



WBS 7 - Project Office US CMS M&O Planning

DOE/NSF Review of the US CMS Detector Project

May 9, 2001

**Jim Hanlon
Fermilab**



Outline

CMS Maintenance and Operations - MOTF

Fermilab oversight of US CMS M&O

Director's review of US CMS M&O Plans

US CMS Operations Management Plan

US CMS M&O WBS, Cost Estimate, and Schedule



CMS MOTF

A CMS Maintenance and Operations Task Force (MOTF) was organized in December 1999

- Establish a complete cost estimate for CMS M&O
- Propose algorithm for M&O cost sharing
- Provide liaison with CERN in regard to M&O

Chair: Lorenzo Foa

Representative matrix from each subdetector

- each large CERN member and non-member state
- small CERN member states and non-member states
- ex-officio members

A goal is to have a draft M&O MOU covering costs and responsibilities by the October 2001 RRB meeting

- Joint deliberations of the collaboration, CERN management, and the funding agencies.



CMS M&O Costs

M&O costs are divided into three categories:

- Category A: shared by the collaboration
- Category B: specific to a particular subdetector
- Category C: borne by CERN as host laboratory

CMS M&O costs begin in 2001 and plateau ~2006-7

- US M&O costs begin 2003

Rough estimate of CMS category A costs: ~14 MCHF/yr

- CERN categorization of M&O costs - April 2001 RRB

Sharing of category A costs

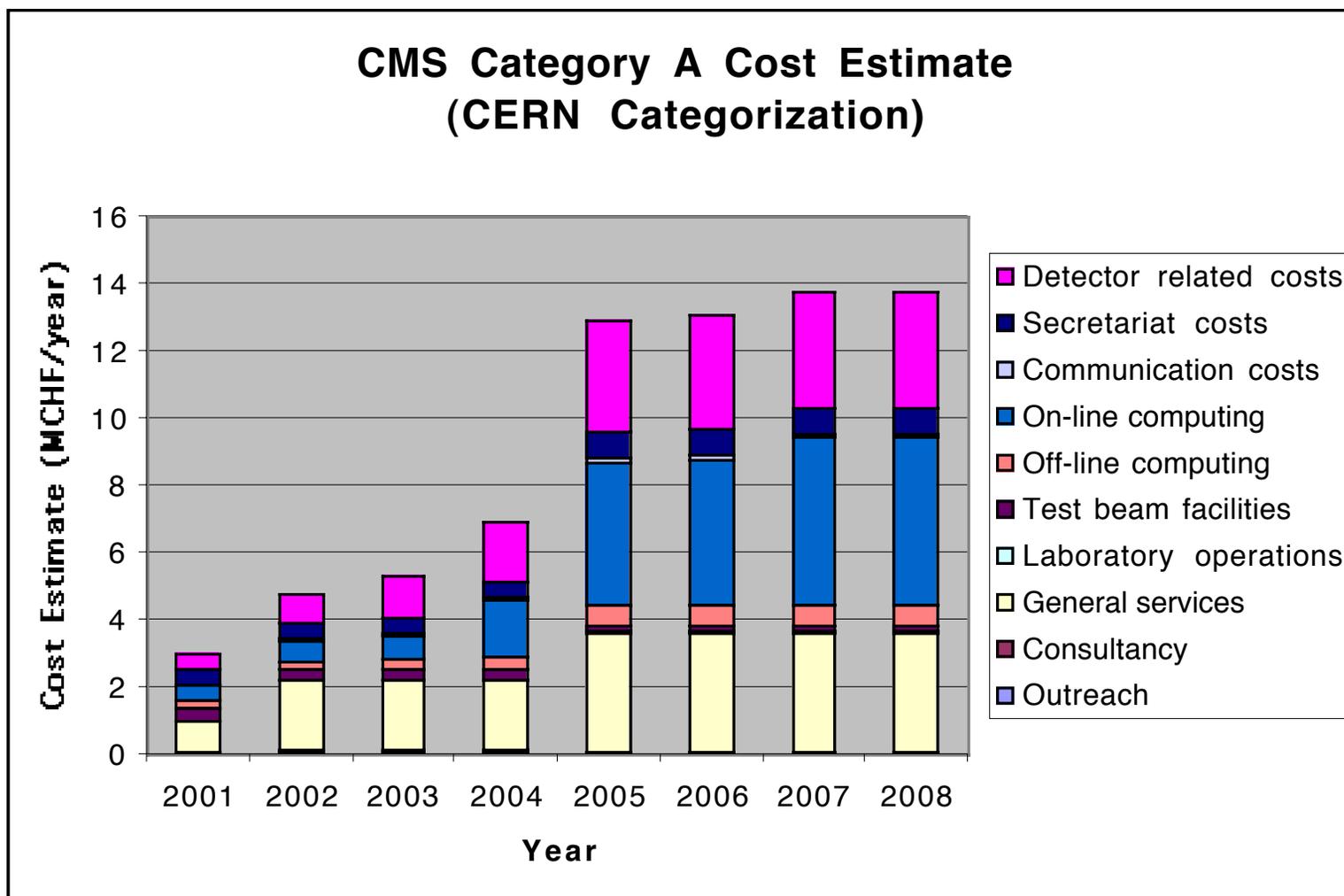
- Investment in the detector or number of scientists
- US share of category A is ~23% with either algorithm

Uncertainty in category A costs

- CHF/USD rate and categorization of M&O costs
- Estimate US CMS category A costs: ~\$2M per year



Category A Cost Estimate





Fermilab Oversight

The DOE/NSF Joint Oversight Group (JOG) has requested that Fermilab, as host laboratory for the US CMS research program, assume management oversight of the pre-operational and operational phases of the US CMS research program including

- **Participation in detector operations and data monitoring**
- **Support for maintenance of US-provided subsystems**
- **Establishment of an environment at Fermilab, including a virtual control room, to facilitate US-based physics analysis**
- **Continuing R&D, with possible fabrication, of detector upgrades to enhance physics productivity**



US CMS M&O Planning

US CMS has, for its part:

- Written a draft Operations Management Plan
- Developed a resource loaded WBS, cost estimate, and schedule for maintenance and operations

An estimate of US CMS M&O activities, cost, and schedule was presented to the JOG in December 2000

A Director's Review of US CMS Maintenance and Operations Planning was held at Fermilab April 11-12, 2001; recommendations include

- consistently define the transition from installation and commissioning to maintenance and operations
- designate management reserve as a separate WBS item
- separate upgrade R&D and upgrades from M&O
- consider expenses to maintain US scientists at CERN to come from direct grants rather than through M&O funding



Operations Management Plan

A draft Operations Management Plan (OMP) has been written which specifies the objectives, organization, WBS, management systems and supporting functions for US CMS M&O

- Objectives: scientific, technical, fiscal, and schedule
- Organization: CMS, US CMS, US CMS Operations
- WBS, cost estimate, and schedule for M&O
- Management systems: reviews and reports
- Supporting functions: QA, ES&H, property management

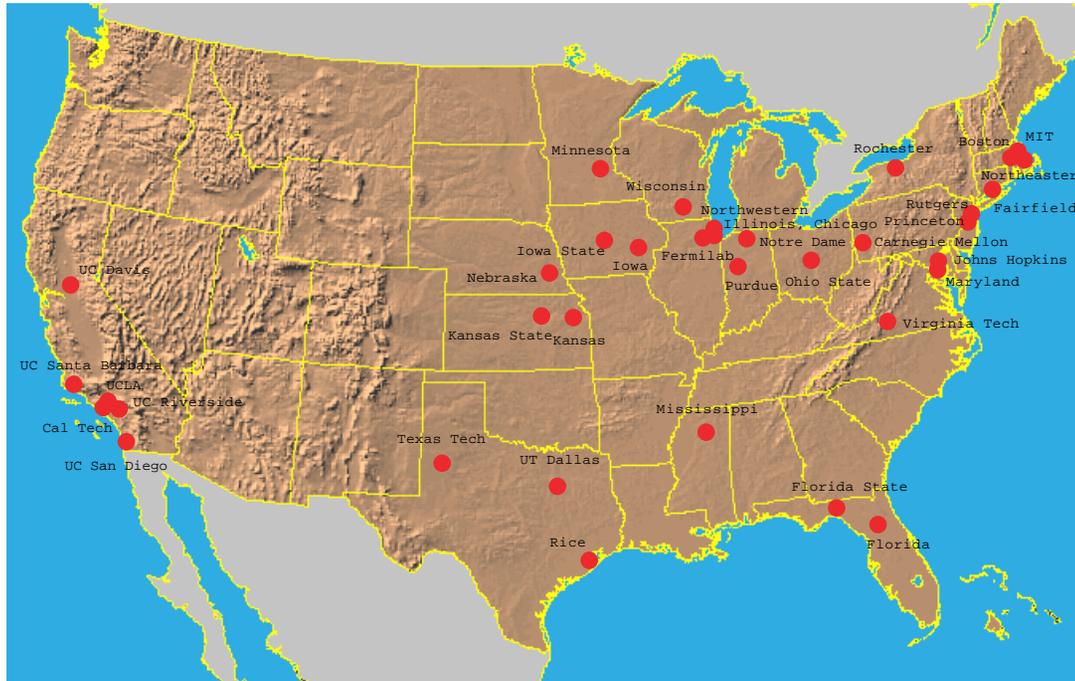
US CMS maintenance and operations are driven by the scientific objectives of CMS

- Exploit the CMS detector at high luminosity in the study of rare phenomena at 14 TeV in the Large Hadron Collider (LHC) at CERN



CMS Collaboration

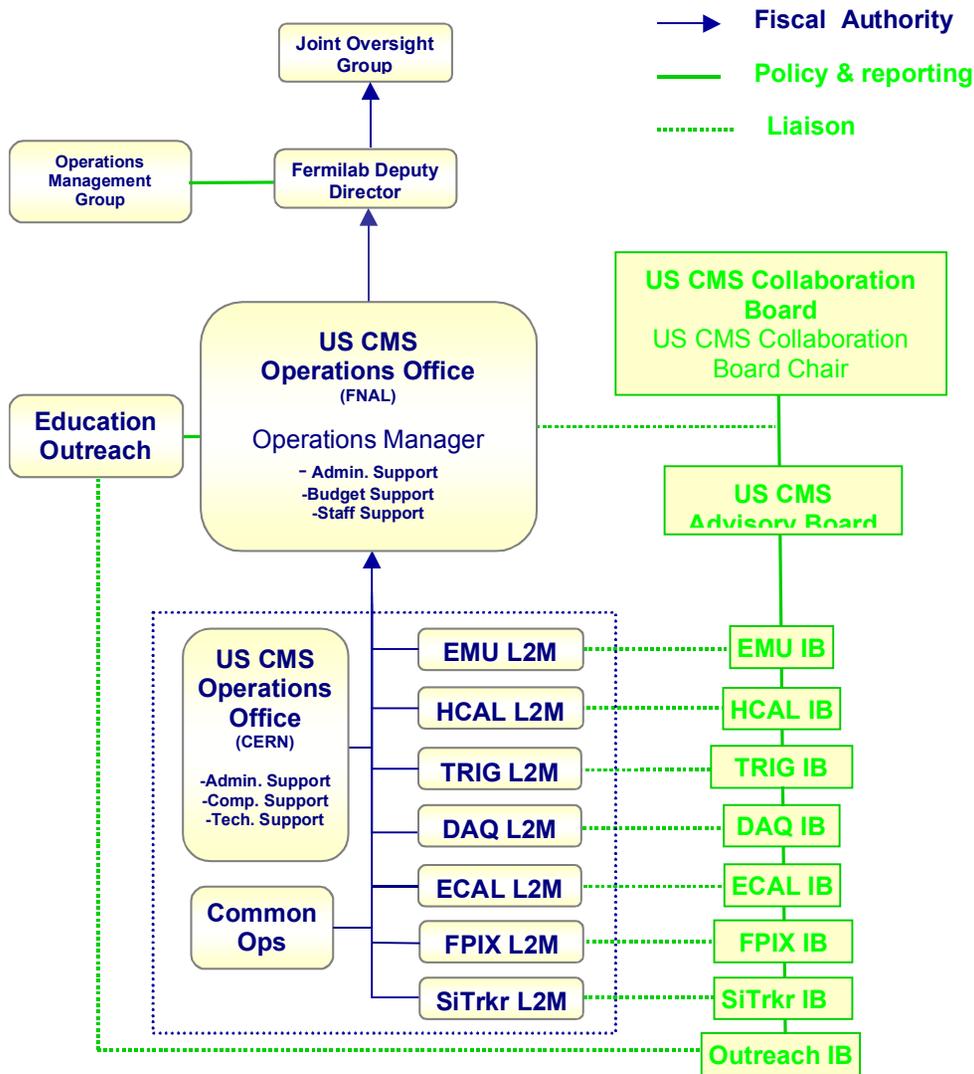
The CMS Collaboration consists of ~1890 scientists at 150 institutions



- **The US CMS Collaboration consists of ~390 scientists at 35 institutions**



US CMS Operations Organization



The OMP addresses only maintenance and operations

Coordination of US CMS maintenance and operations, software and computing, and detector upgrades is crucial to the success of the US CMS research program



US CMS Operations Manager

US CMS Operations are sited at the host laboratory, Fermilab

- DOE and NSF jointly provide requirements, objectives, and funding
- Fermilab Director is responsible for management oversight of US CMS operations
- US CMS Operations Manager has principle authority for day-to-day management of US CMS operations

The US CMS Operations Manager is responsible for

- Appointing, after consultation with US CMS CB, the US L2Ms for subsystem management and coordination
- Maintaining close communication with DOE/NSF and FNAL Directorate
- Regularly interacting with CERN and CMS management on issues relating to US deliverables and/or resources
- Negotiating and signing US MOUs and annual SOWs specifying each institution's deliverables and resources
- Discussing budgets, R&D planning, and other issues with the US CMS collaboration



Level 2 Subsystems

The US CMS level 2 managers (L2Ms) were asked to consider the maintenance and operations activities associated with their subsystem and to provide:

- **Resource loaded Microsoft Project file of M&O cost estimate and schedule**
 - task oriented, with resources loaded on tasks
- **Estimated M&O costs for the period up to FY08**
 - installation and commissioning costs belong with the construction project
 - M&O begins when subsystem is installed and operating in the underground cavern
 - include only costs and resources associated with detector M&O
 - omit scope restoration, upgrade R&D, and upgrades from M&O activities



Subsystem M&O Costs

L2Ms were requested to attach all resources needed to maintain and operate their detector components

- Base program supported grad students, post-docs and senior scientists called out explicitly at zero cost
- Test beam and calibration costs after installation
- Electronics pool rentals and electronics maintenance
- M&S costs associated with M&O
- Technical support - engineers and technicians
- Any additional costs associated with the annual major shutdown

Incremental cost of maintaining senior scientists, post-docs and grad students with a significant detector service component at CERN are omitted from the present cost estimate



MS Project Template

A Microsoft Project template was provided to assist the L2Ms in deriving their M&O cost estimate and schedule

This is a variant of the template used for the construction project

The template provides for information on each individual activity, resource, task manager, and funding method and source



MSProject Template for M&O

uscms_m&o.mpp												
WBS	Task Name	Start	Duration	Cost	US Task?	EDIA?	M&S?	Team Act?	Grant?	Institution	Funding	Task Mgr
	US CMS Maintenance and Operations	Oct 1 '02	1500d	\$0.00	No	No	No	No	No			
1	Endcap Muon	Oct 1 '04	1000d	\$0.00	No	No	No	No	No			
2	Hadron Calorimeter	Oct 1 '04	1000d	\$0.00	No	No	No	No	No			
3	Trigger	Oct 3 '05	750d	\$0.00	No	No	No	No	No			
4	Data Acquisition	Oct 1 '04	1000d	\$0.00	No	No	No	No	No			
5	Electromagnetic Calorimeter	Oct 1 '04	1000d	\$0.00	No	No	No	No	No			
6	Forward Pixels	Oct 3 '05	750d	\$0.00	No	No	No	No	No			
7	Silicon Tracker	Oct 3 '05	750d	\$0.00	No	No	No	No	No			
8	Common Operations	Oct 1 '02	1500d	\$0.00	No	No	No	No	No			
8.1	CMS Category A Costs	Oct 1 '02	1500d	\$0.00	No	No	No	No	No			
8.2	Remote Control Room	Oct 1 '02	1500d	\$0.00	No	No	No	No	No			
8.3	Outreach and Education	Oct 1 '02	1500d	\$0.00	No	No	No	No	No			
9	Operations Management	Oct 1 '02	1500d	\$0.00	No	No	No	No	No			
9.1	US Operations Office	Oct 1 '02	1500d	\$0.00	No	No	No	No	No			
9.2	CERN Operations Office	Oct 1 '02	1500d	\$0.00	No	No	No	No	No			
10	Management Reserve	Oct 1 '02	1500d	\$0.00	No	No	No	No	No			
11	Detector Upgrades	Oct 1 '02	1500d	\$0.00	No	No	No	No	No			
11.1	Upgrade R&D	Oct 1 '03	1250d	\$0.00	No	No	No	No	No			
11.2	Upgrades	Oct 1 '02	1500d	\$0.00	No	No	No	No	No			

Name:	US CMS Maintenance and Operations	Duration:	1500d	<input type="checkbox"/> Fixed	Previous	Next
Start:	Oct 1 '02	Finish:	Sep 30 '08	Percent Complete:	0%	



Resource Rates

Generic resource rates were provided in the MSPProject M&O template:

subsystem_m&o											
ID	Resource Name	Initials	Group	Units	Peak	Std. Rate	Ovt. Rate	Cost/Use	Accrue At	Base Calendar	Code
1	base supported post-doc	b		0	0	\$0.00/d	\$0.00/d	\$0.00	Prorated	Standard	Labor
2	base supported engineer	b		0	0	\$0.00/d	\$0.00/d	\$0.00	Prorated	Standard	Labor
3	base supported technician	b		0	0	\$0.00/d	\$0.00/d	\$0.00	Prorated	Standard	Labor
4	project supported engineer	p		0	0	\$320.00/d	\$0.00/d	\$0.00	Prorated	Standard	Labor
5	project supported technician	p		0	0	\$130.00/d	\$0.00/d	\$0.00	Prorated	Standard	Labor
6	post-doc at cern dislocation allowar	p		0	0	\$0.00/d	\$0.00/d	\$0.00	Prorated	Standard	M&S
7	post-doc at cern travel allownace	p		0	0	\$0.00/d	\$0.00/d	\$0.00	Prorated	Standard	M&S
8	engineer resident at cern	e		0	0	\$400.00/d	\$0.00/d	\$0.00	Prorated	Standard	Labor
9	technician resident at cern	t		0	0	\$240.00/d	\$0.00/d	\$0.00	Prorated	Standard	Labor
10	post-doc for annual shutdown	p		0	0	\$0.00/d	\$0.00/d	\$0.00	Prorated	Standard	M&S
11	engineer for annual shutdown	e		0	0	\$0.00/d	\$0.00/d	\$35,000.00	Prorated	Standard	M&S
12	technician for annual shutdown	t		0	0	\$0.00/d	\$0.00/d	\$25,000.00	Prorated	Standard	M&S
13	subsystem maintenance m&s	s		0	0	\$0.00/d	\$0.00/d	\$100,000.00	Prorated	Standard	M&S

The L2Ms were requested to use their own (hopefully more realistic) rates if available



Subsystem M&O

The submitted subsystem MSProject M&O files have a range in the level of detail provided

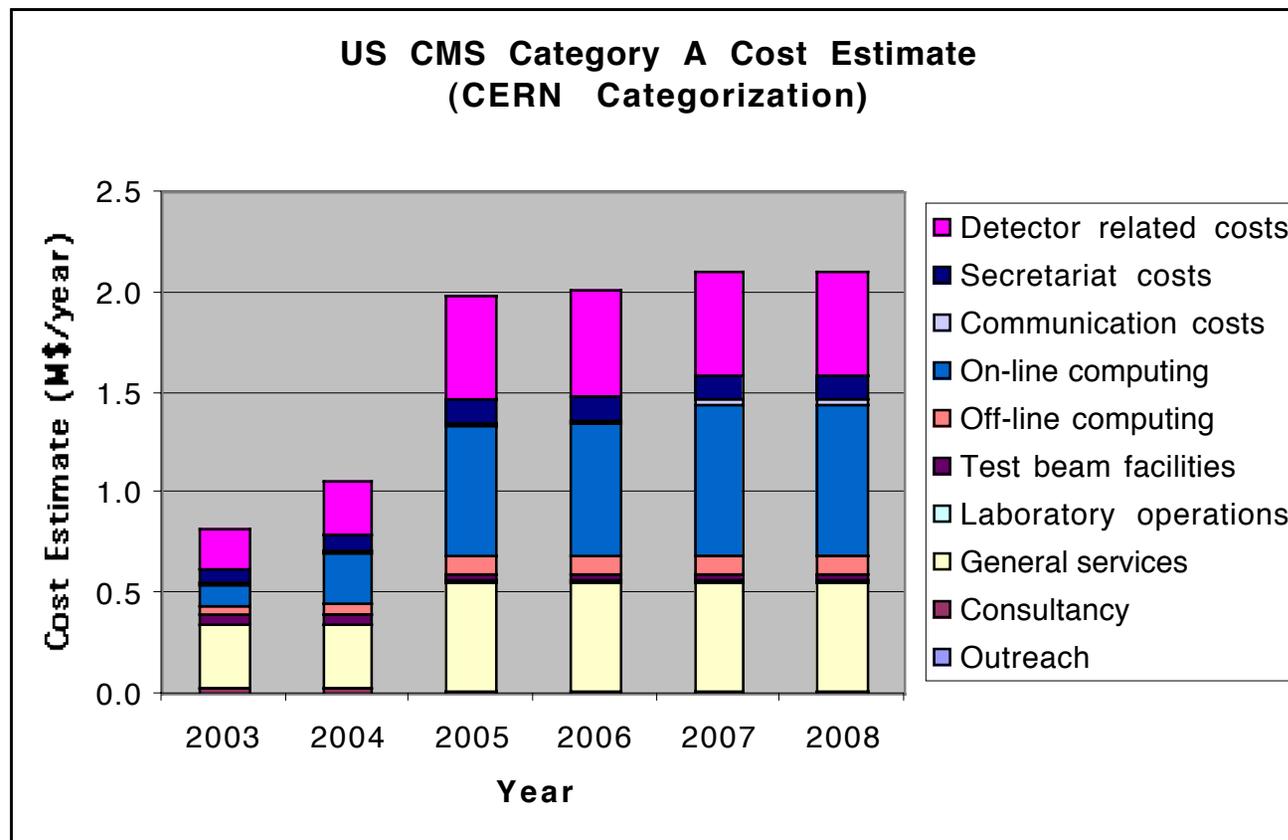
The subsystem M&O files were thoroughly rinsed (lightly scrubbed) by the project office

- **construction project activities and costs were removed**
 - activities prior to installation in underground cavern
- **CMS category A common costs were removed**
 - gas system costs
- **research program costs were removed (post-docs at CERN dislocation allowance)**
- **upgrade R&D and upgrade costs moved from subsystems to a separate WBS number**
- **a few cost estimates which we thought unreasonable were either decreased or increased after consultation with the relevant L2M**



Common Operations

The US CMS share of CMS common M&O costs (Category A costs) is estimated assuming a pro rata share of 23% and a CHF/USD rate of 1.5





Remote Control Room

A remote control room with adequate office space and sufficient services at Fermilab is a critical part of the strategy to create a coherent national US CMS research effort

Needed for both installation and commissioning and operations phase of CMS

- debug EMU and HCAL readout systems
- remote monitoring of operations

Estimate based on CDF Run II plans and Run I experience

- staffing level of ~1.5 FTE (high-level CP + assistant)

Need beginning in FY03 to monitor EMU and HCAL systems taking cosmic ray data in SX5



US CMS Operations Office

Operations Office branches are anticipated both in the U.S. and at CERN

- **Operations Office at Fermilab**
 - Overall coordination of US CMS M&O activities
 - Liaison with the host laboratory, funding agencies, US CMS collaboration and with CMS at CERN
 - Tracking and reporting M&O activities and costs
- **NSF branch of the U.S. operations office**
- **Operations Office at CERN**
 - Coordination of US CMS activities at CERN
 - Support for U.S. personnel on temporary or long term assignment at CERN (computing, shipping, travel, housing, ...)
 - Technical coordination for US CMS M&O activities
 - **management of a US CMS technician pool**



Operations Office Activities

The staffing level of the US CMS Operations Offices are derived from experience with the construction project and consideration of the tasks involved, and scale well from the CDF operations office at Fermilab

The Operations Office is largely a level of effort operation

M&S cost estimates associated with supporting the project office are obtained from construction project office experience

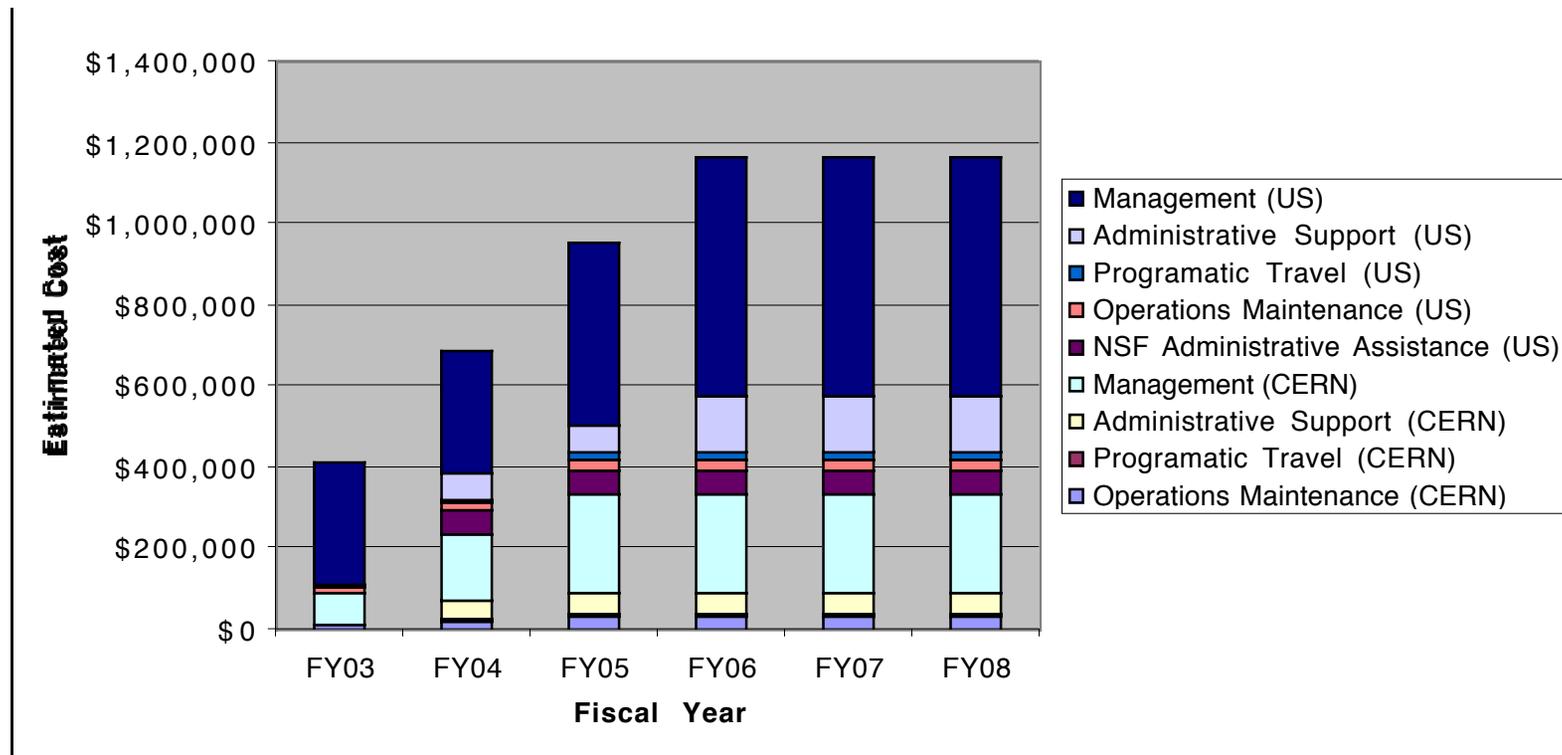
There is significant overlap with construction project office personnel; a smooth transition from construction to M&O activities is anticipated

- The detailed phasing from construction to M&O activities can only be specified after the M&O funding profile is known**



Operations Office Cost Estimate

The Operations Office cost estimate is largely level of effort; the staffing levels and M&S cost estimates are based on experience from the construction project office





Management Reserve

A management reserve of ~25% is explicitly called out as a separate WBS item

- A contingency analysis at the lowest level seems inappropriate given the nature of M&O
- This level is similar to the reserve held at the beginning of the detector construction project, where the mechanism worked well

Unanticipated problems will arise that must be solved within the given funding envelope

- currency exchange rate fluctuations
- performance problems with one or more US CMS subsystem components
- ...



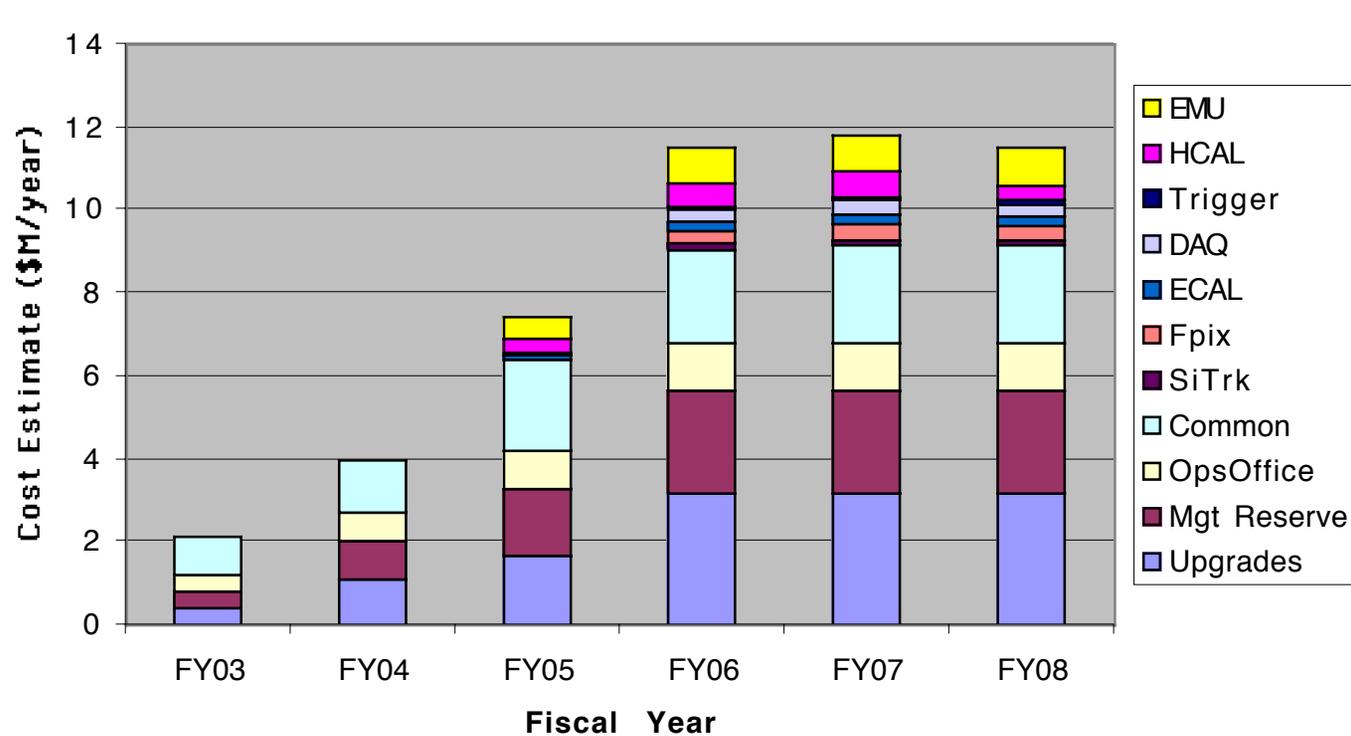
US CMS M&O Schedule

WBS	Task Name	2003		2004		2005		2006		2007		2008	
		Oct	Apr										
0	US CMS Maintenance and Operations												
1	Endcap Muon					■		■		■		■	
2	Hadron Calorimeter					■		■		■		■	
3	Trigger					■		■		■		■	
4	Data Acquisition					■		■		■		■	
5	Electromagnetic Calorimeter					■		■		■		■	
6	Forward Pixels					■		■		■		■	
7	Silicon Tracker					■		■		■		■	
8	Common Operations												
8.1	CMS Category A Costs	■		■		■		■		■		■	
8.2	Remote Control Room	■		■		■		■		■		■	
8.3	Outreach and Education	■		■		■		■		■		■	
9	Operations Management												
9.1	US Operations Office	■		■		■		■		■		■	
9.2	CERN Operations Office	■		■		■		■		■		■	
10	Management Reserve												
11	Detector Upgrades												
11.1	Upgrade R&D			■		■		■		■		■	
11.2	Upgrades	■		■		■		■		■		■	



US CMS M&O Cost Estimate

The cost estimate and resource usage were extracted from the MSPProject files for the years FY03 - FY08:

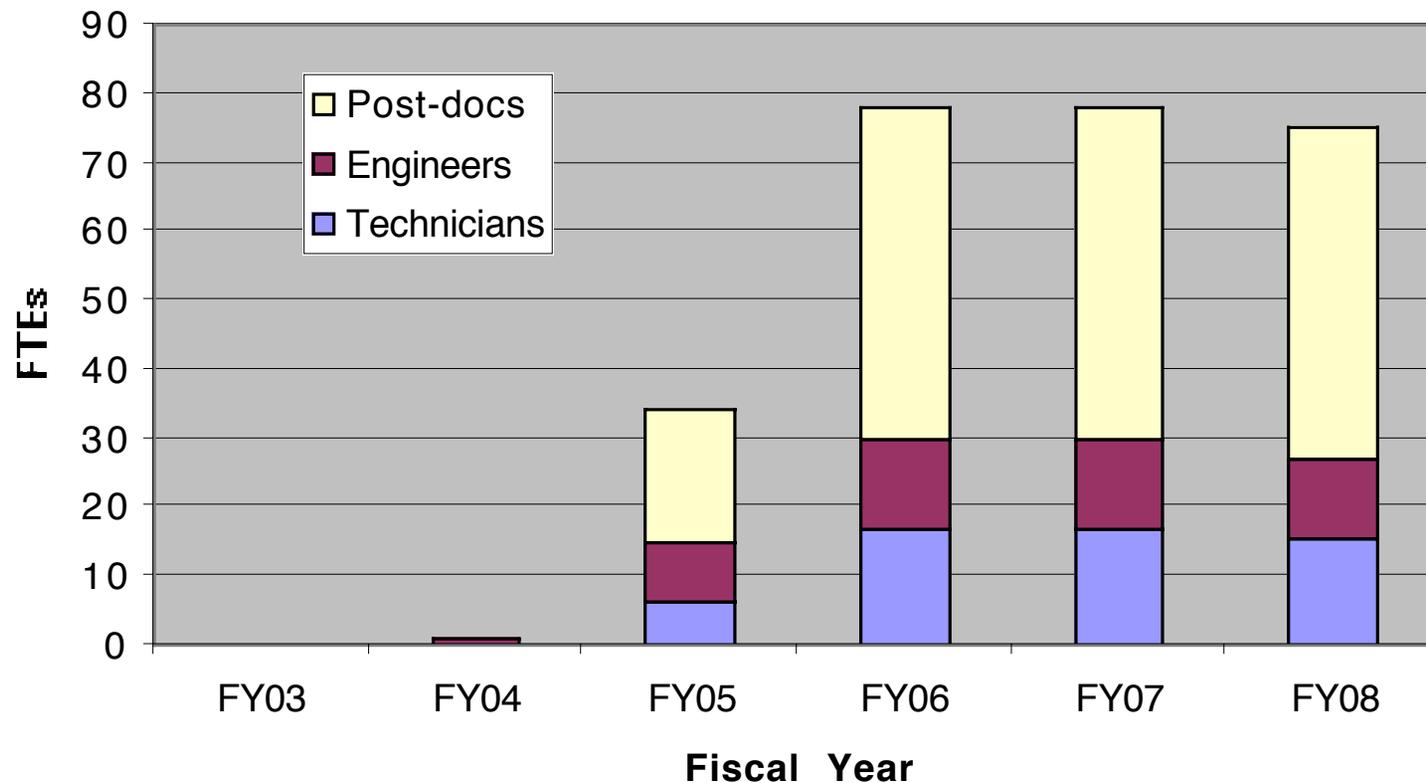


The detailed cost estimates, schedules, and WBS dictionaries are provided in the binders



US CMS M&O Resource Usage

The incremental costs of supporting ~50 post-docs/year with a significant detector service component at CERN are not included in the cost estimates: ~\$0.5M-\$1.0M per year





Summary

Resource loaded MSProject files were obtained from each L2M with their estimate of M&O tasks and costs

Common operations, operations office branches in the US and at CERN, management reserve, and detector upgrade costs are included in our M&O cost estimates

M&O schedules, cost estimates, and WBS dictionaries are obtained from the subsystem MSProject files

Estimated maintenance and operation costs increase from ~\$2M in FY03 to ~\$12M in FY06

Additional costs include maintaining scientific personnel at CERN, as well as Software and Computing Project costs