

Project Manager's Quarterly Progress Report - 2nd Quarter FY 2000
U.S. Large Hadron Collider Construction Project

1. PROJECT IDENTIFIERS

Reporting Period: Through **March 31, 2000**
Program Sponsors: DOE High Energy Physics Division/NSF Physics Division
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2. PROJECT DESCRIPTION

The Department of Energy (DOE) and the National Science Foundation (NSF) have signed agreements committing to collaboration in the construction of the Large Hadron Collider (LHC) at CERN (European Laboratory for Particle Physics) and two of its associated detectors. The U.S. fabrication effort will be carried out at, or under the supervision of, U.S. universities and national laboratories under the terms and conditions described in the International Collaboration Agreement (Agreement) and its Accelerator and Experiments Protocols. The U.S. LHC Construction Project is defined by the goods and services to be provided to CERN under the terms of the Agreement between DOE, NSF, and CERN. These goods and services include DOE contributions to the LHC accelerator, and DOE and NSF contributions to the ATLAS (A Toroidal LHC Apparatus) and CMS (Compact Muon Solenoid) experiments.

The DOE contribution to the LHC accelerator consists of items provided by DOE National Laboratories and CERN direct purchases from U.S. industrial firms. The scope of these contributions is addressed in the Accelerator Protocol and described in detail in an Implementing Arrangement between the collaborating DOE National Laboratories and CERN. The DOE and NSF contributions to the ATLAS and CMS detectors consist of items supplied by the collaborating U.S. universities and DOE National Laboratories. The scope of these contributions is addressed in the Experiments Protocol and described in detail in Memoranda of Understanding for collaboration on construction of each experiment.

The U.S. LHC Construction Project includes the U.S. ATLAS, U.S. CMS, and U.S. LHC Accelerator projects. This report summarizes the overall status of the U.S. LHC Construction Project effort and includes more detailed status information on each sub-project. Additional information can be accessed at the following web sites:

U.S. LHC Project - <http://www.hep.net/doe-hep/lhc.html>

LHC Project - <http://www.lhc.cern.ch/> U.S. LHC Accelerator - <http://www-td.fnal.gov/>
ATLAS - <http://atlasinfo.cern.ch/Atlas/Welcome.html> U.S. ATLAS - <http://www.usatlas.bnl.gov/>
CMS - <http://cmsinfo.cern.ch/Welcome.html> U.S. CMS - <http://uscms.fnal.gov/>

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3. PROJECT MANAGER'S NARRATIVE HIGHLIGHTS

The current list of DOE/NSF project reviews and status meetings is shown below:

<u>Project</u>	<u>Event</u>	<u>Date</u>
U.S. LHC Accelerator	Quarterly Status Meeting	January 25, 2000
U.S. ATLAS	DOE/NSF Review	February 28-March 2, 2000
U.S. CMS	DOE/NSF Review	April 11-13, 2000
U.S. LHC Accelerator	DOE/NSF Review	May 16-17, 2000
U.S. ATLAS	Quarterly Status Meeting	June 9, 2000
U.S. CMS	Quarterly Status Meeting	July 14, 2000
U.S. LHC Accelerator	Quarterly Status Meeting	August 22, 2000

The results of these activities are documented in formal reports and meeting notes. The U.S. CMS and ATLAS projects submit monthly reports and the U.S. LHC Accelerator project submits a quarterly report. Current performance data is summarized in the following tables:

Table 3.1, Schedule Performance Indices

	Planned Complete (BCWS/BAC)	Actual Complete (BCWP/BAC)	Schedule Performance (BCWP/BCWS)
U.S. ATLAS	32%	24%	74%
U.S. CMS	52%	45%	86%
U.S. LHC Accelerator	47%	43%	91%

Table 3.2, Contingency Status (in thousands of dollars)

	Total Project Cost (TPC)	Budget at Completion (BAC)	Contingency	Budgeted Cost of Work Performed (BCWP)	Remaining Work to be Performed (BAC-BCWP)	Contingency/ (BAC-BCWP)
US ATLAS	163,750	120,560	43,190	26,189	94,371	36%
US CMS	167,250	124,396	42,854	51,121	73,275	58%
US Accelerator	110,000	94,232	15,768	37,710	56,522	28%

Table 3.3, Cost & Schedule Performance (in thousands of dollars)

	Cumulative Costs to Date					Costs at Completion		
	Budgeted Cost		Actual Cost	Variance Schedule	Variance Cost	Revised		
	Work Scheduled	Work Performed				Budgeted	Estimate	Variance
U.S. ATLAS	38,515	28,597	27,024	-9,918	1,573	163,750	163,750	0
U.S. CMS	64,773	55,713	57,922	-9,060	-2,209	167,250	167,250	0
U.S. LHC Accelerator	44,299	40,461	42,471	-3,838	-2,010	110,000	110,000	0
CERN Invoices	14,615	14,615	14,615	0	0	90,000	90,000	0
U.S. LHC Total	162,202	139,386	142,032	-22,816	-2,646	531,000	531,000	0

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4. PROJECT MANAGER'S ASSESSMENT

The U.S. projects continue to meet their goals and are reliable and influential partners in the construction of the ATLAS and CMS detectors and the LHC machine.

Cost - Cost performance is good as material contracts are typically below estimates and labor costs continue to track close to plans. Project reviews and reports confirm that each project has adequate contingency available. The detector projects are in the production phase and cost experience on production labor will be an important future indicator of cost performance.

Schedule - Schedule performance is measured through milestone completion and by earned value. These measurements indicate that schedule progress is behind plans averaging about eighty-five percent of the baseline plan. CERN expects to complete construction of the LHC and commence initial operations in 2005. The U.S. schedules are consistent with this goal.

Technical - We remain confident that the U.S. deliverables to CERN can be realized with the planned funding. The U.S. LHC Construction Project deliverables are accepted by CERN and approved by the DOE/NSF Joint Oversight Group. We hope to provide additional items to CERN, within the approved funding, should cost performance be favorable.

ISSUES

LHC Schedules - CERN is conducting a review of the schedules for the LHC machine and the ATLAS and CMS experiments. The results of this review will be presented at the CERN Council meeting in December 2000. Delays on the order of six months in the civil construction work at the ATLAS and CMS construction sites indicate that there will be some delay in the official completion date of the project. The current schedule has beam commissioning in July 2005. DOE and NSF staff are monitoring this activity and considering actions necessary to mitigate the impacts of a delay.

ATLAS and CMS Technical Integration – Staff levels for ATLAS and CMS technical integration and coordination has been less than necessary. Recently CERN provided additional positions to ATLAS and CMS and will evaluate the situation as part of the schedule review.

Radiation Hard Electronics - Although there has been technical progress in the development of radiation hard electronics for the ATLAS and CMS experiments, significant challenges remain including production yields and the viability/interest of current vendors. Export license and dual-use technology issues are additional complications.

Russian Collaborators - Some collaborators on the experiments are behind on their commitments. The Russian collaborators are well behind their original plan but are beginning to show some improvement. ATLAS and CMS management continue to address shortfalls from Russian and other collaborators when schedules dictate. U.S. CMS has accepted additional responsibilities for the hadron calorimeter tasks in order to hold schedule.

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5. NARRATIVE SUMMARY

5.1 U.S. ATLAS CONSTRUCTION PROJECT

ATLAS International – The ATLAS Spokesperson, Peter Jenni, addressed the status of the overall ATLAS experiment at the April 2000 Resource Review Board meeting. Highlights from the Spokesperson are summarized below.

- The fabrication of the large, time-critical components of the common projects are well underway including the magnets and the liquid argon cryostats.
- Emphasis is being given to integration issues that are on the critical path.
- Critical items to be resolved include the barrel toroid coil casing, the liquid argon electrodes, and the risks in radiation-hard electronics. The collaboration is making dedicated efforts to address these problems and to recover schedule.
- ATLAS civil construction work is behind schedule due to adverse soil conditions.
- The overall ATLAS and detector subsystem schedules are under revision.
- The project is nearly on track but with a very difficult schedule for completion in 2005.

U.S. ATLAS - A DOE/NSF Review was conducted on February 29 - March 2, 2000, at Brookhaven National Laboratory. The review committee concluded that there is good technical progress on all fronts. The U.S. baseline scope is expected to be completed in time to meet the ATLAS installation requirements. There is some concern about delays in the start of production of the muon drift tube chambers (Harvard, Michigan, and Washington) and the transition radiation tracker barrel (Indiana, Duke, Hampton). U.S. ATLAS highlights are summarized below.

- Fabrication of the barrel cryostat for the liquid argon calorimeter is progressing quite well at Kawasaki Heavy Industries. Photos are at <http://www.usatlas.bnl.gov/barrel.htm>.
- Tile calorimeter modules are now being delivered to CERN and progress on mechanical assemblies is slightly ahead of schedule.
- There are mixed results on the development of radiation hard electronics. This issue will continue to require a substantial, coordinated effort by the U.S. groups and their international collaborators.
- There are delays in bringing the Transition Radiation Tracker detectors into production. The current expectation is that production will be underway in early June.
- The first muon drift tube chambers are in production at Harvard and a team from ATLAS will visit each of the U.S. production sites in May to validate readiness to proceed with full production.
- The U.S. ATLAS project office is finalizing the revised cost baselines and schedules resulting from the estimate-to-complete exercise. Formal changes to the Level 2 (DOE/NSF control level) baselines will be processed in May.
- The U.S. project team continues to work with the ATLAS subsystem project leaders on schedule issues in an effort to keep U.S. deliverables consistent with ATLAS need dates.

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5.2 U.S. CMS CONSTRUCTION PROJECT

CMS International - The CMS Spokesperson, Michel Della Negra, presented the status of the CMS experiment at the Resource Review Board meeting in April 2000. Highlights presented by the Spokesperson are summarized below.

- There is good progress on the solenoid magnet with some delay in coil winding.
- The experiment has taken beneficial occupancy of the assembly building.
- There are delays in the excavation of the access shafts.
- The collaboration has approved a new strategy for the central tracker that avoids staging. This strategy eliminates the micro-strip gas chambers and relies entirely on silicon layers.
- CMS leadership has evaluated the risk of funding shortfalls from collaborating countries including Russia and has developed contingency plans for addressing the shortfall.
- CMS is making plans for a "working" detector ready for first beam in 2005, taking into account technical and financial constraints. This plan supports completion of major fractions of each detector subsystem in time for first beam.

U.S. CMS - A DOE/NSF Review was conducted on April 11-13, 2000, at Fermilab. The review committee was impressed by the technical progress and generally satisfied with cost performance. There are some schedule concerns, in particular a delay in the design of the front-end electronics for the hadron calorimeter and the start of production for the cathode strip chamber assemblies. U.S. CMS highlights are summarized below.

- The barrel brass absorber and scintillator tiles for the Hadron Calorimeter are on schedule. The front-end electronics are behind schedule and the project is evaluating an alternative plan that would use the Electromagnetic Calorimeter front end electronics.
- Pre-production versions of the Cathode Strip Chambers for the Endcap Muon system have been successfully tested at the LHC luminosity rates in the CERN Gamma Irradiation Facility. Panel production continues and the production start for the chambers is now forecast for the end of June.
- The critical path item for the Electromagnetic Calorimeter is the delivery of the lead-tungstate crystals. The crystals are not a U.S. responsibility. There is schedule slippage in the U.S. electronics effort but this is not a major concern due to the revised schedule for the crystals. The problems with radiation hardness are being addressed through work on an alternative design.
- The Trigger/Data Acquisition System Application Specific Integrated Circuit (ASIC) submissions for the calorimeter are in progress. The muon trigger has been redesigned.
- A readout chip setup for the Forward Pixels has successfully completed a test beam run at Fermilab.
- All U.S. responsibilities for CMS Common Projects are under contract. Fermilab awarded the final contracts for aluminum stabilizer and bulk aluminum. The first 1400-ton barrel yoke ring is complete.

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5.3 U.S LHC ACCELERATOR CONSTRUCTION PROJECT

LHC - CERN is maintaining the July 2005 turn on date for the machine. Interim milestones are routinely met but there is essentially no schedule float. Delays in civil construction work require the development of work around plans.

U.S. LHC Accelerator - A DOE review was conducted on May 3-4, at Brookhaven National Laboratory. U.S. LHC Accelerator highlights are summarized below.

Interaction Region (IR) Quadrupoles

- The short model magnet R&D program was completed this quarter. The final 1.8 meter model magnet was tested in two thermal cycles and confirms that the developed magnet design and fabrication technology meet all LHC requirements.
- An Engineering Design Review of the quadrupole cold mass held in March recommended starting construction of the full-length prototypes.
- The heat exchanger test units were delivered to CERN.

Interaction Region and RF Region Dipoles

- The first 3-meter prototype magnet was produced and successfully completed quench performance tests. A second prototype will be fabricated.
- The production schedule will be delayed four to six months to better match CERN's schedules for supplying parts and approved interface specifications.

IR Feedboxes and Absorbers

- Detailed design work on the Feedboxes and Absorbers is well underway.
- Functional specification for IR absorbers submitted to CERN for approval.

Superconducting Cable Testing and Production Support

- Upgrades to the superconductor test facility at BNL are completed and a few pre-production samples were delivered by CERN. The supply of production samples has not yet begun and is well behind schedule.

Accelerator Physics

- A successful workshop on Accelerator Physics Experiments for Future Hadron Colliders was held at BNL in February with participation by CERN and U.S. labs.

CERN Direct Purchases - DOE reimburses CERN for their payments to qualified U.S. vendors [Reference U.S.-CERN Agreement and Accelerator Protocol]. The status is shown in Table 5.1.

Table 5.1, Status of DOE Payments (in \$000)

Contract Item	Company (U.S. supplier)	Amount Paid	Contract Price	w/ options & escalation
Niobium-Titanium Alloy Bars	Wah Chang	11,952	38,667	48,431
Niobium Sheets	Wah Chang	1,512	5,633	6,951
Superconducting Cable	IGC Advanced Superconductors	1,151	16,447	20,985
Polyamide Insulation Film	Kaneka High Tech Materials	0	5,425	6,510
Enameled Superconductor	IGC Advanced Superconductors		746	968
Totals		14,615	66,918	83,875

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6. FINANCIAL/COST STATUS AND PLANS

TOTAL PROJECT FUNDING PLAN (then year millions of dollars)*

Fiscal Year	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	Total
Machine Funding Profiles (DOE)											
US LHC	2.00	6.67	14.00	15.40	20.10	17.80	17.00	10.20	6.83	0.00	110.00
CERN Direct	0.00	0.00	0.00	8.09	13.11	18.50	14.20	18.80	17.30	0.00	90.00
Machine Total	2.00	6.67	14.00	23.49	33.21	36.30	31.20	29.00	24.13	0.00	200.00
Detector Funding Profiles (DOE and NSF)											
US ATLAS	1.70	3.71	10.05	25.63	28.43	28.80	27.85	22.89	14.69	0.00	163.75
DOE	1.70	3.71	10.05	9.00	16.49	16.51	15.20	15.60	14.69	0.00	102.95
NSF	0.00	0.00	0.00	16.63	11.94	12.29	12.65	7.29	0.00	0.00	60.80
US CMS	2.30	4.62	10.95	38.03	24.26	21.27	27.81	22.83	15.18	0.00	167.25
DOE	2.30	4.62	10.95	32.51	20.30	17.19	23.60	20.40	15.18	0.00	147.05
NSF	0.00	0.00	0.00	5.52	3.96	4.08	4.21	2.43	0.00	0.00	20.20
Detectors Total	4.00	8.33	21.00	63.66	52.69	50.07	55.66	45.72	29.87	0.00	331.00

TOTAL DOE & NSF FUNDS, COSTS, & COMMITMENTS (cumulative \$000)†

U.S. LHC Construction Project	A = Funds Allocated	B = Estimate Actual Costs	C = Open Commitments	D= B+C Total	A-D = Funds Available
U.S. ATLAS	69,520	27,634	4,837	32,471	37,049
U.S. CMS	80,160	56,018	1,905	57,923	22,237
U.S. LHC Accelerator	58,170	39,622	2,257	41,879	16,291
CERN Direct Purchases	21,200	14,615	0	14,615	6,585
Total	229,050	137,889	8,999	146,888	82,162

* The annual funding distribution between projects is subject to change.

† Based on financial reports from the U.S. LHC construction projects. NSF funding is provided after the beginning of the fiscal year and therefore it is necessary to carry-over funding into the subsequent fiscal years.

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7. DOE/NSF COST BASELINES AT LEVEL 2 (in \$000)

U.S. ATLAS Cost Baseline

<u>WBS</u>	<u>Description</u>	<u>Previous</u>	<u>Change</u>	<u>Current</u>
1.1	Silicon System	17,927	102	18,029
1.2	Transition Radiation Tracker	8,187		8,187
1.3	Liquid Argon Calorimeter	35,241	4,630	39,871
1.4	Tile Calorimeter	6,843	107	6,950
1.5	Muon Spectrometer	19,835		19,835
1.6	Trigger/Data Acquisition System	15,211	-4,211	11,000
1.7	Common Projects	9,179		9,179
1.8	Education	286		286
1.9	Project Management	7,779		7,779
	Contingency	43,262	-628	42,634
	U.S. ATLAS Total Project Cost Baseline	163,750		163,750

U.S. CMS Cost Baseline

<u>WBS</u>	<u>Description</u>	<u>Previous</u>	<u>Change</u>	<u>Current</u>
1.1	Endcap Muon	32,010	1,836	33,846
1.2	Hadron Calorimeter	35,727	1,440	37,167
1.3	Trigger and Data Acquisition	13,525	-550	12,975
1.4	Electromagnetic Calorimeter	8,817	638	9,455
1.5	Forward Pixels	6,101	-83	6,018
1.6	Common Projects	23,000	0	23,000
1.7	Project Office	5,168	957	6,125
1.8	Silicon	0	0	0
	Contingency	42,902	-4,238	38,664
	U.S. CMS Total Project Cost Baseline	167,250	0	167,250

U.S. LHC Accelerator Cost Baseline

<u>WBS</u>	<u>Description</u>	<u>Previous</u>	<u>Change</u>	<u>Current</u>
1.1	Interaction Region Components	49,225	302	49,527
1.2	Radio Frequency Straight Section	13,493	1,153	14,646
1.3	Superconducting Wire and Cable	11,352	516	11,868
1.4	Accelerator Physics	4,925	208	5,133
1.5	Project Management	15,291	-1,741	13,550
	Contingency	15,714	-438	15,276
	U.S. LHC Accelerator Total Project Cost Baseline	110,000	0	110,000

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8. SCHEDULE STATUS AND PLANS

8.1 U.S. ATLAS Construction Project Milestones

U.S. ATLAS Major Project Milestones (Level 1)

Description	Baseline Schedule	Forecast (F) Date	Actual (A) Date
Project Start	01-Oct-95	01-Oct-95 (F)	01-Oct-95 (A)
Project Completion	30-Sep-05	30-Sep-05 (F)	

U.S. ATLAS Major Project Milestones (Level 2)

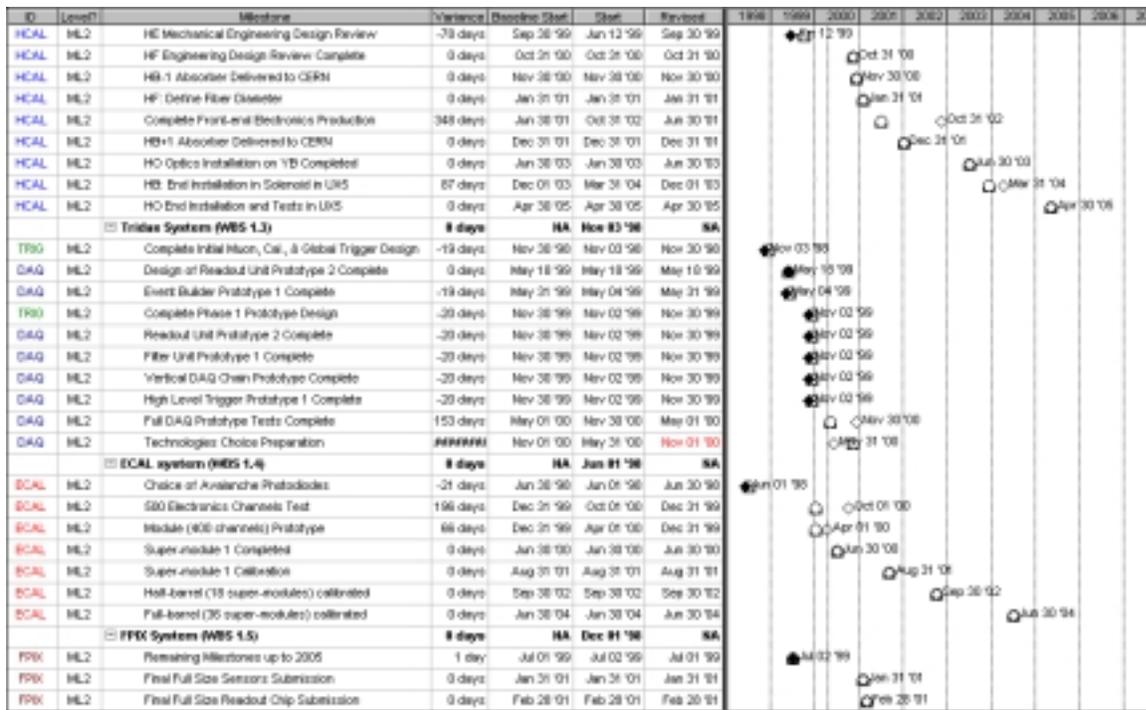
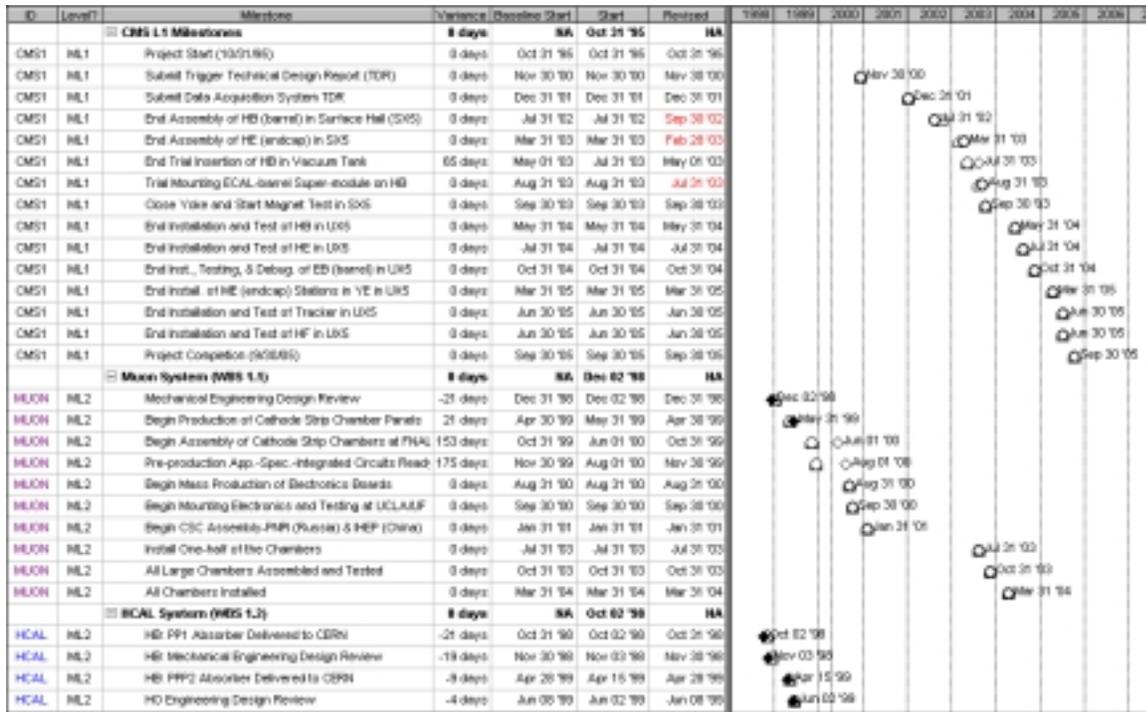
Subsystem	Schedule Designator	Description	Baseline Schedule	Forecast (F) / Actual (A)
Silicon (1.1)	SIL L2/1	Start Full Silicon Strip Electronics Production	30-Mar-01	30-Mar-01 (F)
	SIL L2/2	Start Full Strip Module Production	15-Oct-99	05-Jun-01 (F)
	SIL L2/3	ROD Design Complete	14-Apr-00	22-Nov-00 (F)
	SIL L2/4	Complete Shipment of Silicon Strip Module Production	08-Aug-03	26-Aug-03 (F)
	SIL L2/5	ROD Installation/Final Commissioning Complete	30-Sep-04	30-Sep-04 (F)
TRT (1.2) Mechanical	TRT L2/1	Final Design Complete	31-Dec-98	07-Dec-98 (A)
	TRT L2/2	Module Production Complete	29-Mar-02	03-Jun-02 (F)
	TRT L2/3	Barrel Construction Complete	31-Dec-02	31-Dec-02 (F)
Electrical	TRT L2/4	Select Final Electrical Design	31-Jul-00	19-Jul-00 (F)
	TRT L2/5	Start Production	31-Jul-00	10-Jan-01 (F)
	TRT L2/6	Installation Complete	30-Sep-04	30-Sep-04 (F)
LAr Cal (1.3)	LAr L2/1	Cryostat Contract Award	24-Jul-98	05-Aug-98(A)
	LAr L2/2	Barrel Feedthroughs Final Design Review	30-Sep-98	02-Oct-98 (A)
	LAr L2/3	Start Electronics Production (Preamps)	01-Jun-99	30-Jun-00 (F)
	LAr L2/4	FCAL Mechanical Design Complete	14-Dec-98	15-Dec-99 (A)
	LAr L2/5	FEB SCA Prod. Chip Submission/Contract Award	03-Jul-00	03-Jul-00 (F)
	LAr L2/6	Level 1 Trigger Final Design Complete	01-Mar-00	02-Jan-01 (F)
	LAr L2/7	ROD Final Design Complete	01-Jun-00	01-Jun-01 (F)
	LAr L2/8	Motherboard System Production Complete	01-Jan-01	01-Jun-01 (F)
	LAr L2/9	Cryostat Arrives at CERN	30-Mar-01	30-Mar-01 (F)
	LAr L2/10	Barrel Feedthroughs Production Complete	18-Jul-01	31-Jul-01 (F)
	LAr L2/11	FCAL-C Delivered to EC	03-Sep-01	03-Sep-01 (F)
	LAr L2/12	FCAL-A Delivered to EC	01-Nov-02	03-Mar-03 (F)
Tile Cal (1.4)	Tile L2/1	Start Submodule Procurement	01-Sep-97	01-Sep-97 (A)
	Tile L2/2	Technology Choice for F/E Electronics	15-Nov-97	15-Nov-97 (A)
	Tile L2/3	Start Module Construction	01-May-99	20-Sep-99 (A)
	Tile L2/4	Start Production of Motherboards & Digitizer Boards	02-Jul-99	01-May-00(F)
	Tile L2/5	Start Installation at CERN	01-Jun-02	01-Jun-02 (F)
	Tile L2/6	Module Construction Complete	01-Oct-02	10-May-02 (F)

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Subsystem	Schedule Designator	Description	Baseline Schedule	Forecast (F) / Actual (A)
	Tile L2/7	Installation at CERN Complete	01-May-04	01-May-04 (F)
Muon (1.5)	Muon L2/1	Start MDT Chambers Lines 1 and 3	04-Jan-99	01-May-00 (F)
	Muon L2/2	Start CSC Chamber Production	01-Jul-99	02-Oct-00 (F)
	Muon L2/3	ASD Chip Design Complete	29-Oct-99	01-Jun-01 (F)
	Muon L2/4	Final Design of Global Alignment Devices Complete	28-Apr-00	31-May-00 (F)
	Muon L2/5	CSC IC Production Complete	30-Jun-00	30-Jun-00 (F)
	Muon L2/6	Kinematic Mount Design Complete	30-Jan-01	30-Jan-01 (F)
	Muon L2/7	MDT Chambers (U.S.) Production Complete	30-Sep-03	23-Sep-04 (F)
	Muon L2/8	Kinematic Mount Production Complete	31-Dec-03	10-May-04 (F)
	Muon L2/9	ROD Production Complete	30-Jan-04	06-Jan-04 (F)
	Muon L2/10	MDT Off-Chamber Electronics Production Complete	28-May-04	06-Jan-04 (F)
	Muon L2/11	CSC Assembly/Testing at CERN Complete	31-Dec-04	17-Dec-04 (F)
	Muon L2/12	Global Alignment Final Assembly/Checkout Complete	31-Dec-04	31-Mar-05 (F)
Trigger/DAQ (1.6)	TDAQ L2/1	Select Final LVL2 Architecture	31-Dec-99	31-Mar-00 (F)
	TDAQ L2/2	LVL2 Trigger Design Complete	31-Dec-01	31-Dec-01 (F)
	TDAQ L2/3	LVL2 Trigger Prototype Complete	31-Dec-01	30-Sep-01 (F)
	TDAQ L2/4	Start Production	08-Jan-02	08-Jan-02 (F)
	TDAQ L2/5	Start Installation & Commissioning	05-Mar-02	05-Mar-02 (F)
	TDAQ L2/6	Production Complete	31-Dec-04	29-Oct-04 (F)
	TDAQ L2/7	LVL2 Installation & Commissioning Complete	31-Dec-04	31-Dec-04 (F)

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8.2 U.S. CMS Construction Project Milestones



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9. TECHNICAL BASELINE STATUS

U.S. ATLAS Construction Project - No change. The U.S. ATLAS collaboration defined a list of initial deliverables representing the U.S. contribution to ATLAS. This list was approved by the JOG in March 1998. Deliverables are listed in the U.S. ATLAS Construction Project Management Plan, Appendix 3.

U.S. CMS Construction Project - No change. The U.S. CMS collaboration defined a list of deliverables representing the U.S. contribution to CMS. This list was approved by the JOG in October 1998. The scope of U.S. CMS contribution is described in the U.S. CMS Management Plan, Appendix 2.

U.S. LHC Accelerator Construction Project - No change. U.S. LHC Accelerator Project - The U.S. deliverables to CERN are defined in the Implementing Arrangement to the Accelerator Protocol. The Implementing Arrangement was signed by the CERN and U.S. signatories in July 1998. Reference the U.S. LHC Accelerator Project Management Plan, Annex II, (Approved 6/15/98).

CERN Direct Purchases - No change. CERN will procure from U.S. industrial firms supplies required to construct the LHC accelerator. These supplies will include superconducting alloy, cable, insulation, and other materials.

10. BASELINE CHANGE ACTIVITY

<u>Baseline Control Level</u>	<u>Baseline Changes</u>
Level 1, DOE/NSF Joint Oversight Group	No changes this quarter
Level 2, DOE/NSF Project Office	
U.S. ATLAS	Changes to the Level 2 cost baseline.
U.S. CMS	Changes to the Level 2 cost baseline. One milestone change.
U.S. LHC Accelerator	Changes to the Level 2 cost baseline.

U.S. ATLAS – Cost changes were approved this quarter resulting in increases to the Level 2 cost baseline and a reduction to the contingency budget.

U.S. CMS – One change to a Level 2 control milestone was approved this quarter. In addition there were changes to the Level 2 cost baselines.

U.S. LHC Accelerator – Changes were approved this quarter that increased the Level 2 cost baselines and reduced the contingency budget by \$490K.

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APPENDIX A - FUNDING BY INSTITUTION (in thousands of dollars)

U.S. CMS Construction Project

Institution	FY 1998				FY 1999				FY 2000				Grand Total
	DOE		NSF	Total	DOE		NSF	Total	DOE		NSF	Total	
	Grant	Contract			Grant	Contract			Grant	Contract			
FNAL	0	5,517	0	5,517	0	10,817	40	10,857	0	5,981	0	5,981	22,355
Fairfield	0	29	0	29	0	0	0	0	0	10	0	10	39
Maryland	90	65	0	155	0	132	131	263	0	250	0	250	668
Boston U.	0	32	0	32	31	111	0	142	0	132	0	132	306
Florida State	60	54	0	114	71	118	0	189	80	54	0	134	437
U. of Minnesota	60	95	0	155	161	452	0	613	141	202	0	343	1,111
U. of Iowa	77	62	0	139	20	5	0	25	0	453	0	453	617
U. of Rochester	127	1,159	0	1,286	262	485	0	747	441	253	0	694	2,727
Notre Dame	0	52	0	52	0	44	184	228	0	14	193	207	487
Purdue	38	135	0	173	49	166	0	215	0	175	0	175	563
U. of Miss.	46	100	0	146	68	91	0	159	69	108	0	236	541
U. of Florida	44	95	0	139	184	412	0	596	333	853	0	1,186	1,921
Ohio State U.	140	64	0	204	275	212	0	487	196	732	0	928	1,619
Carnegie Mellon	0	113	0	113	0	291	0	291	0	312	0	312	716
Rice	138	19	0	157	102	56	0	158	132	16	0	148	463
U. of Wisconsin	533	1,052	0	1,585	471	3,598	0	4,069	459	3,197	0	3,656	9,310
U.C. Davis	34	100	0	134	0	78	0	78	263	502	0	765	977
UCLA	150	87	0	237	249	173	0	422	244	391	0	635	1,294
U.C. Riverside	20	10	0	30	0	164	0	164	0	70	0	70	264
John Hopkins	0	29	0	29	0	0	70	70	0	0	40	40	139
Northwestern	0	59	0	59	5	26	0	31	0	114	0	114	204
Rutgers	0	13	0	13	0	0	34	34	0	2	140	142	189
Princeton	0	256	0	256	0	626	0	626	0	667	0	667	1,549
Caltech	0	148	0	148	0	458	0	458	0	367	0	367	973
U.C. San Diego	11	0	0	11	11	90	24	125	36	0	0	36	172
Northeastern	0	0	0	0	0	0	3,370	3,370	0	0	1,741	1,741	5,111
U. Ill.-Chicago	0	0	0	0	0	0	124	124	0	0	309	309	433
U. of Nebraska	0	0	0	0	0	0	24	24	0	0	2	2	26
MIT	0	37	0	37	15	67	0	82	0	78	0	78	197
Iowa State	0	0	0	0	0	0	19	19	0	356	0	356	375
Subtotal	1,568	9,382	0	10,950	1,974	18,672	4,020	24,666	2,394	15,289	2,425	20,167	55,783
Reserve	0	0	0	0	0	3,401	1,524	4,925	0	0	0	0	0
Total	1,568	9,382	0	10,950	1,974	22,073	5,544	29,591	2,394	15,289	2,425	20,167	55,783

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U.S. ATLAS Construction Project

Institution	FY 1998				FY 1999				FY 2000				Grand Total
	DOE		NSF	Total	DOE		NSF	Total	DOE		NSF	Total	
	Grant	Contract			Grant	Contract			Grant	Contract			
ANL	0	1,098	0	1,098	0	967	0	967	0	922	0	922	2,987
BNL	0	3,903	0	3,903	0	2,581	0	2,581	0	6,429	0	6,429	12,913
LBNL	0	633	0	633	0	715	0	715	0	420	0	420	1,768
SUNY/Albany	20	0	0	20	48	0	0	48	50	0	0	50	118
U. of Arizona	320	100	0	420	634	0	0	634	557	0	0	557	1,611
Boston U.	224	0	0	224	298	0	0	298	287	0	0	287	809
Brandeis U.	265	45	0	310	0	0	593	593	0	0	478	478	1,381
U.C.Irvine	193	0	0	193	0	0	93	93	0	0	0	0	286
U.C. SantaCruz	404	0	0	404	63	0	0	63	0	0	568	568	1,035
U. of Chicago	0	54	0	54	0	0	1,069	1,069	0	0	264	264	1,387
Duke U.	190	0	0	190	601	0	0	601	417	0	0	417	1,208
Hampton U.	0	0	0	0	0	0	538	538	0	0	293	293	831
Harvard	234	0	0	234	0	0	654	654	0	0	390	390	1,278
U. of Illinois	50	159	0	209	347	0	0	347	294	0	0	294	850
Indiana U.	190	0	0	190	765	0	0	765	460	0	0	460	1,415
MIT	50	0	0	50	105	0	0	105	177	0	0	177	332
Michigan State	0	35	0	35	0	0	178	178	0	0	293	293	506
Nevis/Columbia	0	675	0	675	0	0	2,680	2,680	0	0	1,422	1,422	4,777
U. of New Mex.	20	0	0	20	30	0	0	30	24	0	0	24	74
Northern Illinois	0	0	0	0	0	0	0	0	0	0	0	0	0
Ohio State U.	0	0	0	0	100	0	0	100	45	0	0	45	145
U. of Michigan	62	254	0	316	716	0	0	716	518	0	0	518	1,550
U. of Oklahoma	30	0	0	30	0	0	41	41	0	0	51	51	122
U. of Penn.	250	0	0	250	300	0	0	300	265	0	0	265	815
U. of Pittsburg	110	0	0	110	0	0	150	150	0	0	210	210	470
U. of Rochester	0	0	0	0	0	0	3,587	3,587	0	0	1,664	1,664	5,251
U.T. Arlington	50	82	0	132	0	0	474	474	0	0	230	230	836
S. Methodist	40	0	0	40	124	0	0	124	30	0	0	30	194
SUNY/Stony B.	27	0	0	27	0	0	1,045	1,045	0	0	1,037	1,037	2,109
Tufts University	50	0	0	50	20	0	0	20	20	0	0	20	90
U. Washington	0	0	0	0	0	0	240	240	0	0	318	318	558
U. of Wisconsin	230	0	0	230	429	0	0	429	665	0	0	665	1,324
Subtotal	3,009	7,038	0	10,047	4,580	4,263	11,342	20,185	3,809	7,771	7,218	18,798	49,030
Reserve	0	3	0	3	157	0	5,289	5,446	327	1,936	1,795	4,058	4,058
									0	2,602	2,928	5,530	
Total	3,009	7,041	0	10,050	4,737	4,263	16,631	25,631	4,136	12,309	11,941	28,386	53,088