



TSIB | Target Systems Integration Building

TSD Topical Meeting 19-Mar-2020

Updated from HEP Presentation March 5, 2020

Outline

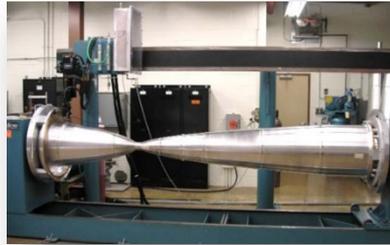
- Overview of Horn Production Process & Existing Capacity
- Impact of Future Demand
- Proposed New Facility to Meet Increased Horn Demand
- Proposed New Facility Construction Schedule
- Conclusion



Overview of Horn Production Process & Existing Capacity

Existing MI-8 Footprint:

- Built in 1997; Addition in 2010
- 23,000 SF



Current Operations:

- Main building for constructing and testing **target devices** and **focusing horns**
- Target Halls support **neutrino** and **muon** beamlines and experiments, including:
 1. NuMI (NOvA),
 2. BNB (ICARUS, SBND, MicroBooNE)
 3. AP-0 (Muon g-2)
 4. Mu2e



Overview of Horn Production Process & Existing Capacity

PROCESS at existing MI-8 Footprint

1 ASSEMBLY 13,000 SF

- 30-ton crane
- Horn Assembly

3 TEST | 6,300 SF

- Crane Coverage
- High-voltage testing

2 WELDING | 1,200 SF

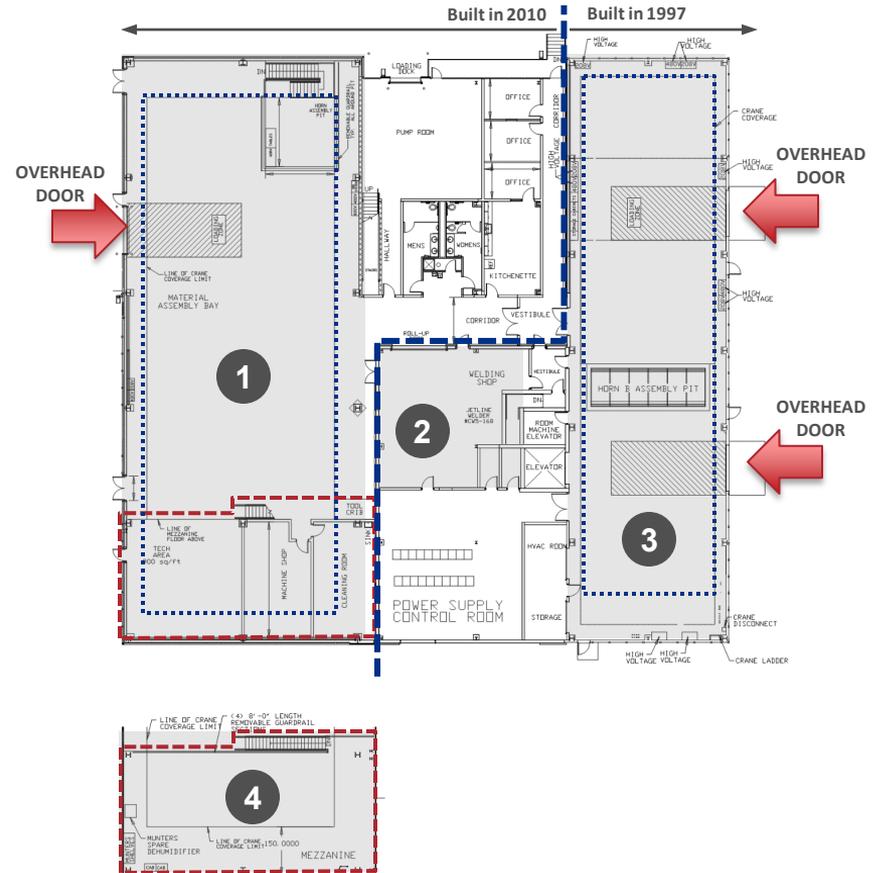
- Welding

4 STORAGE | 2,000 SF

- Horn storage/staging area

Current footprint and existing space is at capacity serving **4 target stations**.

LBNF will **approximately double** the existing demand for production space at MI-8.



MEETING Demand of “Next Generation” Experiments

IDEAL:

- AD Target Systems Group produces all horns at the existing MI-8 facility.

IN REALITY:

- MI-8 footprint running at full capacity to meet demand at **4 Target Stations.**
- Overall size of the MI-8 production areas not suited for the scale of the next generation experiments.

PROPOSAL

- Construct addition to MI-8, increasing horn production capacity to meet the schedules of current obligations and next generation experiments.

CURRENT EXPERIMENTS



FUTURE EXPERIMENTS



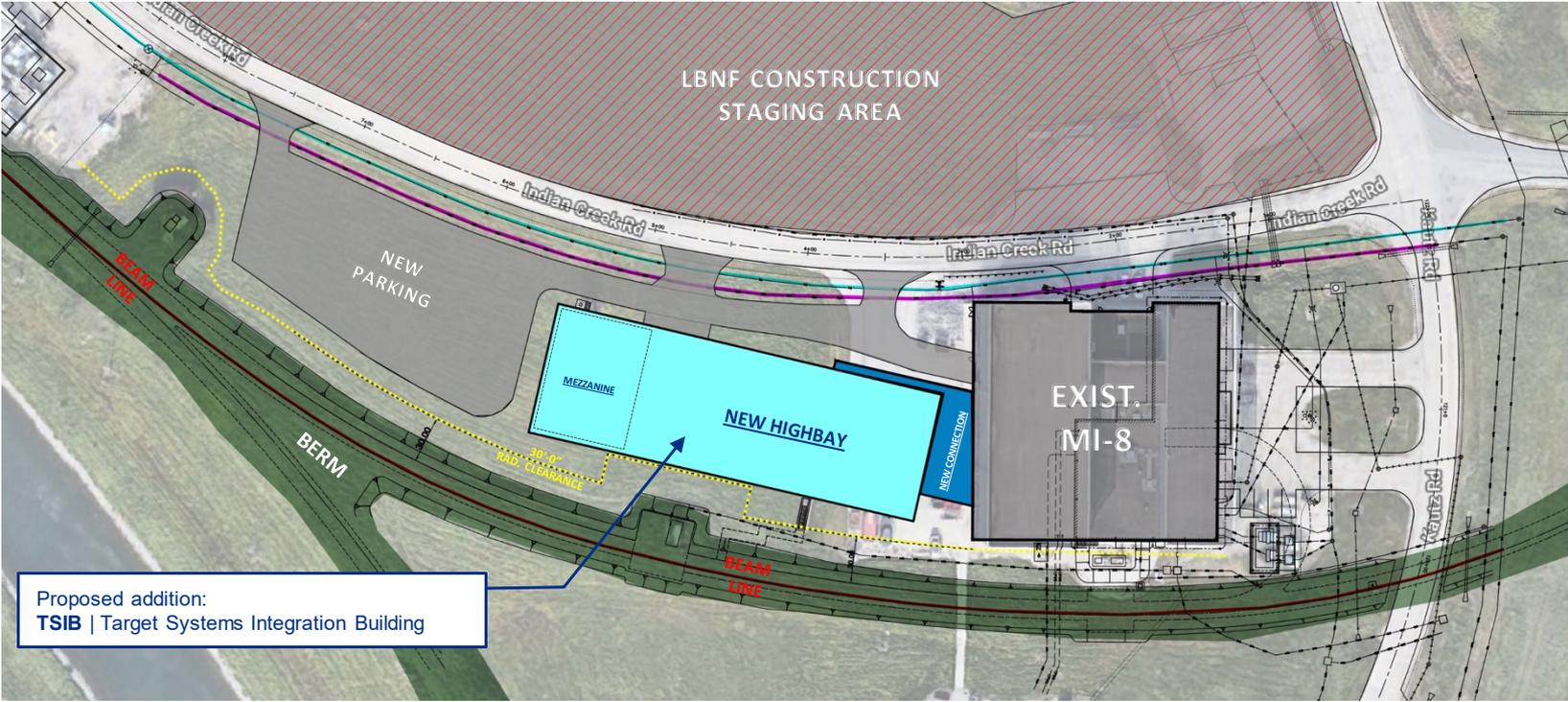
Impact of LBNF Demand

- ***Existing*** future experiment schedules require additional space / capacity by October 2025.
 - **If LBNF schedule is accelerated, then demand for additional space & capacity will also need to be accelerated. *Accelerated schedule not likely....***
- Current MI-8 facility is unable to accommodate the existing horn needs concurrent with an accelerated LBNF schedule.
 - LBNF risks losing a competitive advantage if delayed.



Proposed New Facility to Meet Increased Horn Demand

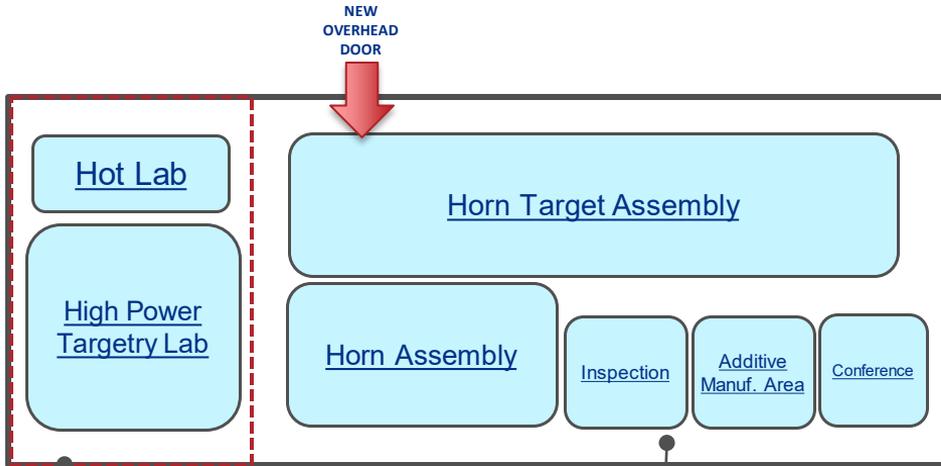
Site Constraints



Proposed addition:
TSIB | Target Systems Integration Building

Proposed New Facility to Meet Increased Horn Demand

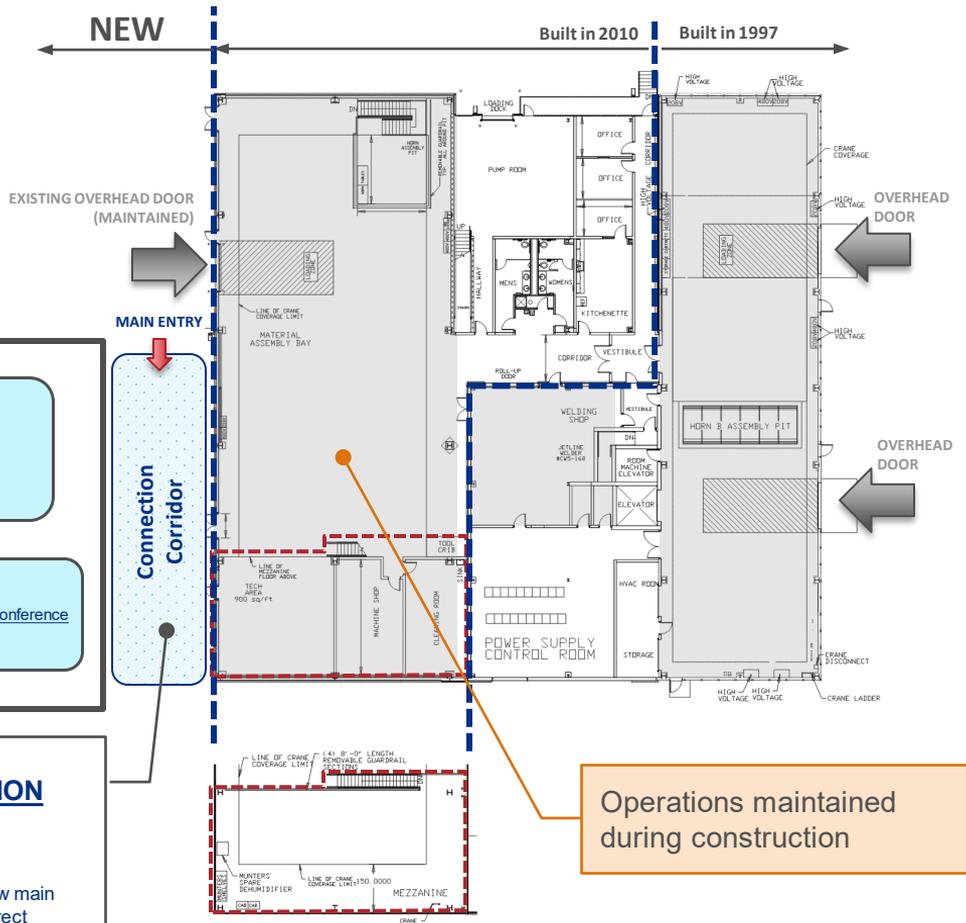
Superceeded layout at expanded footprint



NEW MEZZ.
SIZE: 6,300 SF
FEATURES:
 • Crane coverage
FUNCTION:
 • Storage/Staging

NEW HIGHBAY
SIZE: 20,800 SF
FEATURES:
 • 60-ton crane
FUNCTION:
 • Horn Assembly

NEW CONNECTION
SIZE: 2,500 SF
FEATURES:
 • Provides new main entry and direct access between highbay areas



Operations maintained during construction

Proposed New Facility to Meet Increased Horn Demand

Project Cost at Preliminary Design

Size: 29,600 GSF

Cost: \$14.85 Million

Cost/SF: \$502



Recommended \$/SF based on following models:

\$315/SF ICB-A Highbay (\$2019)
 \$89/SF ICB-A Mezzanine (\$2019)
 \$291/SF MI-8 Addition (\$2011)

Target Systems Integration Building (TSIB)				<i>Civil Constr. ONLY</i>	
<i>Total Project Cost Estimate at early Project Definition</i>					
<i>Proposed</i>					
Bid Year	2022				
GSF	29600				
Escalation:	3.40%				
CONSTRUCTION COSTS					
Space Type	QUANTITY	UNIT		\$/UNIT	TOTAL
Highbay	20800	SF	\$	315	\$ 6,560,000
Entrance Connector	2500	SF	\$	315	\$ 787,500
Mezzanine	6300	SF	\$	100	\$ 630,000
CONSTRUCTION SUBTOTAL					\$ 7,977,500
Escalation (to 2022)					3.40% \$ 552,000
SUBTOTAL					\$ 8,530,000
Indirects Rates					5.45% \$ 465,000
EDIA					25% \$ 2,000,000
SUBTOTAL					\$ 11,000,000
Contingency					35% \$ 3,850,000
\$2022					
TOTAL PROJECT COST					\$ 14,850,000
TOTAL PROJECT \$/GSF					\$ 502

Proposed New Equipment to Meet Increased Horn Demand Production

Equipment Cost at Preliminary Design

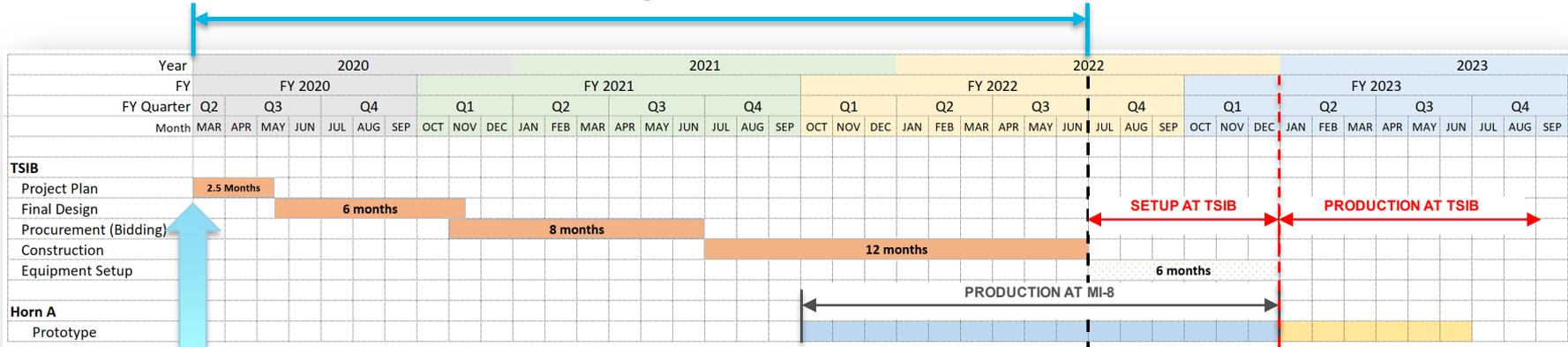
Fume hood	3	3 x 15	6500	19500
Glove box	1	50	5000	5000
Atomic Force Microscope (AFM)	1	50	500000	500000
Laser flash diffusivity	1	10	75000	75000
Dilatometer	1	20	75000	75000
Mechanical load frame	1	20	10000	10000
Fatigue testing machine	1	20	45000	45000
Optical microscope	1	5	2000	2000
Digital microscope	1	20	75000	75000
Scanning Electron Microscope	1	20	150000	150000
EBSD add-on to SEM	1	10	40000	40000
Profilometer	1	20	120000	120000
Hardness tester	2	10	7500	15000
Ultrasonic tester	2	10	10000	20000
Hot cell machining tools	1	0	80000	80000
Polishing wheel station	1	20	1000	1000
Split Hopkinson Pressure bar	1	40	75000	75000
				1307500
Robotic arms	1	10	265000	265000
Robotic controls	1	5	5000	5000
Various robotic kit	1	20	10000	10000
Remote vision system	1	5	10000	10000
Robotic vehicles	1	20	100000	100000
Thermal test chamber	1	30	15000	15000
Induction heater and power supply	1	15	5000	5000
Thermal test stand heaters, instrumentation and kit	1	0	3000	3000
Thermal test control system	1	10	4000	4000
Infrared thermal imaging camera	1	5	3000	3000
Water cooling pump loop	1	40	45000	45000
Nanofiber electrospinning machine	1	10	5000	5000
			TOTAL	3085000

*Proposed
Equipment for
HPT Hot Lab rolls
up to \$3M
without
contingency*

Proposed New Facility Construction Schedule

Key dates for meeting 28 month schedule

28 Month Process Regardless of Start Date



IF Project Plan starts on:
March 1, 2020

THEN beneficial occupancy by:
July 1, 2022

AVAILABLE for horn production by:
Jan 1, 2023

Proposed Options

OPTION 1

Civil Construction
+ Test Equipment

CIVIL CONSTRUCTION = **\$14.85M (GPP)**
EQUIPMENT = **\$3.08M (EQP)**

Total HEP funding = \$17.93M

OPTION 2

Civil Construction
w/ Test Equip
Spend down

CIVIL CONSTRUCTION = **\$14.85M (GPP)**
EQUIPMENT → Spend down

Total HEP funding = \$14.85M

OPTION 3

Civil Construction
w/ Test Equipment
AND
Hot Cell at later project

CIVIL CONSTRUCTION = **\$14.85M (GPP)**
EQUIPMENT → Funded at later date

Total HEP funding = \$14.85M



Conclusion

- Fermilab will be providing high power horns and targetry that is enabling technology for the science program over the next three decades.
 - TSIB is needed to increase capacity to meet future needs.
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Path Forward TBD:

- Advance conceptual designs and building options remainder of FY2020 to reduce costs
- Request funding for A&E work in FY2021
- Fund construction in FY2022 (Procurement + Construction over 20 months)