Status Report: 03
Status as of: 29 February 2000

Contract Title:

BOOSTER APPLICATIONS FACILITY

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

Reporting Period: February 1, 2000 – February 29, 2000

1) Project Objective:

The purpose of this project is to provide a new experimental facility and beam line combined with 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.

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 embedded 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, mechanical service equipment area, and rooms for radioactive storage and miscellaneous items.

Power supplies for the beam transport magnets and 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.

3) Project Head's Summary Assessment:

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

In related events the MP-6 by-pass line was completed and commissioning is expected to commence in late March, 2000.

W.B.S. 1 – BAF Construction Summary

The conventional construction requirements have been finalized and detailed design can go forward for all items.

Design and fabrication of the Booster modifications continue and work is underway on the dosimetry system, safety system, controls and installation and services.

W.B.S. 1.1 – Conventional Construction

The status of conventional construction is as follows:

Task	Design Status	Expected Design Completion Date
1. Experimental Support Building	80%	3/24/00
2. Target Building & Labyrinth	60%	4/7/00
3. Beam Tunnel	50%	4/15/00
4. Access Alcove	25%	5/15/00
5. Power Supply Building	25%	4/30/00
6. Site Work-Road, Fending,Ret. Walls	10%	5/31/00
7. Site Utilities	10%	5/31/00
8. Earth Shielding & Liner	75%	3/15/00
9. Design Package out for Comment		6/1/00
10.Design Package to DCP		6/30/00

W.B.S. 1.2 Booster Modifications

The status of this W.B.S. is as follows:

		% Complete	To Shops
1.2.1.1	Thin Septum		
	Engineering	30	
	Design	0	
	Fabrication	-	04/31/00
1.2.1.2	Thick Septum		
	Engineering	100	
	Design	100	
	Fabrication	-	03/17/00
1.2.1.3	Foil Stripper Assembly		
	Engineering	95	
	Design	75	
	Fabrication		
	Vacuum box	0	01/10/00
	Long lead items	0	01/28/00
	Balance	-	03/15/00
1.2.3.2.1	Move D6 Beam Dump & WCM		
	Engineering	100	
	Design	100	
	Fabrication	60	11/10/99
1.2.3.2.2	New WCM		
	Engineering	100	
	Design	100	
	Fabrication	-	03/10/00
1.2.3.3	D3 IPM & Beam Dump Kicker		
	Engineering	90	
	Design	50	
	Fabrication	-	04/28/00

1.2.3.4 Vacuum System Modifications

Installation for the beam dump and wall current monitor installation at B6 in the Booster ring was planned for and scheduled for this coming summer shutdown. Several heating blankets will be ordered and Bakeout PLC graphics will be reworked to accommodate the new installation. The computer drop for the bake out which is presently at B6 will have to be moved to a location away from the dump to reduce radiation to maintenance personnel.

W.B.S. 1.3 Beam Transport System

No change.

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

A suitable replacement (ID Prom) was found so redesign of the V100 and V101 boards for the Booster Event Link (BEL) will not be required. Engineering will be available by mid-March for redesign of the V197 and V198 boards for replacement of the 50-ohm drivers. The Event Link interface logic will also be reworked on the V196 and this will serve as a test board for the new event link interface circuit. Detailed design documentation for the Event Link system was begun.

Development of software for instrumentation controller - harp data acquisition for the MP6 Bypass beamline was in progress. Front-end software for beamline power supply control was almost complete. Detailed device information was received and database configuration was begun for the full set of devices.

W.B.S. 1.4.2 Personnel Safety System

The Conceptual Design of the Access Control system for the transport line is completed. The initial design of the target area access control has started. The procurement of PLC processors and other components for logic controls was initiated.

W.B.S. 1.5.1 Dosimetry Control

Software

Work is in process to update the detailed design document for the control system to customize it for BAF, as opposed to the original which was specific to the three-cave Bevatron facility. The first two chapters have been done, and work on chapter three is in progress.

Chapter 1 – Requirements.
Chapter 2 – Software Overview
Chapter 3 – Logical Channels and Channel Tables

In parallel, work has started on implementing some of the design in Chapter 3. The first three programs to load the channel tables are already running on a SUN workstation running the latest version of the Solaris operating system, and the fourth program is partially done.

After discussions with C-AD personnel, it was agreed that a SUN/Solaris-based system was the best option taking into account system requirements and compatibility with existing C-AD systems.

A second Software Engineer, Sofia Mitina, who was already a member of the LBNL Engineering Division, joined the project on Feb. 23 and is rapidly coming up to speed. She is currently working on completing the fourth program to load the channel tables, while reviewing the overall design of the system.

Jos Polman (LBNL) has agreed to do the SUN system administration for BAF on an as-needed basis. He has set up one SUN that RP is using, and is in the process of putting the latest version of Solaris on a second SUN for Sofia.

Offices and a work space for BAF work at LBNL have been set up.

Hardware

A conceptual design document has been written for the hardware interface to the booster. In early March, Mark Nyman met at BNL with C-AD staff to discuss various matters relating to the hardware interface and control system.

Former LBNL Engineering Division employee Ron Stradtner has been brought back out of retirement to serve as the Electronics Coordinator for the project. Ron performed a similar function at the Bevalac Biomedical facility for many years and has extensive experience with hardware of the type being developed for BAF.

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

Location for the new substation has been narrowed down to north of the new power supply building and cooling tower. Sectionalizing switches will be located near the manhole where the feeder will be tapped for the substation. Exact locations for the substation and switches will be determined when the approach and by-pass roads are finalized. Ductbanks between buildings for power, control and communications are being sized.

1.7.2 Equipment Cooling Water

Pump Room piping layout is 90% complete and work has started on cooling water distribution piping.

W.B.S. 1.8 Project Services

Development of a project schedule using MS Project is continuing.. See Table I for high level milestones. There were no ES&H or Quality Assurance issues to report for the month of January.

The final report of the Department of Energy Review of the Booster Application Facility was received during this reporting period.

The Committee recommendations are as follows:

W.B.S. 1.1 Conventional Construction

1. At the next review, provide cost and schedule details at WBS Level 5 or 6.
2. Indicate contingency amounts allocated to conventional construction at WBS Level 4.

W.B.S. 1.2 Booster Modifications

1. Address the NASA concerns about the spill structure. Measures should include clarification with NASA on the requirements, development of methods to meet their needs, adjustment of project scope if required to meet their needs, and inclusion of plans for measuring the spill structure during the commissioning.

W.B.S. 1.3 Beam Transport System

1. Proceed with the beamline modeling including field errors in the magnets.
2. Examine the adequacy of the envisioned beamline diagnostics to address typical problems encountered during commissioning.
3. Come to closure with NASA on the target positioning/alignment issue. Adjust the scope of the project, if needed.

W.B.S. 1.5 Experimental Area Outfitting

1. Develop a process that insures adequate documentation for efficient facility life-span maintenance will exist for all systems, particularly software.

W.B.S. 1.7 Project Management

1. Start working with DOE project management to define systems to be initiated in January 2000, including:

    a) Critical path schedule
    b) Lower level milestones
    c) A solidified project baseline (cost and schedule)
    d) Monthly reporting process

2. Update the Project Management Plan to better define the change control process and include NASA by January 2000.

1.7.2 Fiscal

1. Update the BAF cost estimate to include the FY2000 BNL overhead rates.
2. Update the BAF cost estimate using the FY 2001 DOE cost escalation rates. The reduction in the TEC should be assigned to contingency.
3. Project management should ask BNL's Budget Office to eliminate the material burden and other indirect charges on work performed by LBNL and any other DOE laboratories. Savings generated should be assigned to contingency.
4. Project management should ask BNL's Budget Office to apply the special overhead rates to commissioning activities. Savings should be assigned to contingency.
5. Update the BAF operations budget for FY 2003 and include a scenario for 1,200 hours of operation. The operations estimate should include an estimate to cover the D&D budget allocation amount (see item 6).
6. A cost estimate to D&D the BAF needs to be completed, and an annual D&D budget allocation amount calculated. The accounting methodology associated with the proposed escrow account needs to be finalized with BNL's accounting office.
7. A detailed monthly status report format should be developed.

1.7.3 ES&H

1. Ensure that the NASA ES&H requirements will be met.
2. Evaluate the radiation safety of fast switching between protons and heavy ions.
3. Provide the general scope and cost for the D&D of the BAF beamline and the target area; and provide a funding plan (if insufficient funds are anticipated to remain from the 3% work for others surcharge).

The following recommendations have been implemented:

W.B.S. 1.7.1 Project Management – Item 2

W.B.S. 1.7.2 Fiscal – Items 1, 2, 3, 4 and 7.

The remaining recommendations are being worked on and progress will be reported monthly.

4) Summary Status Assessment and Forecast:

a) Financial Status

A total of $3,755,875 was costed or obligated of the $11,450,000 available. Costs represented $2,196,761 and open commitments stood at $1,561,114. 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 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

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

e) Baseline Change proposals – None.

5) <u>Performance Analysis:</u> – method to be determined.

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
Title II Complete	06/30/00
Booster Modifications Design Complete	06/30/00
Beam Transport System Design Complete	09/30/00
Safety Analysis document (SAD) Complete	09/30/01
Conventional Construction Complete	09/30/01
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

TABLE II

BOOSTER APPLICATIONS FACILITY (BAF)
EXPENSE and COMMITMENTS
As of February 29, 2000

		EXPENSES						TOTAL	
	Budget	Salary & Wage	Other Labor	Material & Contracts	Overhead	TOTAL EXPENSES	COMMIT.	EXP. & COMMIT	BALANCE AVAILABLE
1.1 Conventional Construction	2,992,000	45,868	204,522	393,033	115,683	759,106	221,838	980,944	2,011,056
1.2 Booster Modifications	2,251,600	323,213	85,643	37,699	98,917	545,472	76,371	621,843	1,629,757
1.3 Beam Transport System	1,923,000	186,656	357	15,079	40,412	242,504	58,405	300,909	1,622,091
1.4 Controls & Personnel Safety System	597,000	53,673	0	21,778	16,273	91,724	0	91,724	505,276
1.5 Exp. Area Outfitting	1,332,000	16,371	0	0	2,919	19,290	1,200,000	1,219,290	112,710
1.6 Long Term Support Lab	32,000				0	0		0	32,000
1.7 Installation & Services	218,000	72,340	0	3,016	14,036	89,392	0	89,392	128,608
1.8 Project Services	2,136,400	190,914	4,387	18,773	235,199	449,273	4,500	453,773	1,682,627
1 BAF Construction	11,450,000	889,035	294,909	489,378	523,439	2,196,761	1,561,114	3,757,875	7,692,125

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	3,803	202	83	2,400	1,118	0
1.2	Booster Modifications	3,742		219	1,831	1,301	391
1.3	Beam Transport System	4,478		44	1,441	2,336	657
1.4	Controls & Personnel Safety System	1,236		33	431	509	263
1.5	Exp. Area Outfitting	2,710		0	1,042	1,169	499
1.6	Long Term Support Lab	351			0	251	100
1.7	Installation & Services	1,708		7	194	730	777
1.8	Project Services	1,129		96	338	338	357
		19,157	202	482	7,677	7,752	3,044
	Contingency	3,796	38	0	1,484	1,623	651
	Overhead	4,649	52	100	1,819	1,862	816
1	BAF Construction (FY98 $)	27,602	292	582	10,980	11,237	4,511
	Escalation	1,912		0	560	876	476
	Full Cost Recovery @ 3%	993	9	18	357	375	234
1 (TEC)	BAF Construction (BA AY $)	30,507	300	600	11,897	12,488	5,222
	Spares	1,294			3	12	1,279
	Commissioning	1,299					1,299
1 (TPC)	Total Project Cost (BA AY $)	33,100	300	600	11,900	12,500	7,800
1 (TPC)	BAF Construction (BO AY $)	33,100	300	600	10,000	12,000	10,200