

Status Report: 01
Status as of: 31 December 1999

Contract Title:

**BOOSTER
APPLICATIONS
FACILITY**

BROOKHAVEN
NATIONAL LABORATORY



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

Project Period: October 1998 – December 1999

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.

1) Technical Approach Changes: No change.

2) Project Head's Summary Assessment:

	Last Month	This Month
Cost:	N/A	satisfactory
Schedule	N/A	satisfactory
Technical	N/A	satisfactory
Overall	N/A	satisfactory

The BAF Project has gained momentum during the last three months. The management agreement between NASA and DOE was approved in early October and funding again became available in mid-November.

A major highlight was the completion of the penetration of the Booster tunnel by late October.

The DOE, with the support of NASA, conducted a cost schedule and management review of the project during the first week of December 1999 and the results were positive. The total project cost is estimated to be \$33,100,000 and it will take two and one half years to complete.

In related events, the upgrade of MP-6 Tandem Van de Graaff was completed at the end of December and commissioning was started. It is expected that the by-pass beam line will be ready for commissioning in late January.

W.B.S. 1 – BAF Construction Summary

The Booster penetration is complete and detailed design of the experimental support building is 80% complete. Fabrication of Booster Modification components has started. Engineering design is underway for the power and water services and a contract has been placed for the Experimental Area dosimetry control system.

W.B.S. 1.1 – Conventional Construction

The penetration into the Booster tunnel has been completed. This effort included:

Removal of existing earth shielding at the Booster; jacking a 12" dia. pipe through the structurally reinforced corrugated metal wall of the Booster tunnel; installation of ~ 50 linear feet of 11 foot dia. corrugated metal tunnel; and replacement of the earth shielding.

The construction contract was awarded June 14. Notice to Proceed given on August 23, 1999. Work began September 2, 1999 at the end of the RHIC commissioning run and Booster operations. Work was completed on October 29, 1999.

A concrete shield was designed and installed at the interface of the 12 inch penetration pipe and the new tunnel after the penetration was completed. This will prevent radiation

from exceeding guidelines in the adjacent uncontrolled areas external areas. Construction of the beam tunnel and support building can then proceed during Booster operations.

The designs of Experimental Support Building is 80% complete and the design of the Target Cave, beam stop and labyrinth to Support Building is 50% complete. Parameters of the Power Supply Building, Access Structure and site work are under review.

W.B.S. 1.2 Booster Modifications:

The physics design parameters for the slow extraction system have been established. From these parameters, the design specifications for the septa magnets, power supplies and control scheme were determined.

The status of the new devices to be constructed is:

	% Complete	To Shops
Thin Septum Engineering Design Fabrication	20 0	03/31/00
Thick Septum Engineering Design Fabrication	95 99	01/28/00
Foil Stripper Assembly Engineering Design Fabrication Vacuum Box Balance	90 45	01/14/00 01/31/00
Move D6 Beam Dump & WCM Engineering Design Fabrication	100 100 25	11/10/99
New WCM Engineering Design Fabrication	95 95	02/14/00
D3 IPM & Beam Dump Kicker Engineering Design Fabrication	50 25	02/29/00

W.B.S. 1.3 Beam Transport System

The optical design is complete. Magnet selection is 90% complete and vacuum components are being evaluated. Location of the instrumentation packages has been completed.

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

The design of the controls for the Tandem by-pass line is complete and the hardware has been assembled.

W.B.S. 1.5 Experimental Area Outfitting

A contract for the dosimetry system has been placed with Lawrence Berkeley Laboratory.

W.B.S. 1.6 Installation and Services

The preliminary designs for the water cooling and power distribution systems have been completed. Work is underway to determine the optimum routes for dc power routing between the power supply building and the Booster and beam line components.

W.B.S. 1.7 Project Services

Management:

Development of a project schedule using MS Project was started. A first pass at generating a task list using input from managers was initiated and it will allow development of a schedule strategy. Once a task list is completed managers will attach costs to tasks and resulting task duration will be coordinated to form a schedule with real dates and cost tracking. See Table I for high level milestones.

Environmental, Safety, Health and Quality Assurance:

The Environmental assessment was completed January, 1998 and the Findings Of No Significant Impact (FONSI) was signed by the Head of BHG on May 18, 1998.

4. Open Items:
 - 1) Update Management Plan to include NASA input on contingency use.
 - 2) Develop decommissioning costs and factor into operating costs.
5. Summary Status Assessment and Forecast:
 - a) Financial Status

A total of \$2,956,710 (78%) was costed or obligated of the \$3,800,000 available. Costs represented \$1,427,452 and open commitment stood at \$1,529,258. 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

<u>Milestones completed</u>	<u>Baseline</u>	<u>Actual</u>
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	Start	06/31/99
Conventional Construction	Complete	08/15/99

<u>Milestones Upcoming</u>	<u>Baseline</u>	<u>Forecast</u>
Title II Complete	06/30/00	06/30/00

- e) Baseline Change proposals – None.

6. Performance Analysis – 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
Beam Transport System Design Complete	09/30/00
Booster Modifications Design Complete	06/30/00
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 December 31, 1999**

	Budget	EXPENSES				TOTAL EXPENSES	COMMIT.	TOTAL EXP. & COMMIT	BALANCE AVAILABLE
		Salary & Wage	Other Labor	Material & Contracts	Overhead				
1.1 Conventional Construction	942,000	45,868	143,839	287,160	68,091	544,958	231,438	776,396	165,604
1.2 Booster Modifications	740,000	224,774	36,687	24,638	85,993	372,092	79,386	451,478	288,522
1.3 Beam Transport System	269,000	39,063	357	10,215	14,510	64,145	10,050	74,195	194,805
1.4 Controls & Personnel Safety System	127,000	17,991	0	21,250	11,913	51,154	8,384	59,538	67,462
1.5 Exp. Area Outfitting	1,200,000	0	0	0	0	0	1,200,000	1,200,000	0
1.6 Installation & Services	19,000	7,755	0	3,016	14,665	14,665	0	14,665	4,335
1.7 Project Services	503,000	303,219	0	17,862	380,438	380,438	0	380,438	122,562
1 BAF Construction	3,800,000	638,670	180,883	364,141	1,427,452	1,427,452	1,529,258	2,956,710	843,290

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	3,061		0	1,042	1,420	599
1.6 Installation & Services	1,708		7	194	730	777
1.7 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