



U.S. DEPARTMENT OF
ENERGY

Office of
Science

ND & FD Civil Construction

Steve Dixon

Fermilab Short-Baseline Neutrino Working Meeting

30 April 2014

Agenda

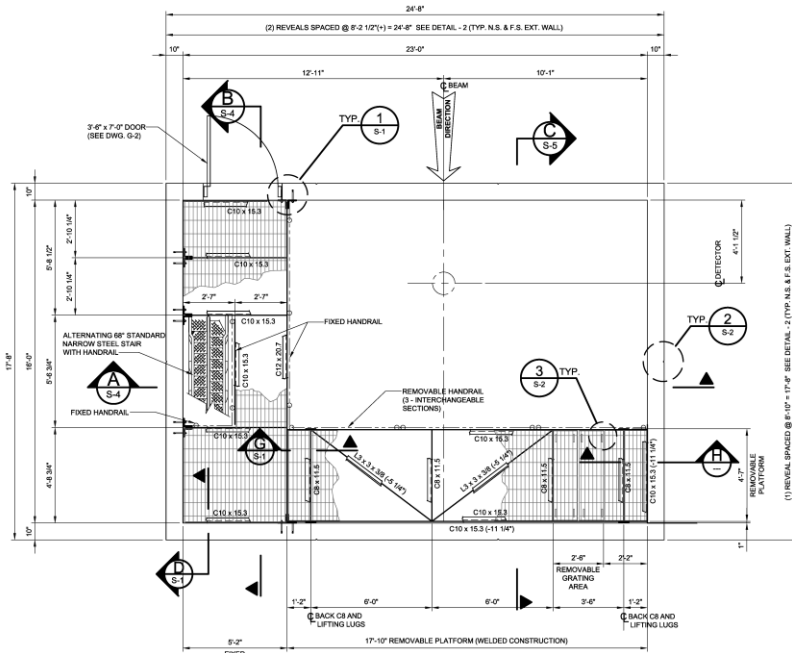
- Recent Building Examples
- Near Detector Building
- Far Detector Building
- Schedule

Recent Building Examples

- SciBooNE Enclosure
- NOvA Surface Building
- LArTF
- MC-1
- Mu2e

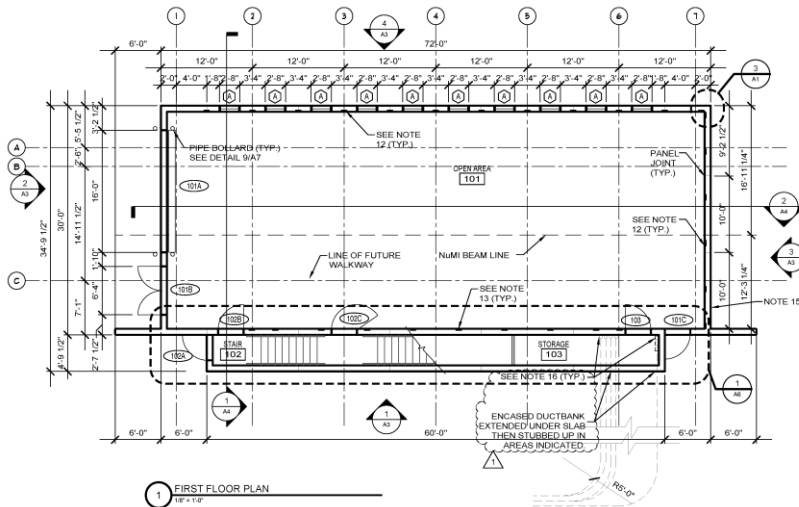
SciBooNE Enclosure

- Constructed in 2006
- \$695,489
- 368 square feet
- \$2,266/square foot



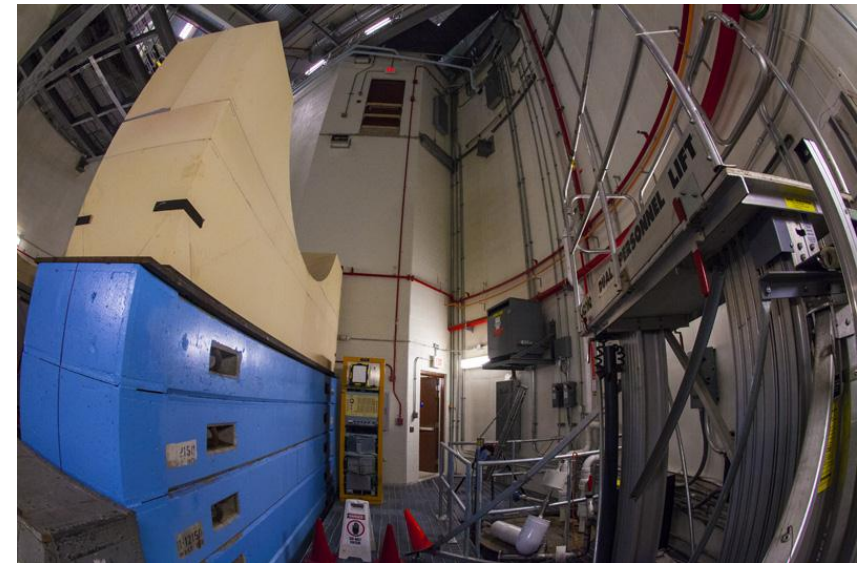
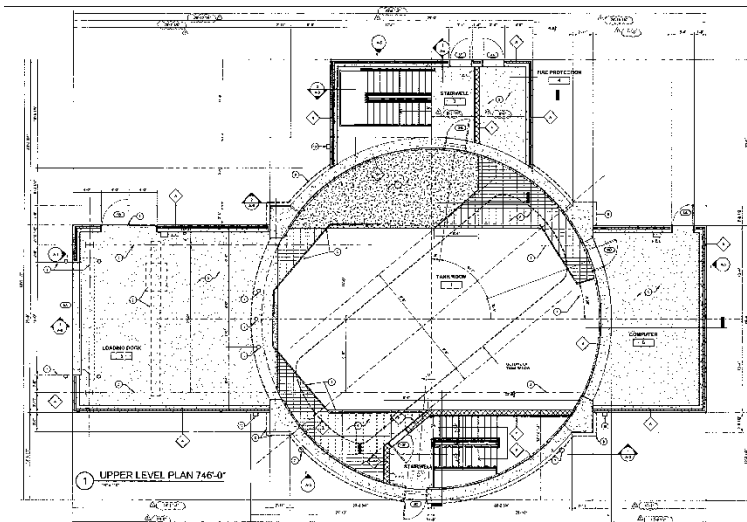
NOvA Surface Building

- Constructed in 2010
- \$1,500,012
- 2,160 square feet
- \$762/square foot



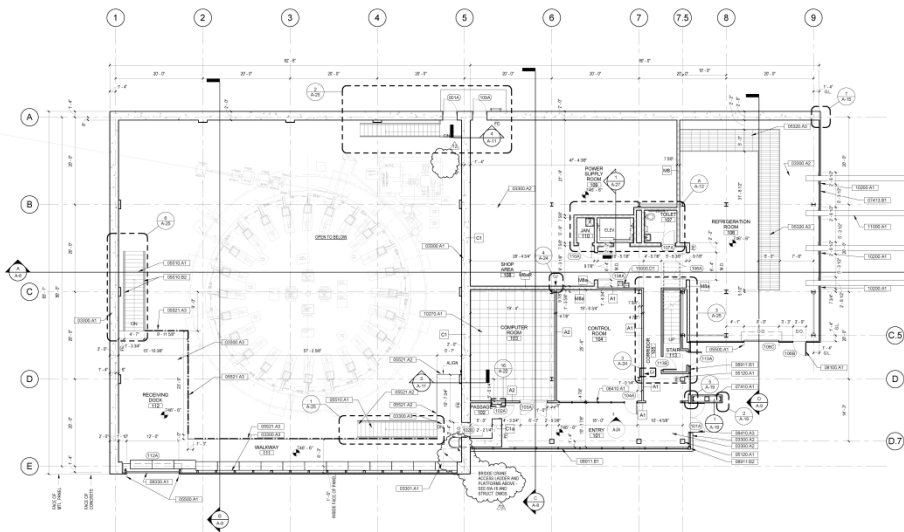
LAr Test Facility

- Constructed in 2013
- \$4,611,182
- 3,500 square feet
- \$1,349/square foot



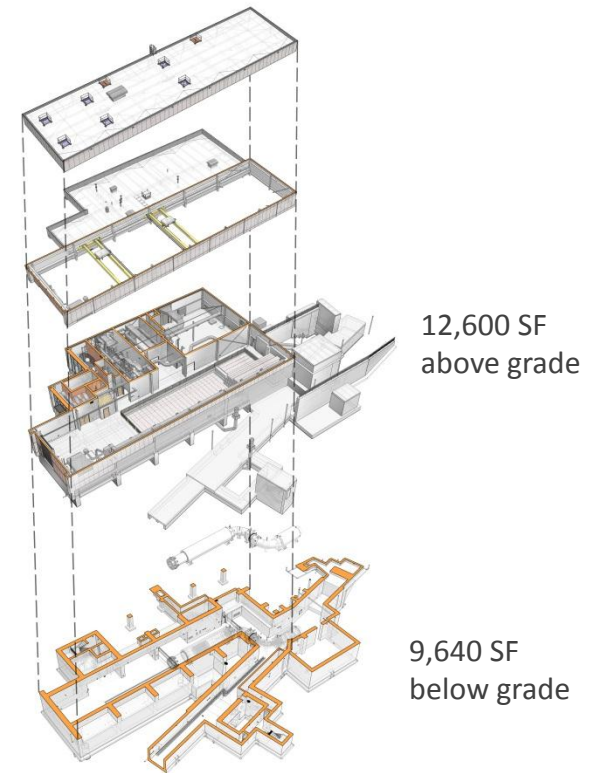
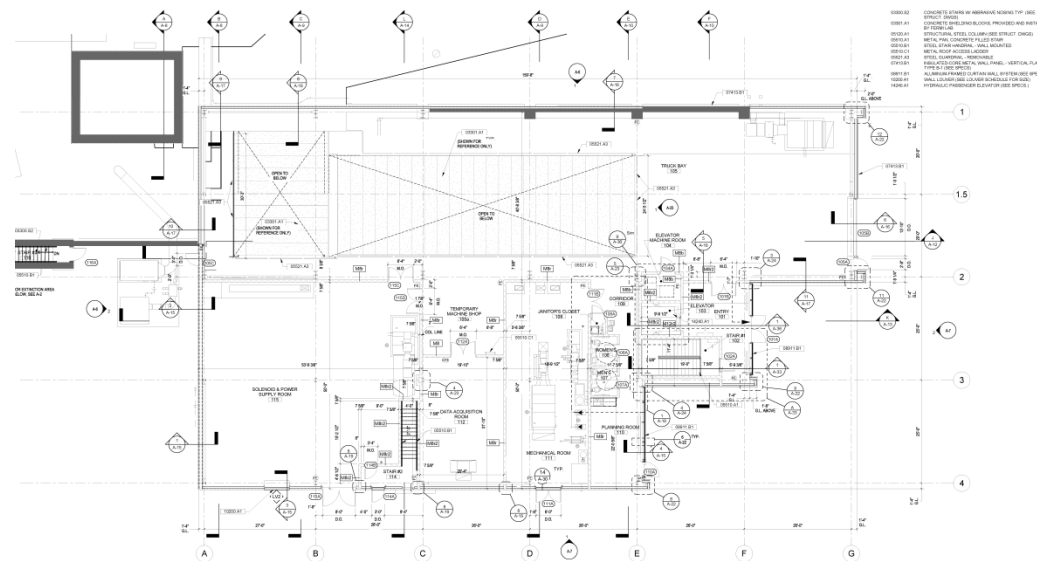
MC-1 Building

- Constructed in 2014
- \$7,100,000 (*budget amount*)
- 13,500 square feet
- \$526/square foot



Mu2e Building

- Start Construction in 2014 (est)
- \$12,172,000 (estimate)
- 22,240 square feet
- \$547/square foot



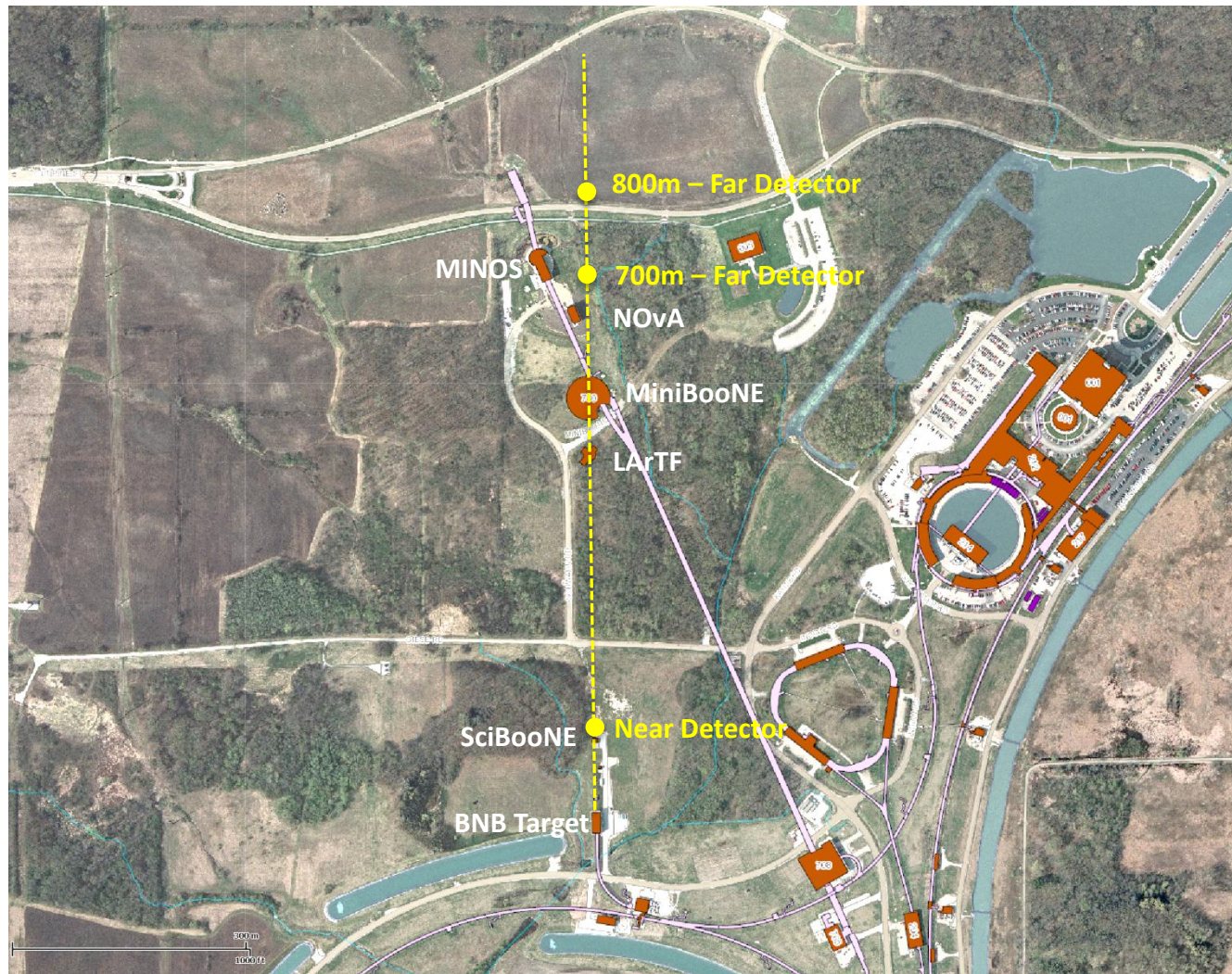
Summary of Recent Construction

	2014				
	SF	Year Built	Constructed Cost	Construction Cost	\$/SF
SciBooNE	368	2006	\$695,489	\$834,000	\$2,266
NOvA Surface Building	2,160	2010	\$1,500,012	\$1,645,000	\$762
LArTF	3,500	2013	\$4,611,182	\$4,720,000	\$1,349
MC-1 (Budget)	13,500	2014	<i>\$7,100,000</i>	<i>\$7,100,000</i>	\$526
Mu2e (Estimate)	22,240	2015	<i>\$12,172,000</i>	<i>\$12,172,000</i>	\$547

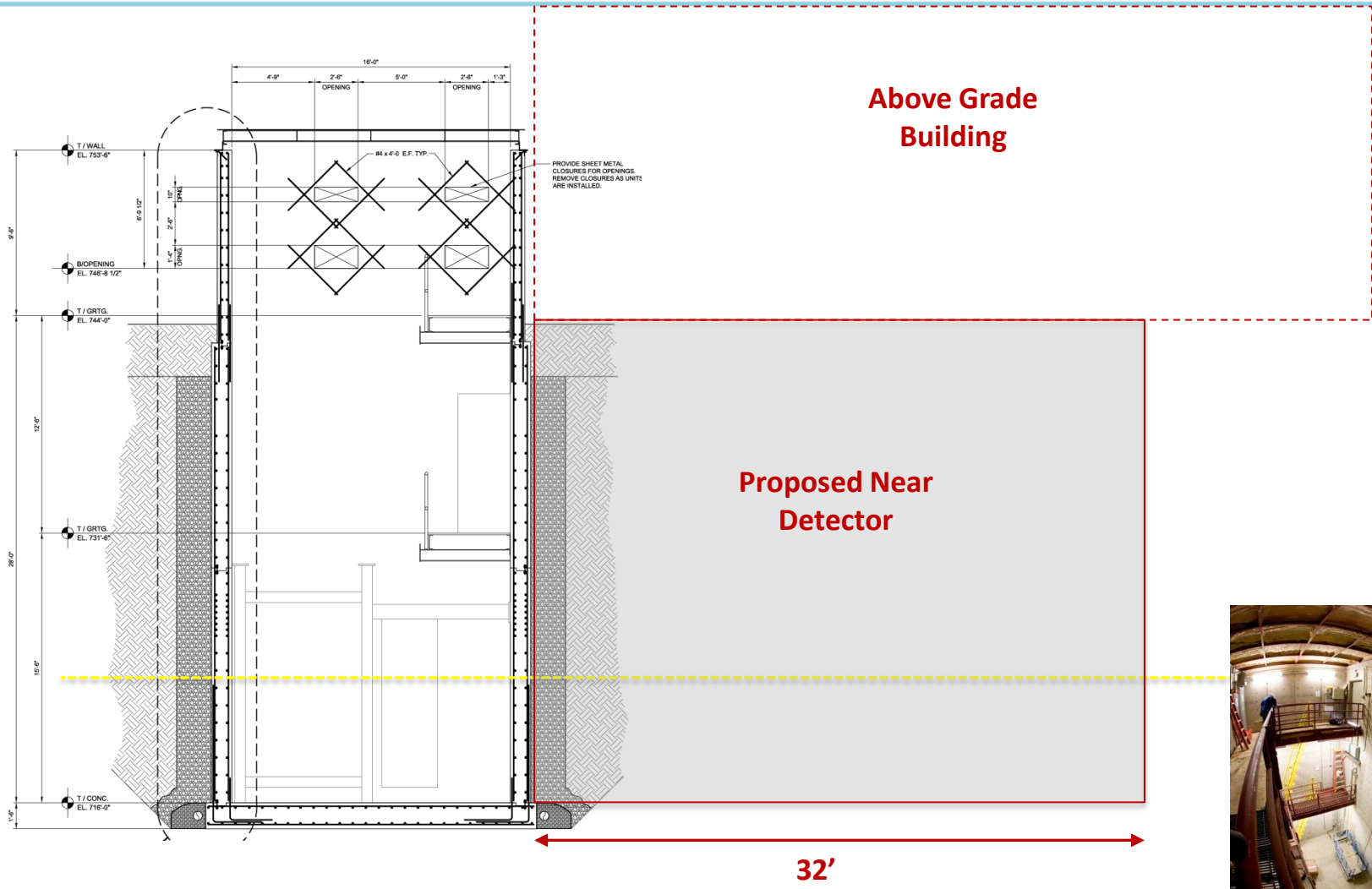
Site Plan



Site Plan



Near Detector – 1st Pass



Near Detector – Two Estimates

SciBooNE Enclosure x 2

FERMILAB FESS COST ESTIMATE				
Suggested Project Budget				\$4,060,000
Indirect Costs (assumes current GPP rates)				\$398,000
Management Reserve/Contingency				\$1,156,000
Engineering, Design, Inspection and Administration				\$508,000
Estimated Subcontract Award Amount				\$1,998,000
Escalation				\$0
Subcontractor's Overhead and Profit				\$46,000
Difficult Conditions				\$93,000
Subcontract Base Estimate				\$1,859,000
Neutrino Campus Plan		Project No.	Status:	Date:
Fixed Price - LAR-1 Enclosure		6-7-91	Pre-CD	25-Apr-14
ITEM NO.	DESCRIPTION OF WORK:	LOW		
01	Site Work	\$215,000		
01	Mobilize	\$5,000		
02	Roadwork	\$15,000		
03	Extend Electrical (1.5 MW)	\$150,000		
04	Extend ICW	\$20,000		
05	Extend Data/Comm	\$25,000		
02	Building	\$1,644,000		
01	LAR-1 Enclosure - 736 sf	\$1,644,000		
	SciBooNE - \$685k in 2006, 368 SF	\$685,000		
	Escalate from 2006 to 2014 (8 years @ 2.3% per year)	\$137,000		
	Increase Size of Enclosure from 368 sf to 736 sf	\$1,644,000		
	This calculated cost includes Subcontractor's OH&P			

50% Management Reserve/Contingency based
on level of design requirements

Surface Building (NOvA Like)

FERMILAB FESS COST ESTIMATE				
			1100 SF	2160 SF
Suggested Project Budget				\$2,940,000
Indirect Costs (assumes current GPP rates)				\$334,000
Management Reserve/Contingency				\$826,000
Engineering, Design, Inspection and Administration				\$362,000
Estimated Subcontract Award Amount				\$1,418,000
Escalation				\$0
Subcontractor's Overhead and Profit				\$76,000
Difficult Conditions				\$64,000
Subcontract Base Estimate				\$1,278,000
Neutrino Campus Plan		Project No.	Status:	Date:
Fixed Price - LAR-1 Surface Building		6-7-91	Pre-CD	25-Apr-14
ITEM NO.	DESCRIPTION OF WORK:	LOW		
01	Site Work	\$215,000		
01	Mobilize	\$5,000		
02	Roadwork	\$15,000		
03	Extend Electrical (1.5 MW)	\$150,000		
04	Extend ICW	\$20,000		
05	Extend Data/Comm	\$25,000		
02	Building	\$838,000		
01	NOvA Near Detector Surface Building - \$1.5m in 2010, 2160 SF	\$838,000		
	NOvA Near Detector Surface Building - \$1.5m in 2010, 2160 SF	\$1,500,012		
	Escalate from 2010 to 2014 (4 years @ 2.3% per year)	\$143,000		
	Decrease Size of Enclosure from 2,160 sf to 1100 sf	\$838,000		
	Same Approximate SF as NDOS Building	\$1,643,000		
	This calculated cost includes Subcontractor's OH&P			
03	Crane	\$225,000		
01	Crane Support Structure	\$75,000		
02	25 Ton Overhead Bridge Crane	\$100,000		
03	Crane Installation/Testing/Commissioning	\$15,000		
04	Mainline Conductor	\$10,000		
05	Crane Electrical Connections	\$25,000		

Near Detector

Working Backwards from \$3m GPP Target

Construction	\$1,608,000
EDIA	\$402,000
Contingency/Management Reserve	\$548,000
Subtotal	\$2,558,000
Indirect Costs	\$472,000
TOTAL	\$3,030,000

 **27% (Typical GPP: 25%-30%)**

Design refinement and better requirement definition is required to go from 50% MR/C to 27%

Far Detector – October 2013 Study

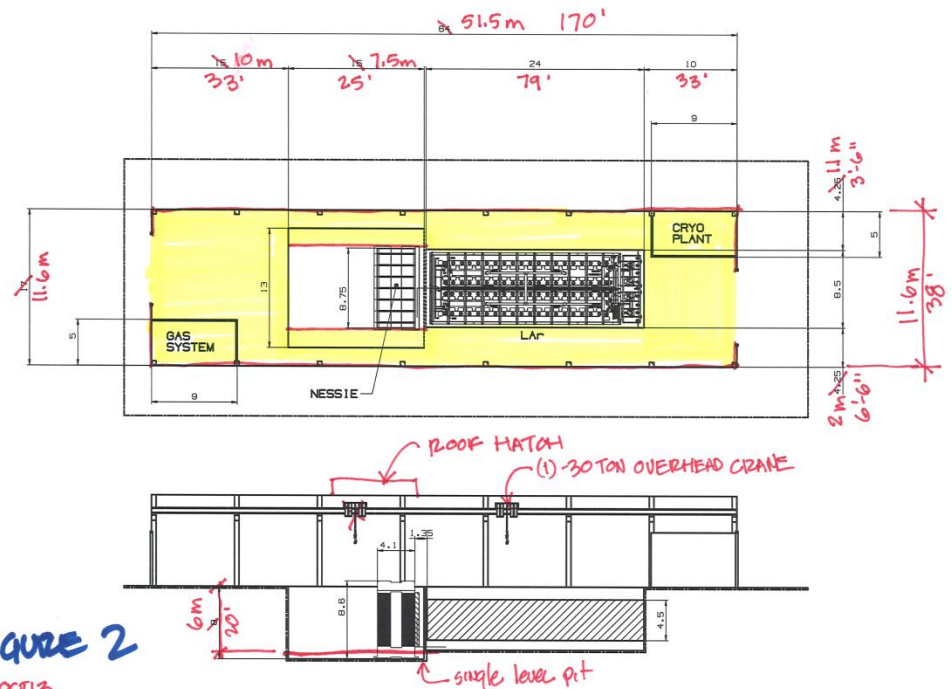


FIGURE 2

0800713
S. DIXON

DATA FROM CERN TECH PROPOSAL (CERN-EPSC-2012-010 AND SPSC-P-397)

Far Detector – October 2013 Study

				Low	High
Suggested Project Budget				\$12,825,000	\$19,935,000
Indirect Costs (assumes current GPP rates)				\$1,277,000	\$1,878,000
Management Reserve/Contingency	50%			\$3,738,000	\$5,839,000
Engineering, Design, Inspection and Administration	30%			\$1,824,000	\$2,841,000
Estimated Subcontract Award Amount				\$5,986,000	\$9,377,000
Escalation	0.0%			\$0	\$0
Subcontractor's Overhead and Profit	15.0%			\$781,000	\$1,223,000
Difficult Conditions	2.0%			\$102,000	\$160,000
Subcontract Base Estimate				\$5,103,000	\$7,994,000
ICARUS/NESSIE at Fermilab					
Fixed Price		Project No.	Status:	Date:	Rev Date
		6-7-89	Pre-CD	11-Oct-13	
ITEM NO.	DESCRIPTION OF WORK:			LOW	HIGH
01	Site Work			\$1,175,000	\$2,260,000
01	Wetland Mitigation (3 acres at 2:1 ratio)			\$450,000	\$660,000
02	Roadwork			\$200,000	\$400,000
03	Electrical (3 MW for Experiment, 1.5 MW for Cyro, 1 MW house power)			\$400,000	\$600,000
04	Extend ICW			\$20	\$300,000
05	Extend DWS			\$50,000	\$100,000
06	Extend Sanitary			\$50,000	\$100,000
07	Extend Data/Comm			\$25,000	\$100,000
02	Building			\$3,928,000	\$5,734,000
01	High Bay (170'x38') - Low based on MC-1 (\$350/sf), High based on Mu2e (\$500/sf) costs			\$2,261,000	\$3,230,000
02	Below Grade Pit Construction Premium (assume 25% of above costs)			\$565,250	\$807,500
03	Architectural Treatment Premium based on location			\$452,000	\$646,000
04	Overhead Crane (1-30 ton)			\$150,000	\$250,000
05	Cyro Plant Chillers (assume 2 chillers + 1 spare)			\$500,000	\$800,000



Far Detector – January 2014 Update

Changes from October 2013 Study


- The requirements for the facility have been changed from a combined ICARUS/NESSIE experiment, to one that supports the construction and operation of only the ICARUS experiment only;
- The length of the building has been reduced from 51.5m (170') to 38m (**125'**);
- The width of the below grade detector pit has increased from 8.5m (28') to 12m (**39.5'**);
- The overall width of the building has increased from 11.6m (38') to 15.5m (**51'**);
- The overhead bridge crane capacity has increased from 30 tons to **40 tons** and the span of the bridge crane has been widened from 11.6m (38') to 15.5m (51') to correspond to the increased building width;
- The updated suggested project budget calculations listed below include increased Fermilab Indirect Rates issued in 24OCT13

Far Detector – January 2014 Update

				Low	High
Suggested Project Budget				\$13,180,000	\$20,529,000
Indirect Costs (assumes current GPP rates)				\$1,435,000	\$2,104,000
Management Reserve/Contingency	50%			\$3,772,000	\$5,918,000
Engineering, Design, Inspection and Administration	30%			\$1,862,000	\$2,908,000
Estimated Subcontract Award Amount				\$6,111,000	\$9,599,000
Escalation	0.0%			\$0	\$0
Subcontractor's Overhead and Profit	15.0%			\$797,000	\$1,252,000
Difficult Conditions	2.0%			\$104,000	\$164,000
Subcontract Base Estimate				\$5,210,000	\$8,183,000
ICARUS at Fermilab					
<i>Fixed Price</i>					
				Project No.	Status:
				6-7-89	Pre-CD
				Date:	Rev Date
				11-Oct-13	21-Jan-14
ITEM NO.	DESCRIPTION OF WORK:			LOW	HIGH
01	Site Work			\$1,175,000	\$2,260,000
01	Wetland Mitigation (3 acres at 2:1 ratio)			\$450,000	\$660,000
02	Roadwork			\$200,000	\$400,000
03	Electrical (3 MW for Experiment, 1.5 MW for Cyro, 1 MW house power)			\$400,000	\$600,000
04	Extend ICW			\$20	\$300,000
05	Extend DWS			\$50,000	\$100,000
06	Extend Sanitary			\$50,000	\$100,000
07	Extend Data/Comm			\$25,000	\$100,000
02	Building			\$4,035,000	\$5,923,000
01	High Bay (125'x 51') - Low based on MC-1 (\$350/sf), High based on Mu2e (\$500/sf) costs			\$2,231,250	\$3,187,500
02	Below Grade Pit Construction Premium (assume 25% of above costs)			\$558,000	\$797,000
03	Architectural Treatment Premium based on location			\$446,000	\$638,000
04	Overhead Crane (1-40 ton)			\$300,000	\$500,000
05	Cyro Plant Chillers (assume 2 chillers + 1 spare)			\$500,000	\$800,000

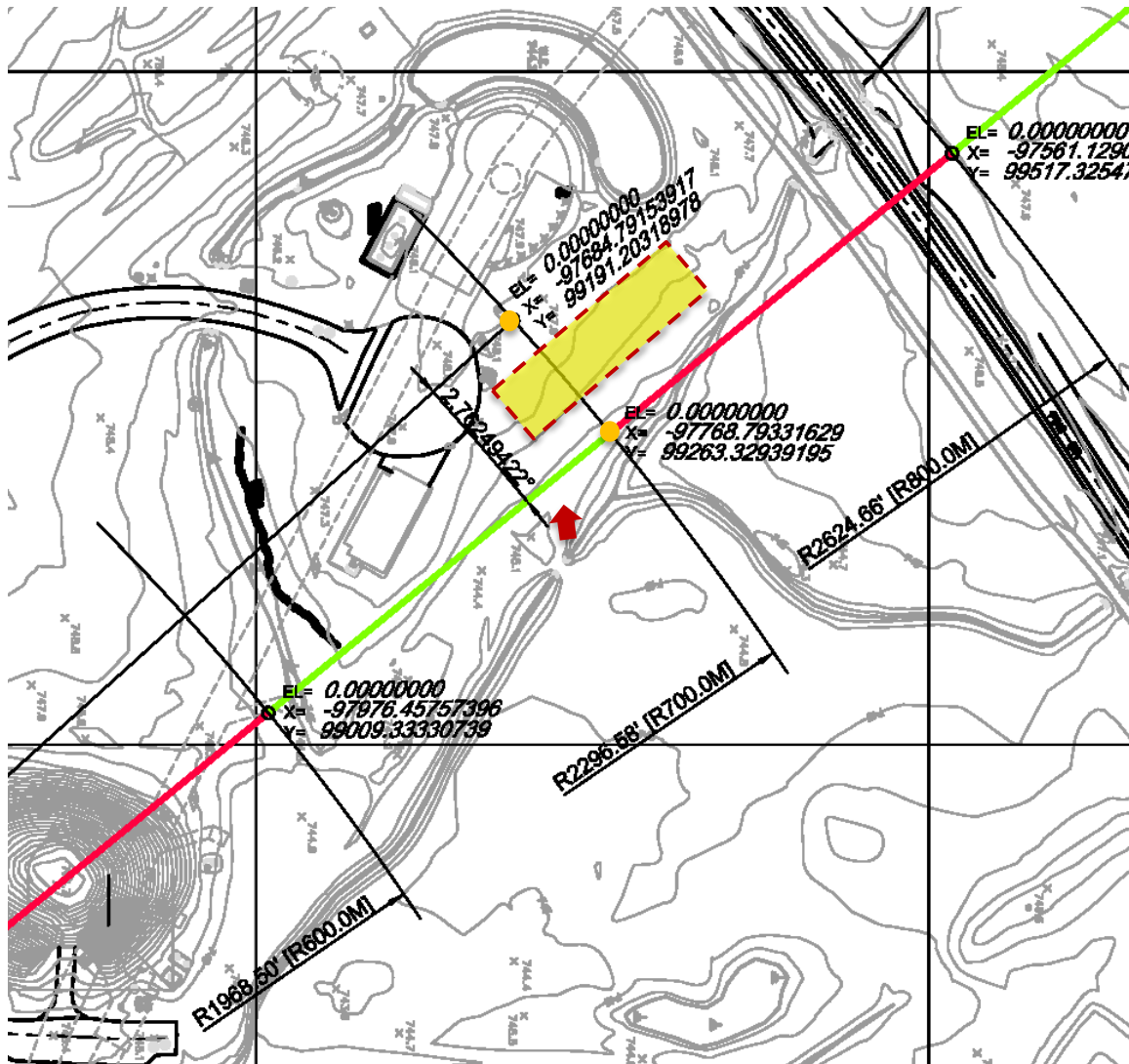
Far Detector

Working Backwards from <\$10m GPP Target

Construction	\$5,424,000	
EDIA	\$1,357,000	
Contingency/Management Reserve	\$1,927,000	 28% (Typical GPP: 25%-30%)
Subtotal	\$8,708,000	
Indirect Costs	\$1,092,000	
TOTAL	\$9,800,000	

Design refinement and better requirement definition is required to go from 50% MR/C to 28%

Far Detector - Wetland



Looking Northwest

Wetland Impact

- \$450k-\$600k
(construction cost)
- ~1+ year

Far Detector – Site Work



**Aerial Photos of
MINOS Construction
in 2003**



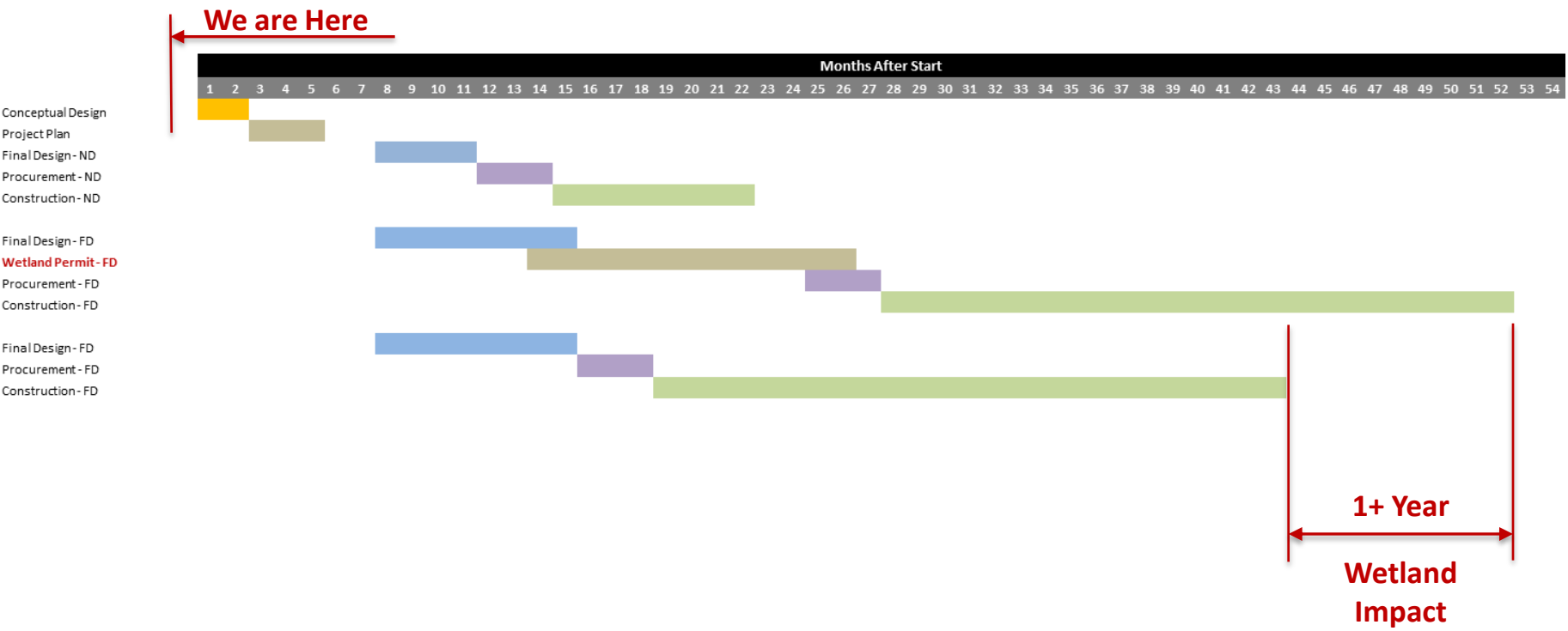
Far Detector - Depth



Aerial Photo from 2013 showing LArTF under construction



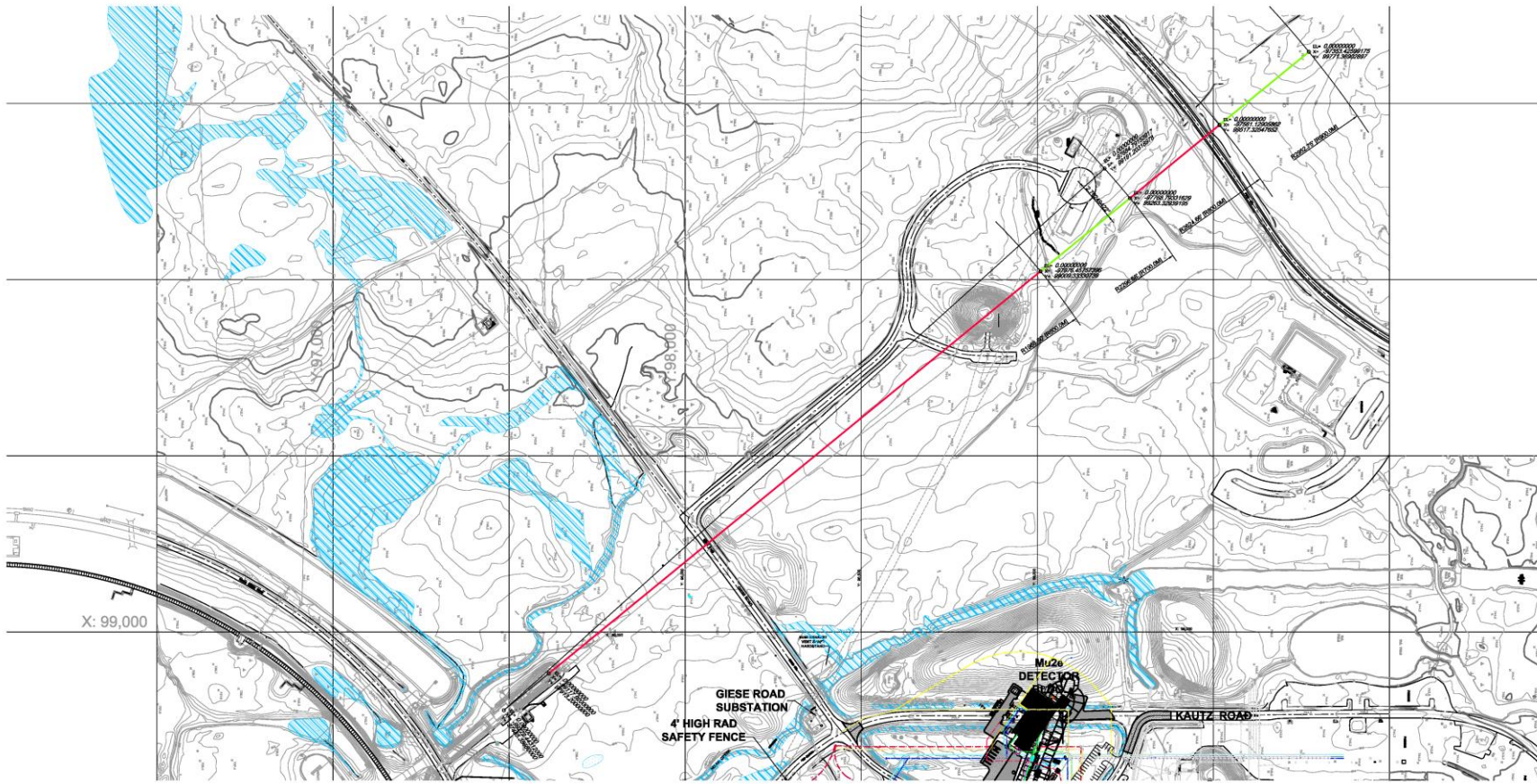
Schedule



Questions

Backup

Site Plan



Site Plan – Far Detector



700m (off axis)



800m (on axis)



700m (on axis)

Photos - SciBooNE



Excavation Begins at SciBooNE

Photos - SciBooNE



Photos - SciBooNE



Photos - SciBooNE



Photos – Far Detector



Photos – Far Detector



Photos – Far Detector



Photos – Far Detector



Photos – Far Detector



Photos – Far Detector



Photos – Far Detector

