

Status Report: 02
Status as of: 31 January 2000

Contract Title:

**BOOSTER
APPLICATIONS
FACILITY**

BROOKHAVEN
NATIONAL LABORATORY



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

Project Period: January 1, 2000 – January 31, 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

Additional project funding was received from NASA on January 26, 2000, increasing the available budget from \$3,800,000 to \$11,450,000. This action permits the project to continue to gain momentum and remain on schedule. 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 MP-6 Tandem Van de Graaff was pressurized and conditioned to 13.7 MV. Work on the by-pass beam line continued and included operation of the MP6 ion source, alignment of magnets, and completion of the magnet cooling system and AC power connections. Diagnostic boxes remain to be installed prior to start of by-pass line commissioning in February. Extensive development took place this month on instrumentation controller software for ion beam profile data acquisition for the MP6 Bypass beam line. Progress was also made on front-end software for beam line power supply control and on database work for the bypass power supply controller.

W.B.S. 1 – BAF Construction Summary

Layout of the balance of the transport line has been completed and major components located. Fabrication of Booster Modification components is moving along while engineering and design continues for power and water services.

W.B.S. 1.1 – Conventional Construction

Various options for the power supply building location were reviewed and a site was selected. Engineering of the power supply building structure was started.

W.B.S. 1.2 Booster Modifications:

Detailed engineering and design is moving forward with much of the component engineering completed as shown in the table below. Hardware is beginning to filter into Central Shops for fabrication.

The status of new devices to be constructed is:

	% Complete	To Shops
Thin Septum		
Engineering	30	
Design	0	
Fabrication	-	04/31/00
Thick Septum		
Engineering	100	
Design	99	
Fabrication	-	02/28/00
Foil Stripper Assembly		
Engineering	95	
Design	65	
Fabrication		
Vacuum Box	0	01/10/00
Long lead items	0	01/28/00
Balance	-	03/15/00
Move D6 Beam Dump & WCM		
Engineering	100	
Design	100	
Fabrication	40	11/10/99
New WCM		
Engineering	100	
Design	90	
Fabrication	-	03/10/00
D3 IPM & Beam Dump Kicker		
Engineering	90	
Design	50	
Fabrication	-	02/29/00

W.B.S. 1.3 Beam Transport System

Purchase orders for a number of off-the-shelf vacuum components were placed including a fast closing vacuum valve and all metal gate valve.

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

A review of production requirements for timing system components was completed. Several boards needed for the Booster Event link need minor redesign because of parts obsolescence. This will have some cost consequences but will not affect the project schedule. Conceptual design of the beam line personnel safety system was started.

W.B.S. 1.5 Experimental Area Outfitting

Conceptual design for the dosimetry system was started at Lawrence Berkeley Laboratory.

W.B.S. 1.6 Long Term Support Lab

Preliminary planning of floor space and facility requirements has started.

W.B.S. 1.7 Installation and Services

Layout of the power supply building was started as planning of AC power distribution and routing from existing 15 kV feeders continued. Design drawings for equipment layout of the water cooling system are in progress. Flow and control diagrams are 95% complete. Work is underway on the optimum layout of the utility building, beam line tunnel entrance and distribution of DC power, instrumentation, security, magnet cooling water and utilities inside the tunnel.

W.B.S. 1.8 Project Services

Development of a project schedule using MS Project is continuing. Once the 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. There were no ES&H or Quality Assurance issues to report for the month of January.

- 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 \$3,352,483 (29.3%) was costed or obligated of the \$11,450,000 available. Costs represented \$1,787,369 and open commitment stood at \$1,565,114. 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

<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	06/31/99	06/31/99
Conventional Construction-Start	08/15/99	08/15/99
<u>Milestones Upcoming</u>	<u>Baseline</u>	<u>Forecast</u>
Title II Complete	06/30/00	06/30/00
Booster Mod. Design-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
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 January 31, 2000**

	Budget	EXPENSES				TOTAL EXPENSES	COMMIT.	TOTAL EXP. & COMMIT	BALANCE AVAILABLE
		Salary & Wage	Other Labor	Material & Contracts	Overhead				
1.1 Conventional Construction	2,992,000	45,868	145,139	304,530	95,526	591,063	221,838	812,901	2,179,099
1.2 Booster Modifications	2,251,600	275,011	48,987	31,179	82,616	437,793	80,371	518,164	1,733,436
1.3 Beam Transport System	1,923,000	142,352	357	14,588	32,386	189,683	58,405	248,088	1,674,912
1.4 Controls & Personnel Safety System	597,000	45,549	0	21,778	14,824	82,151	0	82,151	514,849
1.5 Exp. Area Outfitting	1,332,000	7,612	0	0	1,357	8,969	1,200,000	1,208,969	123,031
1.6 Long Term Support Lab	32,000					0		0	32,000
1.7 Installation & Services	218,000	47,795	0	3,016	9,659	60,470	0	60,470	157,530
1.8 Project Services	2,136,400	184,589	3,571	17,862	211,218	417,240	4,500	421,740	1,714,660
1 BAF Construction	11,450,000	748,776	198,054	392,953	447,586	1,787,369	1,565,114	3,352,483	8,097,517

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