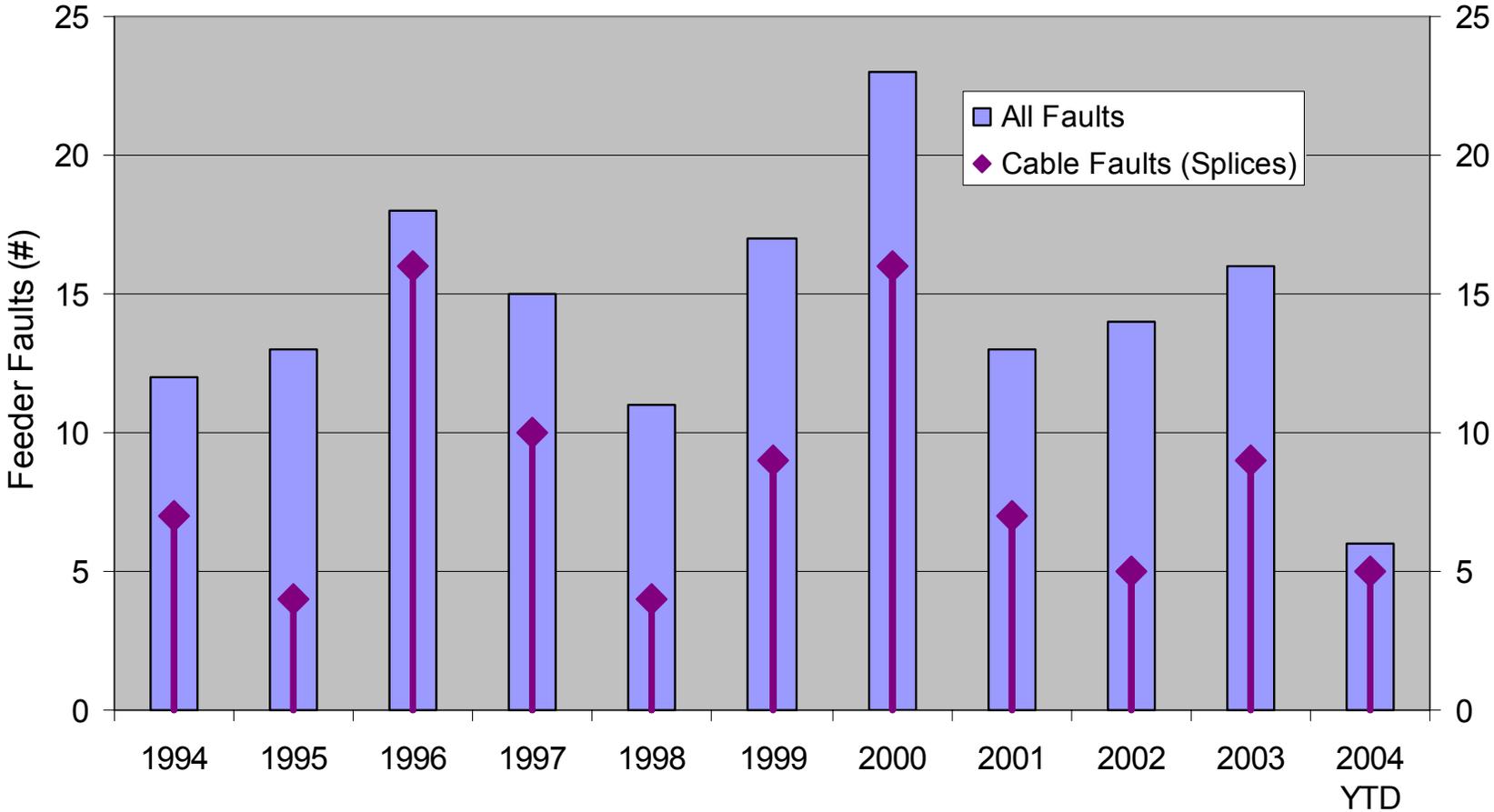
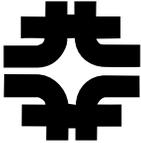
- Third Party Financing (UIP)
 - Central Utility Building electrical and mechanical rebuild
 - Majority of “critical” electrical feeders
 - CDF to D0 utility corridor (ICW, DWS, gas and sanitary)
- NuMI water reuse (pond water supply)
- Main Substation Transformer repair and duct bank replacement
- One “critical” 345 kV pole replacement

Infrastructure Risks (foreseen)

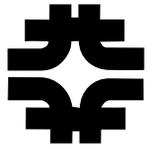


- 345 kV wood power poles
- 13.8kV electrical high voltage system
- ICW underground piping and reservoir supply
- DWS supply and distribution piping
- South Batavia Dam impact on make-up water

Feeder Fault History



High Voltage System Upgrade



MISSION NEED

- Affects entire physics program
Power to all elements of accelerator chain
- Increase accelerator uptime
16 feeder-failure related shutdowns since 1995
- Reduce loss of liquefied helium
\$65,000 per occurrence when feeder fails
- Reduce loss of Pbar stacks

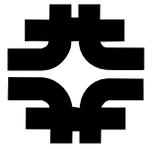
- Improve backfeed capabilities
Redundant power feed to Central Helium Liquefier Plant
- Reduce M&O costs
Improved reliability & fault isolation capabilities



PROJECT SCOPE

- Replace 2.4 miles incoming 345kV power line & poles
- 9 miles of new & replacement underground 13.8kV feeders and associated switches

Infrastructure program



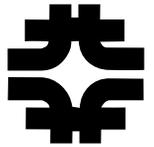
- The Utility Incentive Program (UIP) was very successful over 1998 – 2002 in working through backlog of projects.
 - It won DOE awards.
 - A legal opinion issued in 2002 killed the program.
- The most immediate need is work on the electrical distribution infrastructure.
 - Replace 2.4 miles incoming 345kV power line & poles
 - 9 miles of underground 13.8kV feeders and associated switches
- SLI program had this in funding plans starting FY 2005.
 - We recently learned that our project was delayed to at least 2011, years after the date by which we need to complete the work.

Operations Review Closeout



- **Findings:**
 - Infrastructure needs exceed available current and out-year funding (GPP);
 - Lab has been innovative in identifying and addressing infrastructure needs; \$60M addressed through alternative financing (commendable)
 - Planning for \$12M transmission line replacement also robust (City of Batavia with GPP fallback); flat & 2% growth scenarios will result in stretch-out of replacement
 - Allocation well balanced between infrastructure, ES&H and program

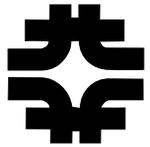
Operations Review Closeout



- **Findings:**

- FNAL infrastructure largely built within same decade; recapitalization needs are likely to be closely spaced in time
- Typical examples are Wilson Hall Safety Improvements, electrical distribution system, potable water mains, industrial cooling water system concerns
- Electrical feeder faults have already impacted Tevatron operations
- Additional recapitalization needs are likely to emerge through the condition assessment survey process over the FY04-09 period
- Price escalation associated with utility contracts for electricity and natural gas is an out-year risk

Summary



- Maintenance of oldest components of high voltage infrastructure is now urgent.
- UIP program has been blocked & SLI program funding will not come before 2011.
- Other third party financing is under investigation but not assured
- GPP funding should be increased immediately to address this need
- \$12M is required over 3 years for high voltage distribution system upgrades