Status Report: 09
Status as of: 30 September 2000

Contract Title:

BOOSTER APPLICATIONS FACILITY

Performing Organization: Brookhaven Science Associates
Location: Brookhaven National Laboratory
Upton, New York 11973-5000

Reporting Period: September 1 - 30, 2000

1) Project Objective:

The purpose of this project is to provide a new experimental facility and beam line and undertake accelerator modifications required to take advantage of heavy-ion beams from the Brookhaven AGS Booster accelerator for radiation effects studies of importance for the NASA Space Program.

Heavy ions will originate in the Brookhaven MP-6 tandem accelerator and be transported to the Booster synchrotron for acceleration to the required energies.

Concurrent operation of the Booster for space radiation research and other kinds of research applications will be achieved by utilizing independent tandem injectors. The beam species and energy for both applications will be independent. Beams from either Tandem will be switched into the common injection line. At the Booster a new slow extraction system will be implemented which will require extensive accelerator modifications and rearrangements. A new beam line and tunnel enclosure will be built to transport the extracted beam to the experimental facility. Uniform beam intensities will be provided over rectangular areas ranging in size from about 1 cm to about 20 cm.

Other existing on-site facilities, such as the medical Department's extensive animal handling installations will also be utilized. Dosimetry and local access control will be provided through a local facility control room.

The conventional facilities to be constructed for the Booster Applications Facility will provide experimental space and support facilities. A labyrinth connects the experimental area with the laboratory support building. The target room is provided with a concrete beam stop imbedded in the back wall. The entire facility is shielded by 15 feet of earth equivalent shielding over the top of the target rooms and transport lines. The laboratory building contains support laboratories, including temporary biological specimen holding and preparation areas, as well as radiological laboratories for work with cell cultures and tissues. Also included are a dosimetry control room, a mechanical service equipment area and rooms for radioactive storage and miscellaneous items.

Power supplies for the beam transport magnets and various other equipment will be located in a power supply building, a pre-engineered steel frame construction.

The funds requested will also provide for spares and facility commissioning.

2) Technical Approach Changes:

No change.

Project Head's Summary Assessment:

	Last Month	This Month
Cost:	satisfactory	satisfactory
Schedule	satisfactory	satisfactory
Technical	satisfactory	satisfactory
Overall	satisfactory	satisfactory

W.B.S. 1.0 BAF Construction Summary

Pre-start paperwork has been completed and construction of the conventional facilities will start in early October. The Design effort is nearing completion for the Booster Modifications and fabrication continues on the major components. Fabrication of the Beam Transport magnets continued this month and the design of the beam line instrumentation continues.

The Controls and Safety System design and construction effort continues. The dosimetry system work continues at LBL.

W.B.S. 1.1 Conventional Construction

Contractor's safety plan was submitted and approved. Contractor given "Notice to Proceed" on 9/22. Kick-off construction meeting with contractor held on 9/28. Contractor started submission of shop drawings.

W.B.S. 1.2 Booster Modifications:

1.2.1 – New Extraction Equipment

Thin Septum:

The vacuum envelope is designed. Detailing will follow. The edge welded bellows in the beamline have been designed. The furnace for ceramic coating has been installed and tested to full temperature. Engineering of the drive system continues. The drive motors have been specified.

1.2.2 – Power Supplies

No change.

1.2.3. – Equipment Modifications

1.2.3.2.1 Move D6 Beam Dump & WCM

Engineering	100	
Design	100	
Fabrication	100	11/10/99

1.2.3.2.2 New WCM

Engineering	100	
Design	100	
Fabrication	90	04/07/00

1.2.3.3 D3 IPM & Beam Dump Kicker

Engineering	90
Design	50

Fabrication – No fabrication required – reuse existing equipment

W.B.S. 1.3 Beam Transport System

1.3.1 Magnets

Machining was completed on the octupole coils and the air trim coils were fabricated.

1.3.2 Power Supplies

The bid package is in progress.

1.3.3 Vacuum System

The Booster halfcell was 3D modeled in order to check interferences with the extraction line for BAF in the Booster tunnel. The instrumentation boxes were inserted into the beamline drawing. Also a pump tee was designed and inserted into the beamline. Spool pipes and bellows were designed which further design the beamline. The instrument box (flag box) location were determined in order to locate camera ports in the walls of the tunnel. A Vacuum instrumentation meeting was held to plan patching into the Booster vacuum controls system and interfacing of the BAF vacuum instrumentation located in the Booster tunnel.

1.3.4 Instrumentation

Design continued on the plunging instrumentation vacuum enclosures. We have become more confident in our approach utilizing a large bellows (9.5" ID) to enable the detector heads to be easily removed during bake-out and for service/modification. Various wire spacing layouts have been drawn to resolve any logistical constraint problems. We have several prototype plunging instrumentation vacuum window assemblies in the machine shop for production; soon they will be tested for strength and reliability.

Effort on the producing the digitized SWIC electronics continues. We have placed an order with Rittal for the euro-card crate hardware.

Evaluation of several competing solutions for measuring the (low level) signals from the ion chambers. We have a 20-bit charge detector ADC, investigating a recycling integrator approach, and evaluating a current to voltage conversion techniques.

We are considering using an 8" cross piece vacuum assembly (similar to what we will use in BAF transport) for the test assembly which is being designed to evaluate various flag materials

and scintillator performance with iron beams during the upcoming NASA run in the A3 beam line.

Investigation of an alternative to the existing video frame-grabber continues. We have imported data from a Sony DWF-300 digital camera via the Sony 1394 "Firewire" data bus to a laptop computer for analysis. Next we will do the same using a PCI 1394 interface card into a PC running LINUX. Investigation of different techniques to transfer digitized video images from the cameras to the frame-grabber with out repeaters continues.

W.B.S. 1.4 Controls and Personnel Safety System

1.4.1 Controls

The V297, V296 modules for the Booster Eventlink have been built and tested. The front panels for these units were expected soon. Technician effort was concentrated on the changes in the event decode PLD's in the booster controllers necessitated by event reassignments. The wave-form generator (V115) order was due at month end, but will be several weeks late, with no schedule impact.

1.4.2 Personnel Safety System

The initial design of the tunnel access gates was done. The initial design of the target area access system was started. A prototype setup will be demonstrated at the A1/NASA slow beam line for the upcoming NASA experimental run.

W.B.S. 1.5. Experimental Area Outfittng

Software

Work has started on the testing of certain components of the channel table load sub-system and the demand scaling system.

Work has started on the conversion of the numerous VMS command files over to SUN Solaris OS.

Work continues on the display system.

Hardware

The ion chamber bodies are being fabricated. We are having some difficulty with the gold adhering to the Kapton without a copper underlayer. We have a fix and expect success within the next few weeks.

The recycling integrator analog front-end prototype has been designed. We have not yet received all the parts for the analog section; delivery is expected near the end of the year. The first VME Crate should arrive any day.

W.B.S. 1.6 Long Term Support Lab

No change.

W.B.S. 1.7 Installation and Services

1.7.1 Electric Power Distribution

No change.

1.7.2 Equipment Cooling Water

No change.

1.7.3 Installation

No change

W.B.S. 1.8 Project Services

1.8.1 Project Management

An adjustment was made to the installation schedule this month. The installation of the booster beam dump in the B3 straight section was rescheduled to take place during the FY2001 shutdown.

During the planning for the impervious water shield, it was noted that a storm sewer pipe ran under the new design location. The re-routing of this line will take several months.

The availability of engineering effort has been less than planned and the completion of the Booster Modification Design Complete milestone has been rescheduled for 12/31/00. This milestone is on the critical paths and every effort will be made to accelerate component fabrication to compensate for the stretch out of the design phase.

1.8.2 Fiscal

No change.

1.8.3 Quality Assurance

No change.

1.8.4 Environment, Safety and Health

No change.

3) Open Items:

Implement Budgeted Cost of Work Scheduled (BCWS) versus Actual Cost of Work Performed (ACWP) tracking.

4) Summary Status Assessment and Forecast

a) Financial Status

A total of $12,470,886 was expensed or obligated of the $12,700,000 available. Costs represented $6,248,050 and open commitments stood at $6,222,836. The Project Total Estimated Cost (TEC) is $30,507,000. The Total Project Cost (TPC) is at $33,100,000.

b) Table II shows detailed expenses and commitments.

c) Table III shows the projected project spending profile.

d) Schedule Status

Milestones completed	Baseline	Actual
Title I Start	11/01/98	11/01/98
Booster Modification Start	04/01/99	04/01/99
Title II Start	04/01/99	04/01/99
Title I Complete	06/31/99	06/31/99
Conventional Construction-Start	08/15/99	08/15/99
Booster Penetration Complete	10/15/99	10/29/99
Title II Complete	06/30/00	06/30/00
Beam Transport Design-Complete	09/30/00	09/30/00

Milestones Upcoming	Baseline	Forecast
Booster Mod. Design-Complete	06/30/00	12/30/00

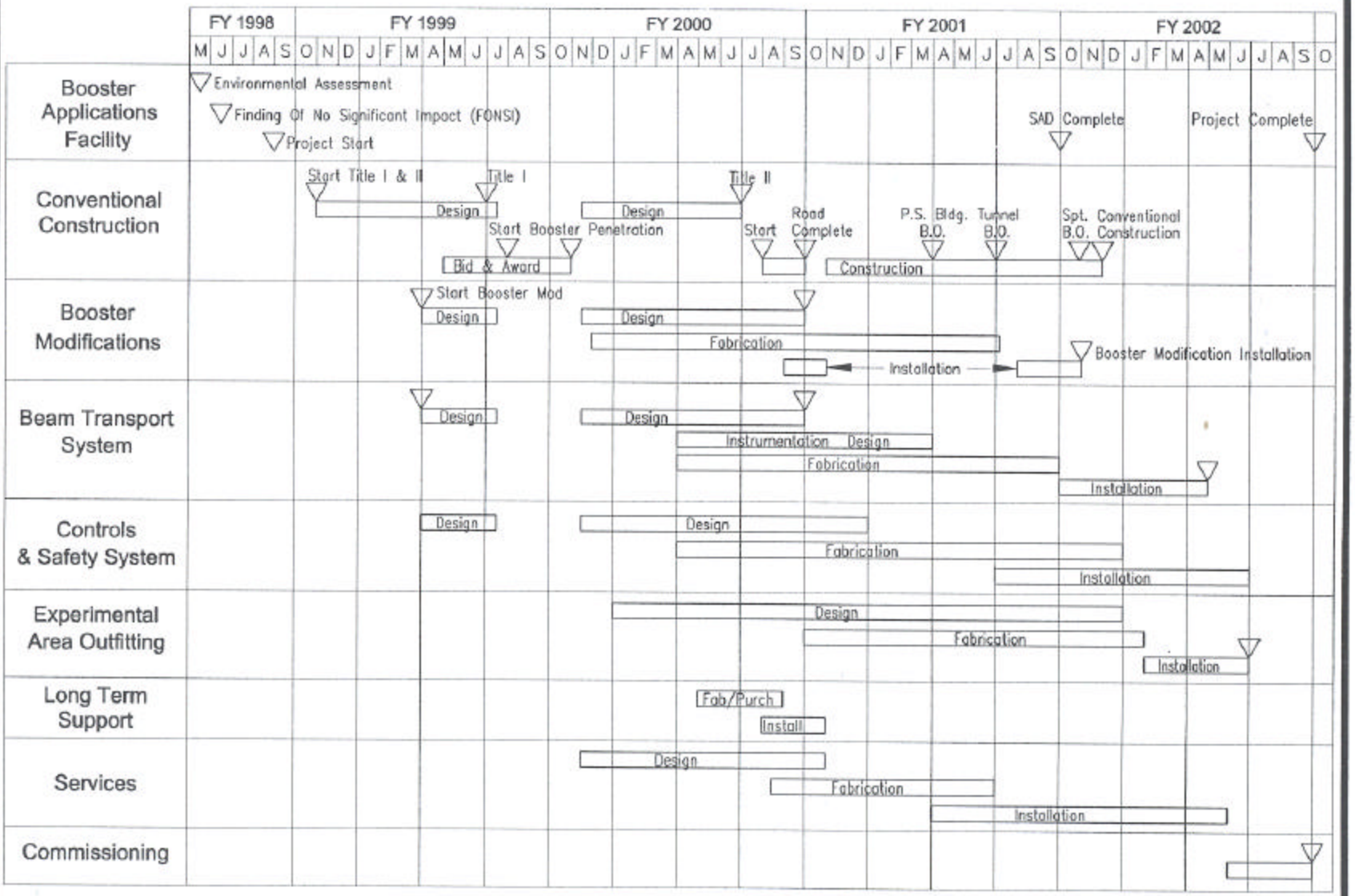
e) Critical Path: Booster Modifications Installation Complete.

f) Baseline Change proposals – None.

Table I
BAF Project Milestones

Project Start	10/01/98
Title I Start (Preliminary Design)	11/01/98
Booster Modification Design Start	04/01/99
Title II Start (Final Design)	04/01/99
Title I Complete	06/31/99
Conventional Construction Start	08/15/99
Booster Penetration Complete	10/15/99
Title II Complete	06/30/00
Booster Modifications Design Complete	09/30/00
Beam Transport System Design Complete	09/30/00
Safety Analysis document (SAD) Complete	09/30/01
Conventional Construction Complete	11/30/01
Booster Modifications Installation Complete	10/30/01
Beam Transportation System Installation Complete	04/30/02
Experimental Equipment Installation Complete	06/03/02
Project Complete	09/30/02

Booster Applications Facility
Master Milestone Schedule



* Milestones are for task completion unless otherwise noted.

TABLE II
BOOSTER APPLICATIONS FACILITY (BAF)
EXPENSE and COMMITMENTS
As of September 30, 2000

	Budget	EXPENSES Salary & Wage	Other Labor	Material & Contracts	Overhead	TOTAL EXPENSES	COMMIT.	TOTAL EXP. & COMMIT	BALANCE AVAILABLE
.1 Conventional Construction	5,098,000	84,129	397,546	583,297	204,909	1,269,881	3,920,442	5,190,323	(92,323)
.2 Booster Modifications	2,029,000	717,631	169,716	154,853	240,255	1,282,455	629,633	1,912,088	116,912
.3 Beam Transport System	1,019,000	518,004	84,796	117,748	124,965	845,513	155,373	1,000,886	18,114
.4 Controls & Personnel Safety System	515,000	231,649	296	95,729	66,870	394,544	90,689	485,233	29,767
.5 Exp. Area Outfitting	1,200,000	0	0	573,369	87,029	660,398	629,248	1,289,646	(89,646)
.6 Long Term Support Lab	383,000	0	2,095	266,673	39,581	308,349	12,304	320,653	62,347
.7 Installation & Services	1,173,000	313,766	0	22,557	62,205	398,528	766,901	1,165,429	7,571
.8 Project Services	1,160,000	489,019	0	53,045	534,637	1,076,701	5,745	1,082,446	77,554
CONTINGECY	73,000					0		0	73,000
SPARES	50,000		9,913		1,768	11,681	12,501	24,182	25,818
BAF Construction	12,700,000	2,354,198	664,362	1,867,271	1,362,219	6,248,050	6,222,836	12,470,886	229,114

TABLE III
BOOSTER APPLICATIONS FACILITY (BAF)
COST ESTIMATE
Spending Profile
($ in Thousands)

		TOTAL	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002
1.1	Conventional Construction	4,673	248	80	3,308	1,037	0
1.2	Booster Modifications	4,851		282	2,248	1,825	494
1.3	Beam Transport System	5,638		56	1,754	2,624	1,204
1.4	Controls & Personnel Safety System	1,557		8	539	677	333
1.5	Exp. Area Outfitting	3,068		0	1,159	1,346	564
1.6	Long Term Support Lab	455		0	383	73	0
1.7	Installation & Services	2,171		9	479	736	947
1.8	Project Services	3,258	9	165	1,241	1,172	671
		25,668	257	600	11,106	9,490	4,213
	Contingency	4,840	42	0	543	2,814	1,440
1 (TEC)	BAF Construction (BA AY $)	30,507	300	600	11,650	12,304	5,653
	Spares	1,294			150	296	848
	Commissioning	1,299					1,299
1 (TPC)	Total Project Cost (BA AY $)	33,100	300	600	11,800	12,600	7,800
1 (TPC)	BAF Construction (BO AY $)	33,100	300	600	6,000	16,000	10,200