Liquid Argon Test Facility (LArTF) GPP Project

FESS Project No. 6-7-82

Director's Review

General Plant Project

Conventional Facilities

Chuck Federowicz

GPP Project Manager

FESS/Engineering

Agenda

- Project Charter
  - Scope
  - Cost
  - Schedule
  - Project Team
- Design
- Project Execution
  - Funding
  - Baseline Costs
  - Schedule
  - Risk

Project Charter

"The GPP Project"

Scope

Cost

Schedule

Team

Project Charter - SCOPE

A general purpose facility for the study of liquid Argon detectors will be constructed, with internal outfitting for the first of the cryostats (MicroBooNE) to be studied. The internal outfitting will be designed and constructed to accommodate alteration to future follow-on configurations.

Project Charter - COST

The Total Estimated Cost (TEC) for this project is estimated to be $6,600,000 funded in FY12 dollars.

The TEC includes Construction, EDIA (Engineering, Design, Inspection and Administration), Management Reserve and Indirect Costs. The TEC has been escalated to FY12 dollars (3%).

Also included in the TEC are the Indirect Costs associated with this project, which is based on current published laboratory rates (as of April 2011).

Project Charter - SCHEDULE

Based on Directive Approval	Month 0	Aug. 2011
Engineering Start	Month 0	Aug. 2011
Construction Start	Month 3*	Nov. 2011
Construction Complete	Month 17**	Jan. 2013***
Engineering Complete	Month 19	Mar. 2013
Project Complete	Month 21	Apr. 2013

* Assume Final Design Complete – August 2011
** Includes 2 months float
*** Coincides with expected delivery of MicroBooNE Detector

Project Charter – PROJECT TEAM

Fermilab Directorate

ORGANIZATIONAL PROCESS ASSETS

Championing Organization

Particle Physics Division

Key Stakeholders

MicroBooNE
Liquid Argon Experiments

Business Services Section

D. Carlson
Section Head

J. Collins
Procurement Manager

G. Leonard
Legal

ES&H

N. Grossman
ES&H Director

M. Michels
Associate Head

D. Cossairt
Associate Head

T. Miller
Associate Head

Facilities Services Section

R. Ortgiesen
FESS Head

K. Collins
FESS Deputy Head

R. Ortgiesen (acting)
FESS/E Department Head

B. Shull
FESS/Operation Head

J. Macier
FESS/Site Services Head

PROJECT SPONSERS

Bruce Chrisman
Chief Operating Office

Mike Lindgren
Head, Particle Physics Division

INTEGRATED PROJECT TEAM

Regina Rameika, PPD
Fermilab Project Director

Chuck Federowicz, FESS/E
Fermilab Project Manager

Jonathan Hunt, FESS/E
Fermilab Project Coordinator

Tim Trout, FESS/E
Fermilab Construction Coordinator

To Be Determined
Fermilab Procurement Administrator

Subcontractor

Design

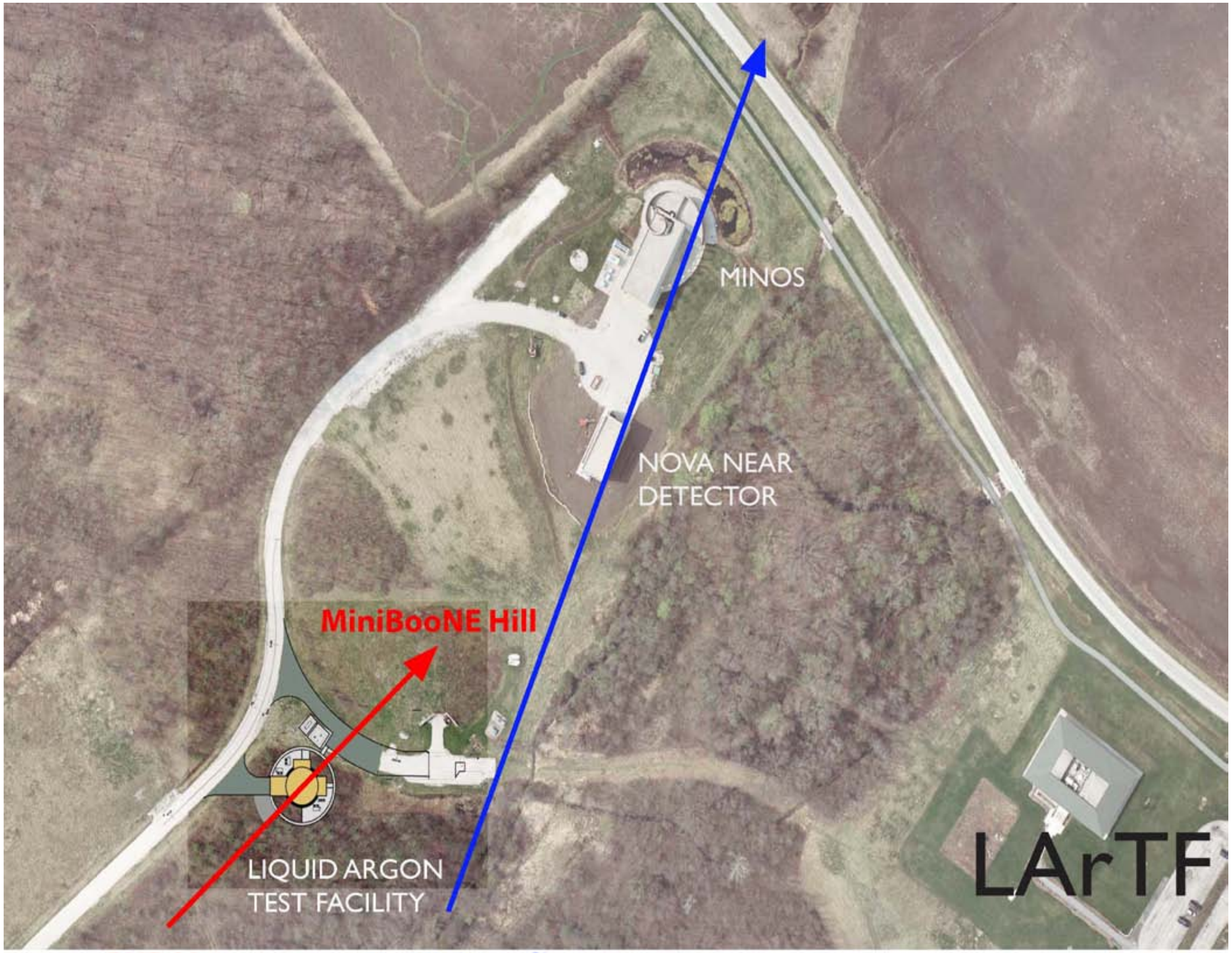
Design

Design

Introduction

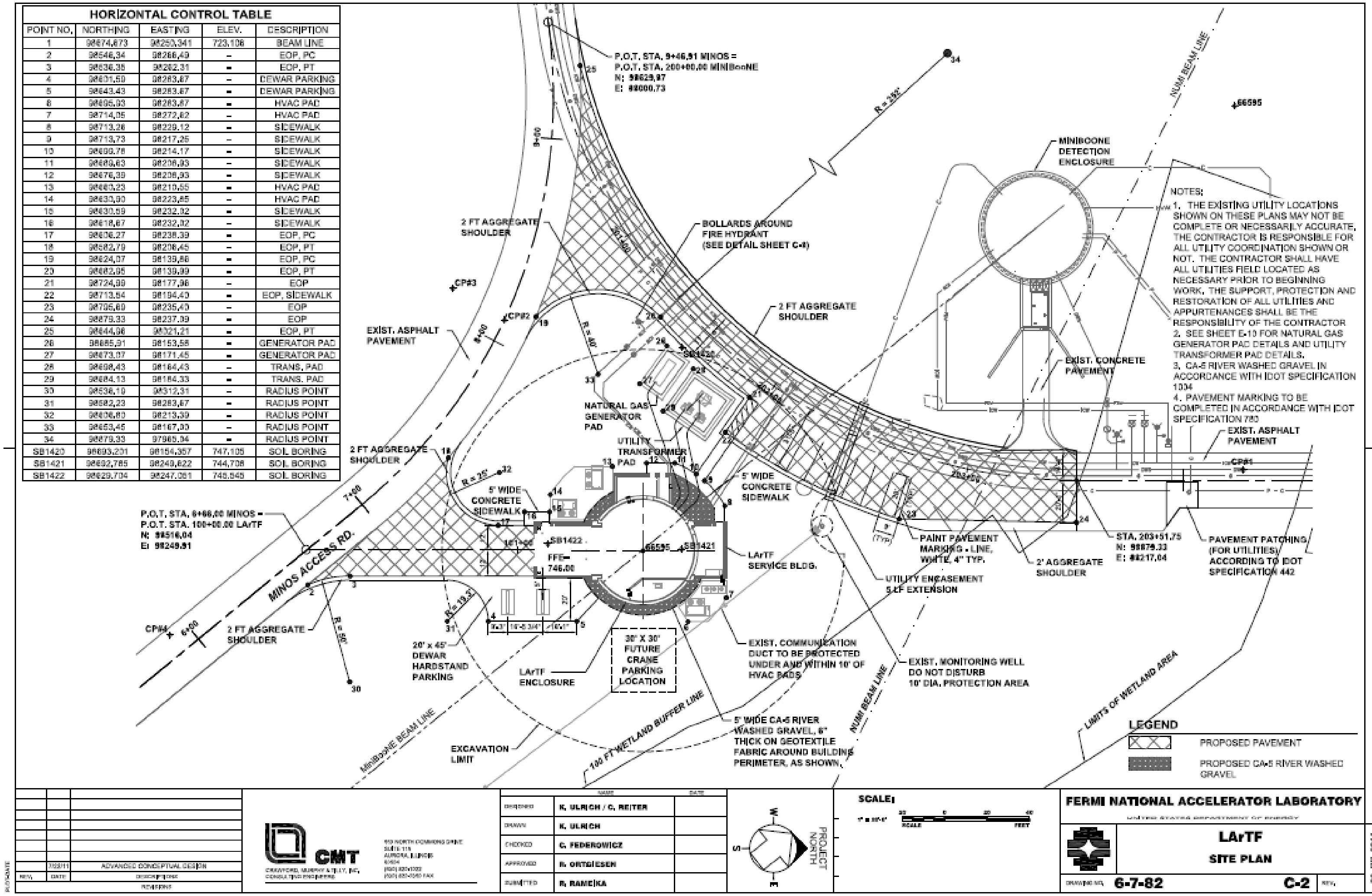
- The use of Liquid Argon as the basis of large scale neutrino detectors for future neutrino experimentation is under active investigation. A program of increasing scale liquid Argon detector development is scheduled at Fermilab, possibly leading to the use of a very large scale liquid Argon detector at a future site for long baseline neutrino research. A small detector has been installed, successfully operated, and removed in the MINOS Hall of the Fermilab NuMI beamline. The next upscale of the liquid Argon program at Fermilab is the MicroBooNE experiment, to be followed by studies of other alternative cryostat designs. It is proposed to operate these devices (serially) in a new facility to be constructed in the Fermilab Booster Neutrino Beam (BNB) just upstream of the existing MiniBooNE Facility, which is still active.

Location (with neutrino beamlines)



BNB Line NuMI Beamline

Location (as shown in 95% review)

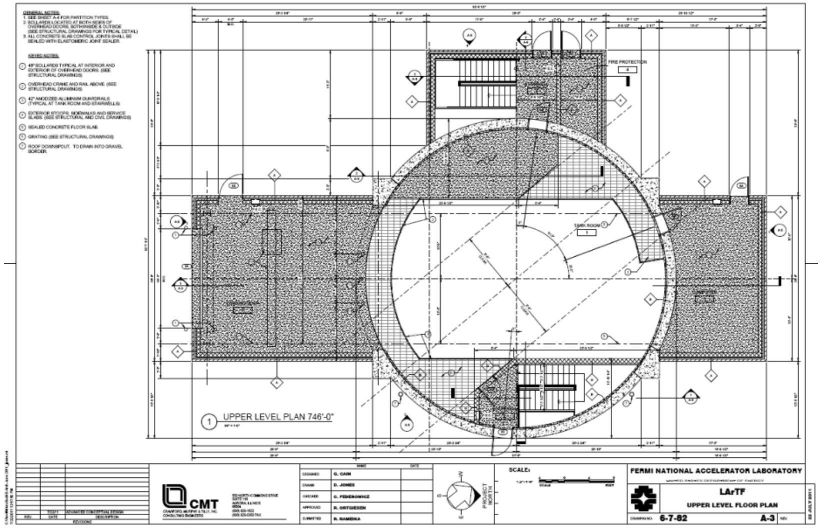


HORIZONTAL CONTROL TABLE				
POINT NO.	NORTHING	EASTING	ELEV.	DESCRIPTION
1	98674.673	98250.341	723.106	BEAM LINE
2	98546.34	98266.49	–	EOP, PC
3	98536.35	98282.31	–	EOP, PT
4	98601.50	98283.87	–	DEWAR PARKING
5	98643.43	98283.87	–	DEWAR PARKING
6	98695.93	98283.87	–	HVAC PAD
7	98714.05	98272.82	–	HVAC PAD
8	98713.26	98229.12	–	SIDEWALK
9	98713.73	98217.25	–	SIDEWALK
10	98696.78	98214.17	–	SIDEWALK
11	98689.63	98206.93	–	SIDEWALK
12	98676.39	98206.93	–	SIDEWALK
13	98660.23	98210.55	–	HVAC PAD
14	98630.90	98223.85	–	HVAC PAD
15	98630.59	98232.02	–	SIDEWALK
16	98618.67	98232.02	–	SIDEWALK
17	98606.27	98238.39	–	EOP, PC
18	98582.79	98208.45	–	EOP, PT
19	98624.07	98139.86	–	EOP, PC
20	98682.05	98139.99	–	EOP, PT
21	98724.99	98177.96	–	EOP
22	98713.54	98194.40	–	EOP, SIDEWALK
23	98795.69	98235.40	–	EOP
24	98879.33	98237.09	–	EOP
25	98644.96	98021.21	–	EOP, PT
26	98685.91	98153.58	–	GENERATOR PAD
27	98673.07	98171.45	–	GENERATOR PAD
28	98698.43	98164.43	–	TRANS. PAD
29	98684.13	98164.33	–	TRANS. PAD
30	98536.19	98312.31	–	RADIUS POINT
31	98582.23	98283.67	–	RADIUS POINT
32	98606.60	98213.39	–	RADIUS POINT
33	98653.45	98167.00	–	RADIUS POINT
34	98879.33	97965.04	–	RADIUS POINT
SB1420	98693.201	98154.357	747.105	SOIL BORING
SB1421	98692.785	98249.622	744.708	SOIL BORING
SB1422	98629.704	98247.081	746.545	SOIL BORING

Introduction - continued

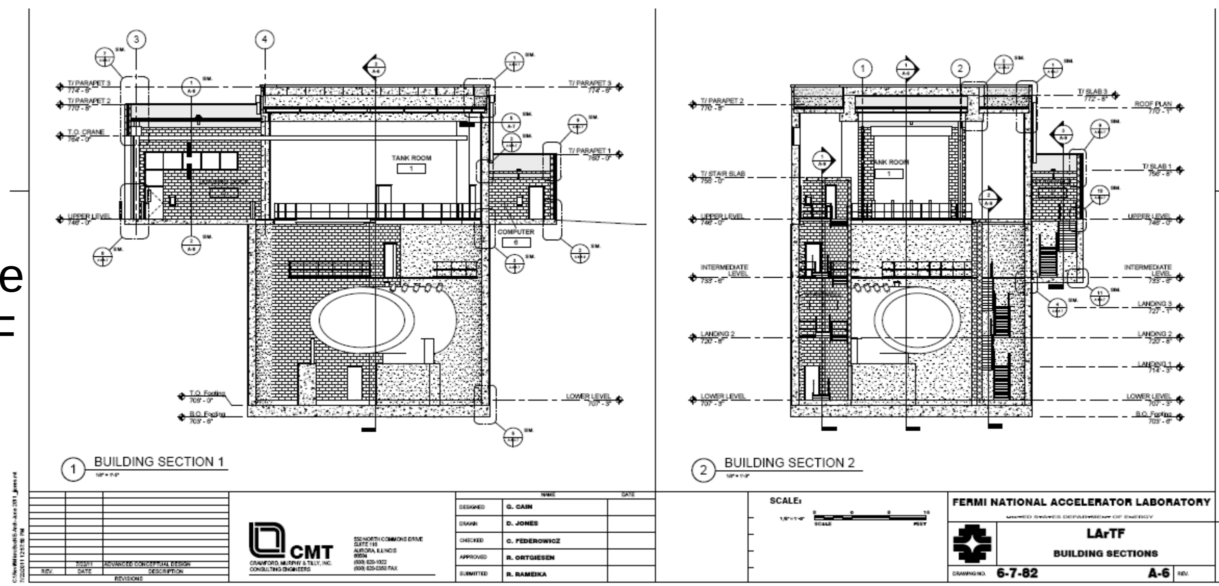
- A general purpose facility for the study of liquid Argon detectors will be constructed, with internal outfitting for the first of the cryostats (MicroBooNE) to be studied. The internal outfitting will be designed and constructed to accommodate alterations to future follow-on configurations.
- The general structure will consist of a cylindrical pit approximately 40’ deep and nearly 50’ in diameter, with an extension of the cylinder above grade with an adequate amount of access/assembly area and an electronics room for housing surface detector readout equipment. The center of the cylinder will be on the BNB beamline approximately 240’ upstream of the center of the MiniBooNE detector. Utilities (electrical, communications, natural gas, and ICW) will be tapped from nearby feeders and piping in existing utility corridors. The proposed site has been examined and is not in any wetlands, defined floodplain, or other protected area.

Introduction to the LArTF Structure



Plan View at grade -746’ elevation

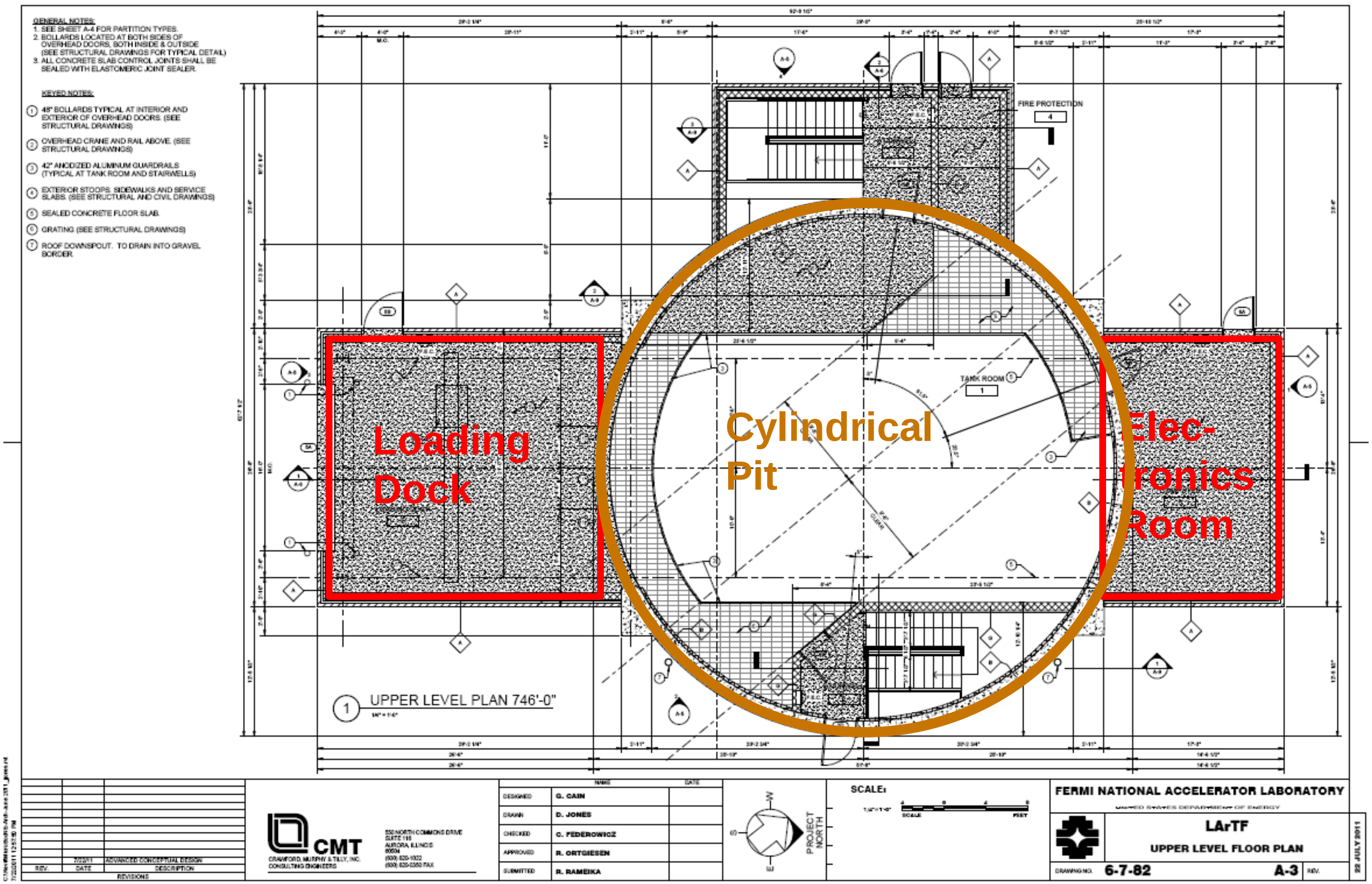
Elevation sections: Showing 50’ diameter cylinder 40’ below grade and above grade LArTF building.



Detailed Description (General)

- The structure shall consist of a cylinder of 50' outside diameter reaching 28' above grade and extending 40' below grade (finished grade to be 746') with an additional rectangular loading dock/truck bay of an area of at least 525 sq.ft. (21' x 25') and an electronics room of an area of at least 410 sq ft (15' x 26').
- The location of the cylinder center shall be approximately 240' upstream of the MiniBooNE Facility. The following are the proposed coordinates for a Detector Center in the cylinder:
  - X [ft] = 98250.341
  - Y [ft] = 98674.673
  - H [ft] = 723.106 - this is the elevation Earth Curvature corrected.
- This point was computed to be collinear with the BNB Decay Pipe center (best fit line through the as found points during construction QC) and 240 feet upstream of the MiniBooNE Detector center.
- For the proposed location of the facility new utilities must be brought from the existing utility corridor, including 13.8kV electrical service, ICW, and natural gas. The existing MiniBooNE Facility will not be disturbed except for outages during utility connections.

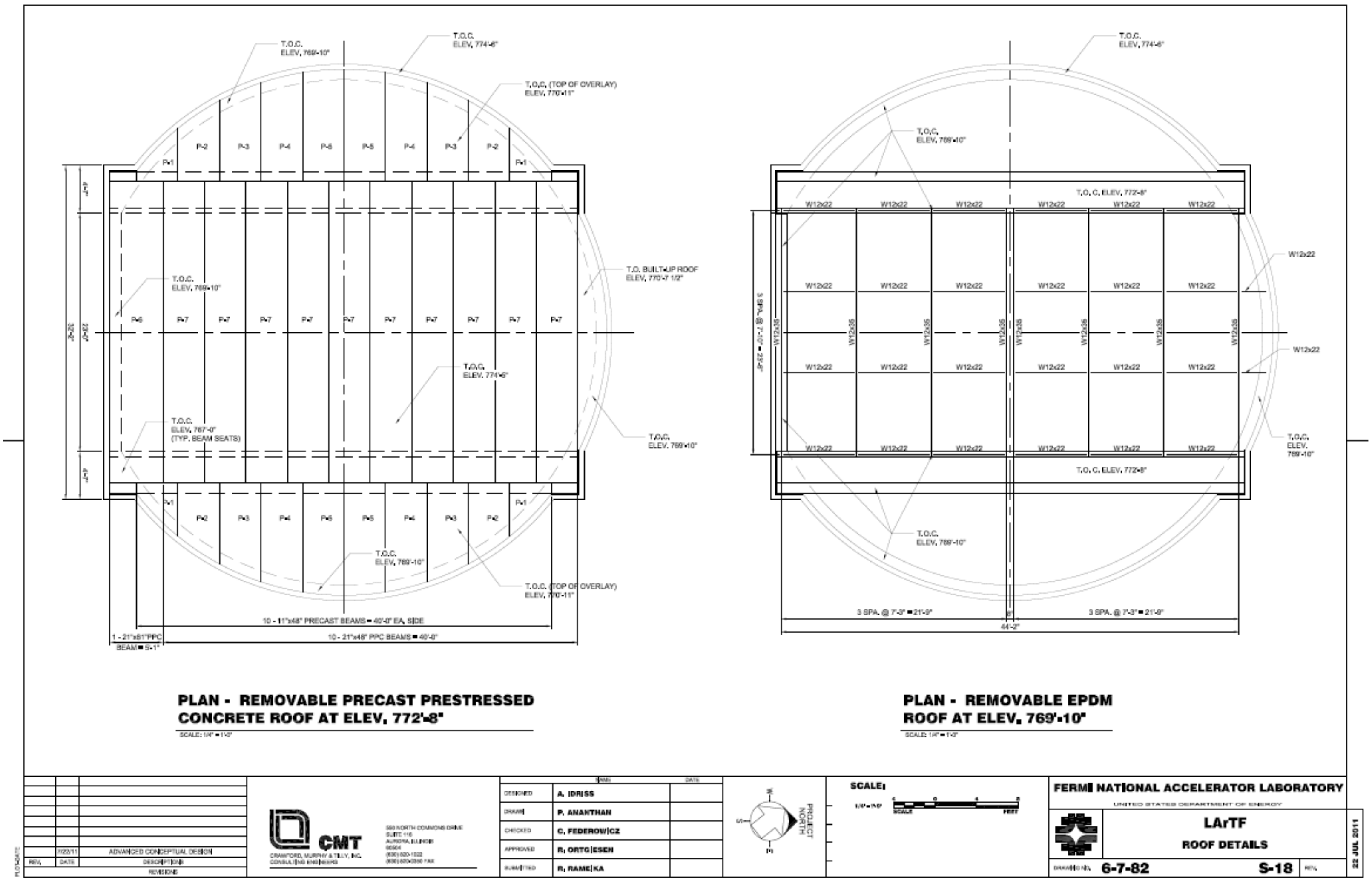
Major Architectural Elements



Detailed Description (2)

- Entries provided at grade will include: first to a delivery area with truck access, second to an electronics room and third, an entry into the fire protection control room.
- A roof with a removable slot will be provided. The roof must have the carrying capacity for 10 foot of earth equivalent material. A concrete "collar" of the cylinder section will be extended above grade to support the roof. The dimensions of the rectangular opening will be 44'2" by 23'. That is a 530" x 276" clear opening. The removable roof section must be made weather tight.
- Electrical service will include one 150 kVA transformer and one 500 kVA transformer.
- Provision for safe egress in the event of an ODH incident must be provided.
- New taps to existing ICW (industrial Cold Water), natural gas, electric, and DWS (Domestic Water Service) services in the nearby utility corridor are required. There may be a need for an additional ICW line to create a "loop" so that ICW can be used for process chilling and then discharged back into the ICW system.

Major Architectural Element - Roof



Detailed Description (3)

- There is a total of 1860 sq ft available at the elevation 706 level.
- A 5 ton crane will be located within the Loading Dock. Crane coverage within this area will be approximately 16' x 22' = 352 sq ft at elevation 746.'
- There will be a paved road to the loading dock.
- Building electrical power will require a 500 kVA transformer. Clean power will be provided by a 150 kVA transformer. The electrical service motor control center will be located on the west wall of loading dock area.
- A natural gas emergency power generator rated at 150KW is required, with an automatic transfer switch. This emergency service is sized for cryogenics monitoring and HVAC for ODH escape, etc.

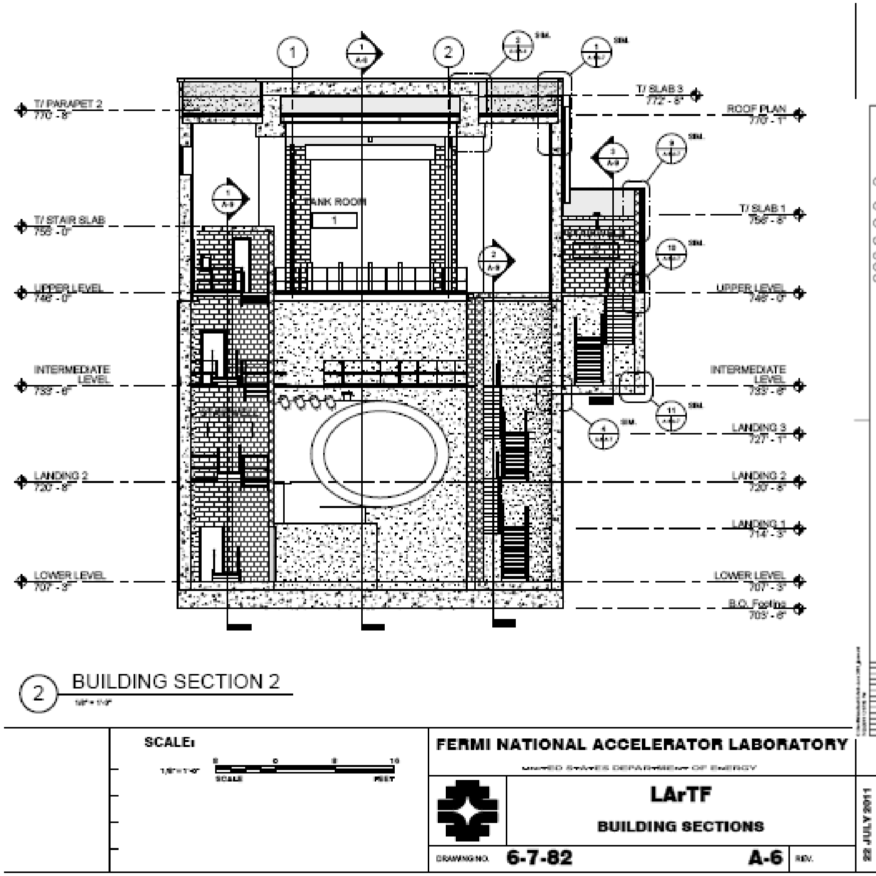
Detailed Description (4)

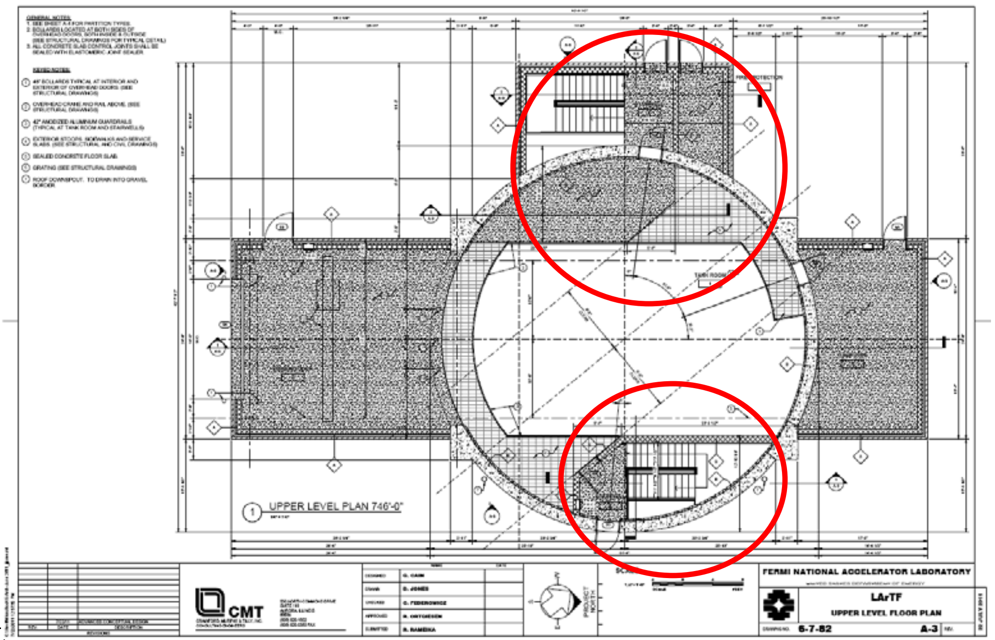
- Fire suppression with a sprinkler system, and fire alarms, will be provided. Mounting of the sprinkler pipes will be consistent with the removable roof requirement.
- Cryogenic transfer piping to be mounted on the east wall of loading dock area.
- Human occupancy expectation is 20 max during installation, approximately 0 during operations. The assumption is that there are no sanitary facilities provided in the structure, which means portable toilets are necessary.
- Radiation interlocks not necessary; ODH alarms, etc. are necessary.
- Standard lighting specifications.

Detailed Description: (Outfitting for the first usage - MicroBooNE)

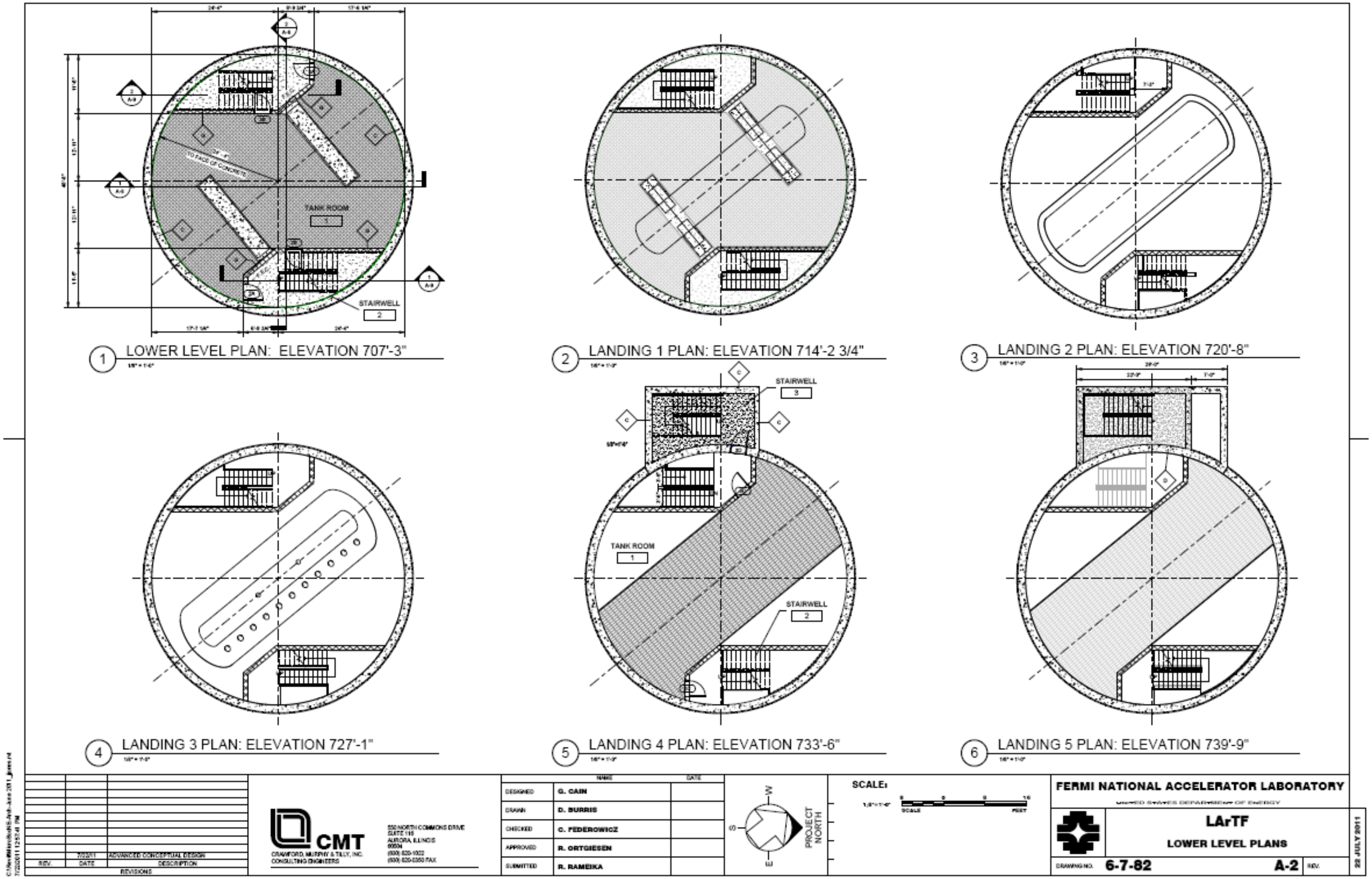
- For MicroBooNE there will be five entries provided at grade: first to a delivery area with truck access, second to an electronics room, **third a door into one of two vertical stair columns to access the various below grade levels, fourth a door into the second stair column through an outside covered entry,** and fifth, an entry into the fire protection control room.
- The removable slot in the roof is sufficient to permit the entry of the MicroBooNE Detector cryostat .
- Provision for safe egress in the event of an ODH incident **in the pit** must be provided.
- Supports for the cryostat, readout electronics, and refrigeration equipment must be constructed.
- Adequate ICW for process cooling must be provided

The Over-Pressurized Stairways





The Stairway Landings



Outfitting Specifications

- The location of the liquid argon tank with the detector shall be “close” to the MiniBooNE detector center, approximately on the existing MiniBooNE beamline in both plan and elevation, but approximately 240’ upstream of the MiniBooNE Facility. The following are the proposed coordinates for the MicroBooNE Detector Center :
  - X [ft] = 98250.341
  - Y [ft] = 98674.673
  - H [ft] = 723.106 - this is the elevation Earth Curvature corrected.
- It is proposed to house the detector tank, supporting refrigeration, readout electronics, and delivery area in the basic cylinder and two attached structures at grade. The new facility will require three working elevations dictated by the refrigeration plant under the cryostat and the beamline center:
  - 706’0”/707’3”, “Refrigeration Plant Level”.
  - 732’4”/733’6”, “Detector Readout Service Level”.
  - 746’, “Loading Dock Level/Electronics Room Level”

Outfitting Specifications (2)

- The insertion of the argon tank/detector shall be by an exterior movable crane through the removable roof sections. The dimensions of the rectangular opening will be 44’2” by 23’. That is a 530” x 276” clear opening.
- There is a total of 1860 sq ft available at the elevation 706 level. About 410 sq ft will be used to provide two emergency exit stairways that are over pressurized to maintain an ODH-zero classification. The remaining approximately 1450 sq ft at elevation 706 will be available for refrigeration equipment and other support services for the liquid argon detector tank.
- The five ton capacity crane will be extended into the cylinder to move refrigeration equipment between the loading dock level and the 706’ elevation level. There will be a 15’ pick height above elevation 746’, and the hook will descend to elevation 706’ requiring a total hook travel of approximately 55’.
- The crane will cover about 16’ x 40’ = 640 sq ft over elevation 706’.

Outfitting Specifications (3)

- In addition to the paved road to the loading dock, paved tube tanker parking for a pair of tube tankers may be required.
- There will be two enclosed, over pressurized access stairs from elevation 746’ down to elevation 706’. The elevation change up to grade will be 40’ (65 steps) above elevation 706’. Emergency egress within the ODH zero stairways will therefore require a climb of about 5 stories.
- The electronics cable run from the detector tank to the electronics will be approximately 100’ or less.
- There will be four distinct HVAC regions.
  - (Area A) The electronics room.
  - (Area B) The loading dock.
  - (Area C) The over pressurized ODH “zero” exit stair columns to ground from el 706’.
  - (Area D) The remaining spaces (the rest of the cylinder structure) will be designed with sufficient exhaust fans such that in the event of an ODH accident the conditions should not exceed ODH-1.

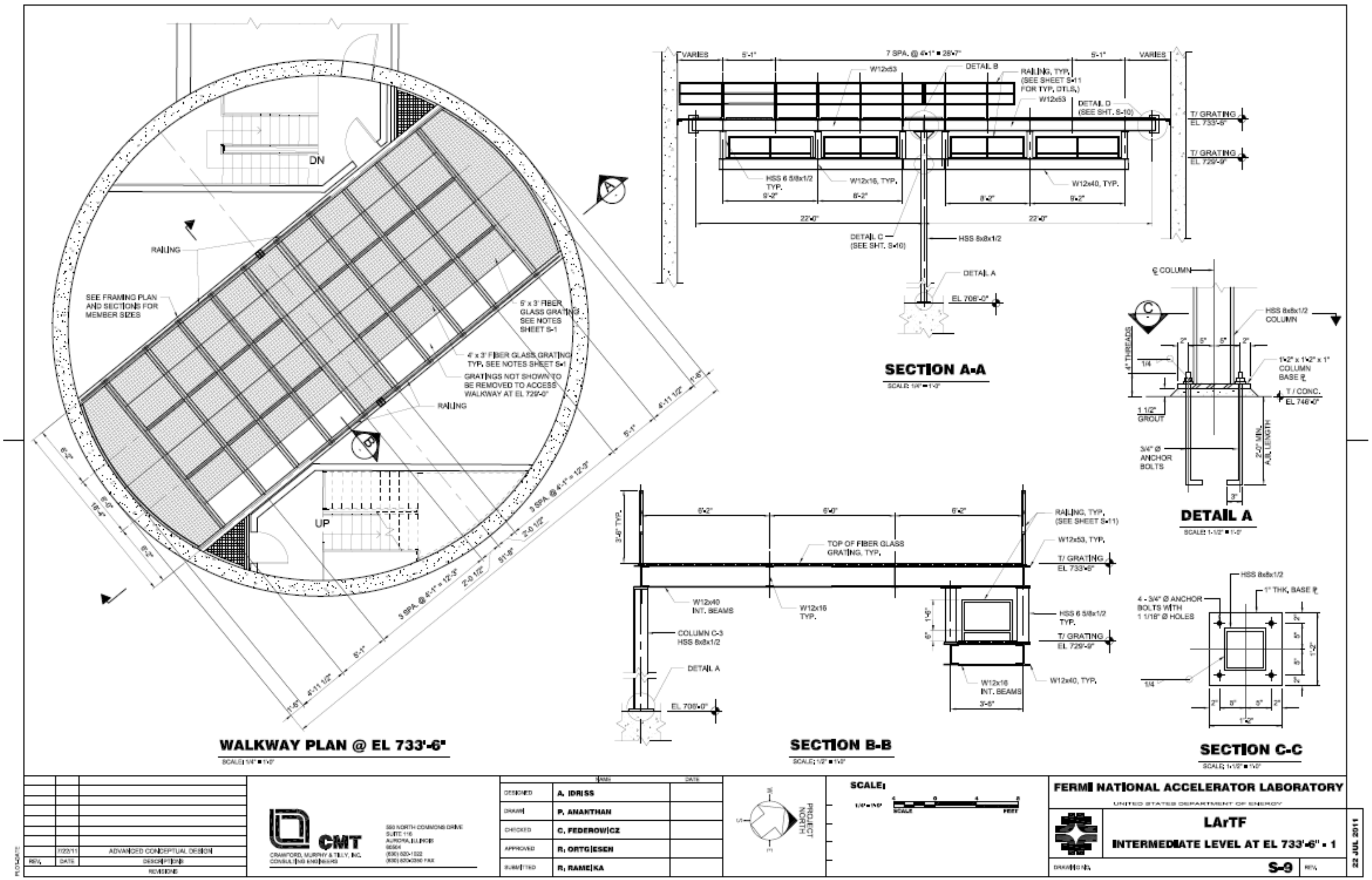
Outfitting Specifications (4)

- An argon spill volume will be created with insulation under a grating built 15” above the 706 elevation floor.
- The argon spill vent (air-exchange) rate is 7500 CFM. The standard non-accident air exchange rate will be consistent with an occupancy of 20 people.
- In the exit stairs the ODH “zero” over pressurization will be between ½” and 1” water overpressure.
- Conventional HVAC is specified for the four HVAC areas defined above:
  - Area A ---72F to 75F, 50% RH max, no min RH, (12 racks @25KW/rack)
  - Area B---not conditioned, 65F min.
  - Area C---60F to 80F, 55%RH max, no min RH, 60F min, ½” to 1” water overpressure.
  - Area D--- not conditioned, 55% RH max, no min RH, 60F min, standard air exchange for 20 people occupancy, 7500 cfm exhaust under ODH accident.

Outfitting Specifications (5)

- Process cooling water is required, 10 gpm, 2 degree working temperature drop. An ICW loop will be created with discharge back the ICW system.
- Cryogenic transfer piping to be mounted on the east wall of loading dock area.
- Outside storage requirements – LN2 tank, small LAr dewar.
- The walkways around the cryostat will be modular in design with engineered lift points. The individual modular pieces will weigh less than 5 tons so that they may be lifted with the 5-ton crane, and stored in the receiving area. This will permit the installation of the modular walkways before the delivery of the cryostat, and permit easy disassembly when the cryostat is ready to install, or after installation if the cryostat must ever be removed for servicing.

The Walkways at El 733'6"



Design Status

- The 95% Design and Specifications prepared by CMT have been delivered on Friday July 22.
- The 95% package is available for the Reviewers.
- The 95% package has been distributed to FESS and other concerned staff for review and comment using the standard FESS system for comments.
- A two week comment period is underway.
- Senior Fermilab Management has reviewed the proposed structure for aesthetics. A request to place brick on the cylinder, and precast concrete on the attached structures has been made, as shown on the title page rendering of this presentation. This change will be made by CMT in the bid set.

Project Execution

“Executing the Project”

Funding

Baseline Costs

Schedule

Risk

Project Execution - FUNDING

The Total Estimated Cost (TEC) for this project is estimated to be $6,600,000 funded in FY12 dollars.

	FY12
Construction	$3,895,000
EDIA	$974,000
Management Reserve	$1,202,000
Subtotal	$6,071,000
Indirect Costs	$529,000
TOTAL	**$6,600,000**

Project Execution – BASELINE COSTS

FERMILAB FESS COST ESTIMATE							
ESTIMATED SUBCONTRACT AWARD AMOUNT							$3,740,000
Escalation		3.0%					$109,000
Difficult Conditions		5.0%					$173,000
Subcontract Base Estimate							$3,458,000
Liquid Argon Test Facility			Project No.	Status:	Date:	Rev Date	
			6-7-82	PP	27-Jul-11	00-Jan-00	
ITEM NO.	*DESCRIPTION OF WORK:*		*QUANTITY*	*UNITS*	*UNIT COST*	*AMOUNT*	
00	**General**	**$118,000**					
01	From CMT Estimate, dated 7/22/11		1	Lot	$118,000.00	$118,000	
01	**Civil**	**$351,000**					
01	From CMT Estimate, dated 7/22/11		1	Lot	$350,640.00	$350,600	
02	**Architectural**	**$300,000**					
01	From CMT Estimate, dated 7/22/11		1	Lot	$299,850.00	$299,900	
	(removed Fermi-furnished 5-Ton crane)						
03	**Structural**	**$1,761,000**					
01	From CMT Estimate, dated 7/22/11		1	Lot	$1,760,675.00	$1,760,700	
04	**Mechanical**	**$301,000**					
01	From CMT Estimate, dated 7/22/11		1	Lot	$301,250.00	$301,300	
05	**Plumbing**	**$78,000**					
01	From CMT Estimate, dated 7/22/11		1	Lot	$78,250.00	$78,300	
06	**Fire Protection**	**$103,000**					
01	From CMT Estimate, dated 7/22/11		1	Lot	$103,360.00	$103,400	
07	**Electrical**	**$446,000**					
01	From CMT Estimate, dated 7/22/11		1	Lot	$446,000.00	$446,000	
	(removed Fermi-furnished equipment)						

Construction Cost 1 – Conventional Construction Subcontract

Project Execution - BASELINE COSTS

FERMILAB FESS COST ESTIMATE

						ESTIMATED SUBCONTRACT AWARD AMOUNT	$155,000
Escalation			3%				$5,000
Subcontract Base Estimate							$150,000
Liquid Argon Test Facility				Project No.	Status:	Date:	Rev Date
Advanced Procured Items				6-7-82	PP	27-Jul-11	
ITEM NO.		*DESCRIPTION OF WORK:*		*QUANTITY*	*UNITS*	*UNIT COST*	*AMOUNT*
01		**Equipment**	**$150,000**				
	01	15KV 4-Bay Switch		1	Lot	$20,000.00	$25,000.00
	02	500kVA Transformer		1	Lot	$45,000.00	$50,000.00
	03	150kVA Transformer		1	Lot	$25,000.00	$25,000.00
	04	5-Ton Bridge Crane		1	Lot	$50,000.00	$50,000.00

Construction Cost 2 – Fermilab Long-Lead Procurements

Project Execution - BASELINE COSTS

25% MR

		Base Cost	Management Reserve	Indirect Costs	Subtotal
1.1	Preliminary Design ED&I				$0
1.2	Final Design ED&I	$390,000	$98,000	$93,000	$581,000
1.3	Construction ED&I	$390,000	$98,000	$198,000	$686,000
2.1	Preliminary Design Administration				$0
2.2	Final Design Administration	$97,000	$24,000	$54,000	$175,000
2.3	Construction Administration	$97,000	$24,000	$54,000	$175,000
3.1	Fixed Price Construction	$3,740,000	$935,000	$101,000	$4,776,000
3.2	Time and Materials Construction	$0	$0	$0	$0
3.3	Advanced Procurement	$155,000	$23,000	$29,000	$207,000
	TOTALS	**$4,869,000**	**$1,202,000**	**$529,000**	**$6,600,000**

Assumes exempt civil > $500K

15% MR

Project Execution - SCHEDULE

Based on Directive Approval	Month 0	Aug. 2011
Engineering Start	Month 0	Aug. 2011
Construction Start	Month 3*	Nov. 2011
Construction Complete	Month 17**	Jan. 2013***
Engineering Complete	Month 19	Mar. 2013
Project Complete	Month 21	Apr. 2013

* Assume Final Design Complete – August 2011

** Includes 2 months float

*** Coincides with expected delivery of MicroBooNE Detector

The construction schedule based upon the weekly photographs of the similar MiniBooNE construction – 12 months.

The proposed schedule has been integrated by the MicroBooNE Project into their planning.

Schedule for MicroBooNE (1)

MicroBooNE Construction Timeline Estimated From Revision of MiniBooNE Actual schedule		
Dixon Bogert, May 2011		
Week #	**Date**	**Estimated Work Accomplished by this date**
0	10/17/2011	Assumed start of site mobilization
1	10/24/2011	Clear and grub site
2	10/31/2011	First (of eventually three) excavation lifts
3	11/7/2011	Excavation near bottom of third lift
4	11/14/2011	Finish excavation; form sump; pour sump; set base gravel
5	11/21/2011/	Mudslab poured. Start base form; start to lay base bar.
6	11/28/2011	Continue Base form work; more bar.
7	12/5/2011	Pouring base slab
8	12/12/2011	Start first wall lift interior forms, first 180 degrees
9	12/19/2011	Bar, pour, first 180 degrees first lift
10	12/26/2011	Strip first 180 degrees first lift, FBP second 180 degrees first lift
11	12/31/2011	Lab Closed this week
12	1/7/2012	Damp proof first lift, set under drains around
13	1/14/2012	Gravel (CA-6?) back fill 2/3 first lift; form interior first 180 degrees second lift
14	1/21/2012	Bar and form first 180 degrees second lift
15	1/28/2012	Close first 180 degree second lift, pour?
16	2/4/2012	Interior form, bar second 180 degree second lift
17	2/11/2012	Second lift poured and stripped; damp proof second lift, start to raise backfill
18	2/18/2012	FBP Piers to grade, temp interior stairs
19	2/25/2012	Backfill to grade, Footings truck entry and elec room

Schedule for MicroBooNE (2)

20	3/3/2012	More entry way FBP; more backfill
21	3/10/2012	More FBP entry, start to bar third (above grade) lift first 180 degrees
22	3/17/2012	Above grade lift FBP
23	3/20/2012	FB but no pour first 180 degrees third lift
24	3/27/2012	FBP 3rd lift first 180 degrees
25	4/3/2012	Steel erection - craneway and truck entry and elec room
26	4/10/2012	Continue steel erection
27	4/17/2012	Walls truck entry and elec room, under floor conduit
28	4/22/2012	FBP third lift second 180 degrees; strip first 180 degrees
29	4/29/2012	FBP thrid lift second 180 degrees, pour floors truck and elec room
30	5/6/2012	Utilities work, strip 3rd lift, ditch grading
31	5/13/2012	More interior work, block wall stairs, emergency passage, etc.
32	5/20/2012	Continue block walls
33	5/27/2012	install stairs in escape way
34	6/4/2012	roof truck entry, elec room
35	6/11/2012	Form main roof beams
36	6/18/2012	Cast roof beams
37	6/25/2012	Strip roof beams, cure, elec rough in start
38	7/2/2012	Set roof precast pieces
39	7/9/2012	Ready for cryostat any time now; weatherize roof?
40	7/16/2012	Duct banks
41	7/23/2012	Fire "tree" for sprinklers; sprinkler pies, vesda pipes
42	7/30/2012	interior fit out continues
43	8/6/2012	More interior fit out; more sprinklers, some HVAC seen

Note: CMT has designed pre-cast roof beams; may go faster.

Schedule tie-in To MicroBooNE Project!

Schedule for MicroBooNE (3)

44	8/13/2012	Interior paint; electrical rough in continues
45	8/20/2012	More elec rough in
46	8/27/2012	HVAC units arrive; more elec.
47	9/3/2012	more outfitting all trades
48	9/10/2012	Time allotted for cryostat mastic
49	9/17/2012	Time allotted for cryostat mastic
50	9/26/2012	lights on; interlocks installed
51	10/3/2012	More outfitting
52	10/10/2012	More outfitting - erect platforms
53	10/17/2012	More outfitting - erect platforms
54	10/25/2012	Done?

Actual MiniBooNE Construction Schedule

MiniBooNE Construction Timeline From Photographic Records in FermiVMS Photo Books

Dixon Bogert, May 2011

Week #	Date	Work Accomplished shown in picture of this date
0	10/22/1999	Assumed start of site mobilization
1	10/29/1999	Clear and grub site
2	11/5/1999	First (of eventually three) excavation lifts
3	11/12/1999	Excavation near bottom of third lift
4	11/19/1999	Finish excavation; form sump; pour sump; set base gravel
5	11/29/1999	Mudslab poured. Start base form; start to lay base bar.
6	12/3/1999	Continue Base form work; more bar.
7	12/10/1999	Pouring base slab
8	12/17/1999	Start first wall lift interior forms, first 180 degrees
9	12/23/1999	Bar, pour, first 180 degrees first lift
10	12/31/1999	No pix.
11	1/7/2000	Strip first 180 degrees first lift, FBP second 180 degrees first lift
12	1/14/2000	Damp proof first lift, set under drains around
13	1/21/2000	Gravel (CA-6?) back fill 2/3 first lift; form interior first 180 degrees second lift
14	1/28/2000	Bar and form first 180 degrees second lift
15	2/4/2000	Close first 180 degree second lift, pour?
16	2/11/2000	Interior form, bar second 180 degree second lift
17	2/18/2000	No pix.
18	2/25/2000	Second lift poured and stripped; damp proof second lift, start to raise backfill
19	3/3/2000	Back fill comoplete to grade; Form and bar entry addition, temp interior stairs

MiniBooNE Construction Schedule (2)

20	3/10/2000	No pix.
21	3/17/2000	More entry way FBP; more backfill
22	3/24/2000	More FBP entry, start to bar third (above grade) lift first 180 degrees
23	3/31/2000	Above grade lift FBP
24	4/7/2000	Start sphere install (fit and clamp)
25	4/17/2000	about 1/3 sphere fit and clamp; a little more FBP
26	4/24/2000	about 2/3 sphere fit and clamp
27	4/28/2000	about 3/4 sphere fit and clamp
28	5/5/2000	Sphere fit and clamp done
29	5/12/2000	Sphere weld
30	5/19/2000	Sphere weld complete; Place precast ground floor beams
31	5/26/2000	No pix.
32	6/1/2000	FB but no pour first 180 degrees third lift
33	6/9/2000	FBP 3rd lift first 180 degrees
34	6/15/2000	No pix.
35	6/22/2000	No pix.
36	6/29/2000	No pix.
37	7/5/2000	FBP third lift second 180 degrees; strip first 180 degrees
38	7/14/2000	FBP thrid lift second 180 degrees, damp proof first 180 defrees, precast floor laid
39	7/21/2000	Utilities work, strip 3rd lift, ditch grading
40	7/27/2000	More interior work, cylinder wall stairs, etc.
41	8/4/2000	No pix.
42	8/11/2000	"Back fill" (hill) third lift
43	8/18/2000	More back fill third lift hill, form roof entry

MiniBooNE Construction Schedule (3)

44	8/25/2000	Precast (form pieces) of roof installed; start bar for cast roof
45	9/1/2000	Cast roof formed and poured
46	9/8/2000	Fill on top roof started; paint tank
47	9/15/2000	More backfill third lift hill
48	9/22/2000	Backfill hill on top roof; utility ductbanks
49	9/30/2000	Duct banks
50	10/10/2000	Fire "tree" for sprinklers; sprinkler pies, vesda pipes
51	10/13/2000	hill near done; interior fit out continues
52	10/20/2000	More interior fit out; more sprinklers, some HVAC seen
53	10/27/2000	Interior paint; electrical rough in start
54	11/3/2000	More elec rough in
55	11/10/2000	HVAC units arrive; more elec.
56	11/17/2000	work on interior of sphere
57	11/24/2000	No pix.
58	12/1/2000	No pix.
59	12/8/2000	lights on; interlocks installed
60	12/15/2000	More outfitting
61	12/22/2000	No pix.
62	12/29/2000	No pix.
63	1/2/2001	Looks to be done

More Information on MiniBooNE

- The original contract DID NOT INCLUDE the construction of the sphere. The original contract was for 49 weeks. 8 weeks was added to the original contract to manage installation of the sphere construction and installation extending the schedule to 57 weeks.

Project Execution - RISK

“Managing Risk”

Project Execution - RISK

- Completed Engineering Risk Assessment as required by Fermilab Engineering Policy
- As determined by the Engineering Risk Assessment, the project will use a risk-based graded approach.
- Based on the Engineering Risk Assessment and internal FESS procedures regarding the execution of GPP Projects, a standard level of review will be implemented.
  - Project Plan – Lab-Wide Comment and Compliance Review (CCR)
  - Design Documents – 95% CCR

Project Execution - RISK

Engineering Risk Assessment

Project: Liquid Argon Test Facility (LArTF)
Lead Engineer: C. Federowicz
Department: FESS/Engineering
Date: July 28, 2011

		Engineering Risk Element							High Risk	Subtotal	Assessment
Chapter		A	B	C	D	E	F	G			
1	Requirements and Specifications	1	2				2		≥ 10	5	Standard Risk
3	Requirements and Specification Review	1	2		2	1	2		≥ 16	8	Standard Risk
4	System Design	1	2	2		1	2	1	≥ 19	9	Standard Risk
5	Engineering Design Review	1	2	2		1	2	1	≥ 19	9	Standard Risk
6	Procurement and Implementation		2		2	1	2	1	≥ 16	8	Standard Risk
7	Testing and Validation	1				1	2	1	≥ 13	5	Standard Risk
8	Release to Operations						2		≥ 4	2	Standard Risk
9	Final Documentation		2				2		≥ 7	4	Standard Risk

Project Risk Element								High Risk	Subtotal	Assessment
H	I	J	K	L	M	N	O			
3	2	1	2	1	3	1	2	≥ 25	15	Standard Risk

Engineering Risk Elements	
A	Technology
B	Environmental Impact
C	Vendor Issues
D	Resource Availability
E	Safety
F	Quality Requirements
G	Manufacturing Complexity

Project Risk Elements	
H	Schedule
I	Interfaces
J	Experience / Capability
K	Regulatory Requirements
L	Project Funding
M	Project Reporting Requirements
N	Public Impact
O	Project Cost

Project Execution - RISK

Preliminary Risk Identification

No.	Potential Risk	Potential Problem	Handling Plan, Steps and Schedule
A.	**Management/Programmatic**		
1	Funding delay due to continuing resolution	If annual funding authorization is delayed at the beginning of each FY, resulting in Continuing Resolution greater than 3 months, then there could be delays as a result of a shortage of funding.	Use single year funding.
2	Ongoing Operational Constraints	If contractor does not get outages or tie-ins as scheduled, then there could be delay in construction completion.	Identify outages early; Perform during pre-construction those outage-required tie-ins that can be isolated (valved, switched, etc.); CPM schedule requirement in the contract; Contingency for night/weekend work.
3	Submittal of Contractor Substantial Claim	If the AE or GC submits a substantial claim, then there could be cost and/or schedule impacts to resolve dispute.	Provide quality design; select quality contractor and reserve construction contingency; monitor construction closely.
4	Construction Market - Materials and Labor - Unavailability of subcontractors/ Construction workforce	If the world, national, or local construction market is experiencing high volumes of work at the time the project requests proposals for construction (as may occur in response to 2010 efforts to stimulate the world economy), then: construction materials prices could be inflated; material supply timelines could be protracted; price premiums may be applied by local subcontractors that are close to capacity; the best qualified local subcontractors may choose not to participate if fully subscribed.	Ensure construction escalation factors used in estimates are accurate and current with each estimate; monitor market conditions and adjust construction contingency if required; actively market project within metro-area construction community. Fixed-price General Contractor will have responsibility to obtain and coordinate const. materials and resources. In addition to GCs, consider prequalifying subs available for GCs to use. Use 10% scope contingency if necessary.
5	Construction Market - Bids come in too high	If the world, national, or local construction market is experiencing high volumes of work at the time the project requests proposals for construction (as may occur in response to 2010 efforts to stimulate the world economy), then: bids could come in too high and the GC contract would have to be rebid.	Ensure construction escalation factors used in estimates are accurate and current with each estimate; monitor market conditions and adjust construction contingency if required; actively market project within metro-area construction community. Fixed-price General Contractor will have responsibility to obtain and coordinate const. materials and resources. Include sufficient float in GC RFP period to allow for rebid. Use 10% scope contingency if necessary.
B.	**Schedule**		
6	Field Permit Delays	If key permits (dig permit, SWPPP, etc.) are not received in time, then construction schedule and cost could be impacted.	Identify permits early & close coordination.
7	Late Equipment/Material Deliveries by GC	If major equipment/material is delivered late or damaged, then construction schedule could be impacted.	Identify long lead/challenged items early - potentially pre-purchase them; GC contractually responsible for on-schedule deliveries; call out schedule milestones in the contract spec; require all submittals & reviews to be included in GC's critical path schedule; require monthly schedule updates; monitor GC schedule;
8	Owner-Caused Delays	If interferences from site operational or other construction activities; excessive design changes; delayed business operations (delayed payments, prolonged contract modifications) cause construction impacts, then the schedule could be delayed and/or the contractor could ask for damages.	Plan and Communicate construction phase requirements with FESS and Operations to ensure interferences with site ops are prevented; freeze base design at Title I to ensure A/E can focus on fully completing the design without being distracted by changes during Title II; conduct thorough design reviews; establish and proceduralize project-specific business operations processes.

Project Execution - RISK

Preliminary Risk Identification

No.	Potential Risk	Potential Problem	Handling Plan, Steps and Schedule
C.	Cost		
9	Estimates are higher than budget	If the estimates are higher than Project baseline estimate, then the scope may have to be revised.	Ensure a realistic Construction Estimate; implement design to cost strategy; internal review to verify cost. Use 10% scope contingency if necessary.
10	Changes or losses key personnel	If the AE design team has a turnover of key personnel progress could be affected.	Use reselected FESS A/E firms
11	Additional Support Costs Due to Delays	If construction extends beyond the current scheduled completion date, additional support costs would be incurred above and beyond current budget.	A CPM schedule with the general contractor is identified and required in the contract; Identify outages early and coordinate with support personnel to minimize effort during delay periods. Consider placing penalties in the contract to recoup costs due to contractor induced delays.
D.	Design		
12	Design Changes	If customer causes a discretionary change or enhancement in the approved design late in the design phase, then the design may have to be revised. Additional time and $$$ would be necessary.	Review/acceptance of design by key stakeholders
13	AE design team changes or loses key personnel	If the AE design team has a turnover of key personnel progress could be affected.	Contract language will speak to retention of key personnel.
14	Final design delayed	If the AE design team does not deliver the final design on time it could delay construction start.	Sufficient float will be provided on final design delivery. Contract language will provide firm delivery dates for final design. 50 and 95% design reviews will be performed to ensure progress.
15	Errors & Omissions in Design by A-E	If there are errors and omissions in the design, then construction costs will be increased.	Through 50/95% Design Reviews and constructability reviews by Fermilab & CM, resolve issues, design to cost clause. External constructability review on 90% design will likely identify errors and omissions. In addition, pre-selected Fermilab AE contracts have an error and omissions clause to cover cost impacts.
E.	Procurement		
16	Delay in Procurement Approval Process	If the procurement process experiences approval delays that take longer than normal, project schedule and budget could be extended.	Early close coordination with BSS Procurement.
F.	Construction		
17	Contractor(s) selected cannot not complete work satisfactorily or defaults on contract	If an inexperienced or weak vendor/sub is selected (award of contract), then their poor performance could impact the schedule, cost, quality, and safety.	GC to be held contractually responsible for subcontractor performance.
18	Unforeseen/Undocumented subsurface conditions including problems with encountering existing structures, systems, materials (legacy issues), or structurally inadequate soils.	If unforeseen obstacles, conditions, design issues, or unforeseen legacy issues are encountered, then design could require revision, construction contractor impacted, and a field change order would be necessary. An event/incident could also occur.	Thorough geo-tech site assessment (soil borings) by A/E; evaluation of Fermilab historical information to identify potential previous land uses and legacies; follow Fermilab excavation permit process; include in competitive construction RFPs the requirement to provide unit prices (per CY) for work associated with encountering structurally "bad soils."

Project Execution - RISK

Preliminary Risk Identification

No.	Potential Risk	Potential Problem	Handling Plan, Steps and Schedule
19	Disruptions to a Fermilab facility	If the contractor breaks or damages a utility system, then the operation of neighboring facility could be impacted. Excessive dust, vibrations, noise could also impact these facilities.	Follow Fermilab excavation permit process; Identify noise and vibration tolerances of on-site Lab "neighbors"; specially schedule work that will cause noise/vibration above tolerances; SWPPP to include dust prevention measures to which contractors will be held.
G.	**ES&H**		
20	Inadequate Attention to Safety	If there is inadequate attention to safety (such as may be evidenced by a serious accident or injury, or by minor occurrences that indicate a poor performance trend), then personnel could be hurt; property could be damaged, and cost and schedule could be impacted.	Establish a measurable safety goal as a fundamental success metric for the project; instill full understanding and buy-in of the project's safety goal by all involved; reward safe behavior; include safety commitment and performance as a key contractor/supplier evaluation criterion, verify compliance with project HA's
21	Water Pollution	If storm water pollution prevention plan is not adequate, then pollution could enter the storm drain system during construction. (Necessary documents may not be prepared/submitted, necessary controls may not be implemented, and necessary inspections may not be performed.)	Develop a project-specific SWPPP using previously proven plan as a guide, incorporating lessons learned; require detailed storm water pollution prevention requirements to be shown on the design drawings; include Fermilab's proven erosion control specification in the construction contracts; require contractors to submit their own SWPPP plans/arrangements for approval to confirm conformance to requirements; conduct inspections per SWPPP.
H.	**Quality**		
22	System Performance Does Not Meet Criteria	If conventional facilities do not meet the criteria, then research activities may be impacted, e.g., access issues, NMZ'x etc.	Thorough design reviews, construction inspections.
23	Quality Deficiencies with installed construction components	If construction components are not properly installed and inspected, quality issues could result.	Require A/E to identify inspection hold points for critical areas in const. specs.; implement a thorough shop drawing/submittal review and approval process to ensure in-field installation documents reflect requirements; conduct & document inspections to confirm compliance to design requirements and approved submittals; contract with specialist testing agency for structurally critical inspections and tests (soil compaction confirmation; concrete tests; rebar inspections; steel connections inspections); ensure adequate level of project oversight of construction work.

Project Execution - RISK

Scope Contingency

In the event that the acceptable upper-limit proposal is exceeded, scope contingency has been identified as a means of reducing scope while still providing a fully-functional building at project completion. The Request for Proposal (RFP) will ask for a base-bid price incorporating the full scope as defined by the subcontract documents. In addition to a base-bid price, the RFP will ask for an alternate deduct price based on each of the following alternate deduct options:

- Delete precast/prestressed concrete roof (~$100K)
- Delete brick veneer (~$75K)
- Delete interior bridge crane (~$50K)

5% Scope Contingency Defined

Project Execution - RISK

Environmental, Safety & Health (ES&H)

Environmental Review Form – APPROVED categorical exclusion

MAR -8 2011

Dr. Bruce L. Chrisman
Chief Operating Officer
Fermilab
P.O. Box 500
Batavia, IL 60510

Dear Dr. Chrisman:

SUBJECT: NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) DETERMINATION AT FERMI NATIONAL ACCELERATOR LABORATORY (FERMILAB) – MICRO BOOSTER NEUTRINO EXPERIMENT (MICROBOONE) PROJECT

Reference: Letter, from B. Chrisman to M. Weis, dated February 24, 2011, Subject: National Environmental Policy Act (NEPA) Environmental Evaluation Notification Form (EENF) for the MicroBooNE Project

I have reviewed the Fermilab EENF for the MicroBooNE Project. Based on the information provided in the EENF, I have approved the following categorical exclusion (CX):

Project Name	Approved	CX
MicroBooNE Project	3/04/2011	B3.10, B1.15

I am returning a signed copy of the EENF for your records. No further NEPA review is required. This project falls under a categorical exclusion provided in 10 Code of Federal Regulation 1021, as amended in November 1997.

Sincerely,

Original Signed by
Mark E. Bollinger
Deputy Manager

Michael J. Weis
Site Manager

Enclosure:
As Stated

cc: P. Oddone, w/o encl.
Y. - K. Kim, w/o encl.
N. Grossman, w/encl.
T. Dykhuis, w/encl.

bc: P. Siebach, CH-STS, w/encl.
M. McKown, CH-OCC, w/o encl.
J. Scott, FSO, w/o encl.
R. Hersemann, FSO, w/encl.

Project Execution - RISK

Environmental, Safety & Health (ES&H)

- NPDES Storm Water Permit, Notice of Intent will be submitted when project is approved
  - Submittal of Storm Water Pollution Prevention Plan required 30 days prior to start of construction
  - SWPPP submittal/approval falls within 3 month schedule between Project Start and Construction Start

High Performance Sustainable Building

Building will be reviewed for possible certification under LEED and Guiding Principles.

CONCLUSION

- FESS/Engineering has successfully managed many GPP's, including the original MiniBooNE Detector Project, within cost and schedule and in safe manner.
- A project team has been assembled to successfully execute this project.
- Adequate contingency in both cost, schedule and scope is incorporated into the project plan.
- The design team has worked the design of this facility over several years and has worked many iterations finally arriving at a coherent design which satisfies the need of MicroBooNE as well as future argon detectors.