

# Update on LBNF to Long-Baseline Neutrino Committee

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23 June 2017



# Topics

- Funding Status (U.S. DOE perspective)
- LBNC milestones and schedule
- LBNC Review Recommendation Status
- Updates
  - Risk
  - Staffing
  - Procurement
  - Engagement with other DOE labs
  - Design Codes and Standards equivalency
  - Beamline
  - Miscellaneous issues
- Summary

# DOE Funding Status for LBNF/DUNE-US – 1 of 2

- **FY17 Funding Status**

- FY17 omnibus appropriation signed into law 5 May 2017. LBNF/DUNE-US funded at \$50M, \$5M above LBNF/DUNE plan and President's Budget Request (PBR).
- Allows project to move forward with CD-3a equipment purchase and construction work as well as FSCF final design, when funds fully arrive and contracts are ready.
- Also allows for modest carryover to FY18 (will be needed...)
- Funding still arriving in monthly (1/12 annual appropriation) amounts. Will potentially cause challenge to award contracts until full funding arrives (possibly mid-July).

# DOE Funding Status for LBNF/DUNE-US – 2 of 2

- **FY18 Funding Status**

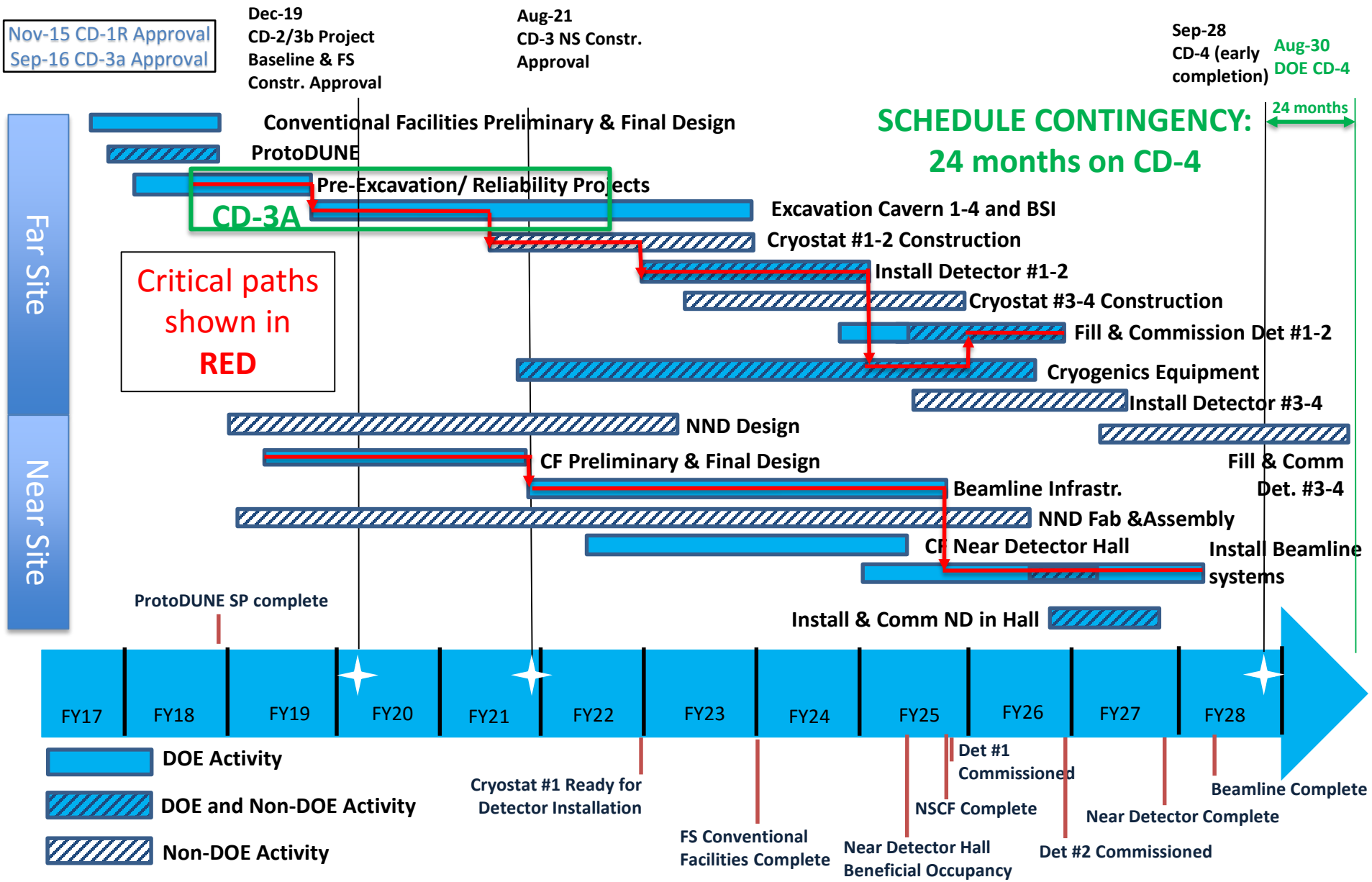
- Good news: PBR is \$55M; above FY17 PBR and final appropriated amount
- Not as good news: PBR is \$55M, \$40M below planned level of \$95M
- While we expect Congress to enact a higher funding level than the PBR, we are uncertain about timing and amount of increase
  - We are implementing the PBR amount into project DOE resource-loaded schedule.
  - We are in a new phase of the project – execution of work; awarding of contracts
- LBNF and DUNE leadership consensus is to prioritize Far Site work over Near Site work
  - Constrained and sequential nature of far site work
  - Support collaboration objectives for detector install and detector commission schedule
- Funding at PBR level will delay start of near site conventional facilities and beamline preliminary design

# Status of LBNC Milestones

USFY	Quarter	Milestone	2016 Q4	2017				2018	
LBNF milestones									
2016	Q4	CD-3a approved	9/1/16 A						
	Q4	Pre-excavation final design complete	12/21/16 A						
2017	Q2	CM/GC contract in place							
	Q4	Ross shaft refurbishment complete							
2018	Q2	Main excavation final design complete							

- Updates since Mar 2017 LBNC review:
  - CM/GC contract
    - Source evaluation best value selection and report completed
    - Terms and conditions negotiated
    - Consent package forwarded to DOE in early May
    - Goal to award June (*assuming available funding*)
  - Ross Shaft: proceeding - was funding constrained during April due to CR.
  - Main excavation final design:
    - Subcontract is being reassigned from SDSTA to FRA.
    - Design work will begin when funding is available (*hopefully July...*)

# LBNF/DUNE – Schedule Summary Overview (based on \$55M FY18 PBR)



# Status of Responses to LBNC Review Recommendations

	ALL LBNF RECOMMENDATIONS		
REVIEW	TOTAL	CLOSED	IN-PROGRESS
SEP 2015	7	5	2
JAN 2016	1	0	1
OCT 2016	4	3	1
MAR 2017	1	1	0

## Recommendations closed since last review:

- **From Mar 2017 Review:**

- **Rec #1:** “Cryogenics: LBNF should present a prioritized action plan to address urgent interface, risk, and design issues due to unassigned non-DOE cryogenics scope by the next LBNC meeting.”

*The Project has advanced LAr cryogenic design sufficiently to fit within the CF envelope and to inform cryostat penetration design. We recognize the need for this design to proceed, but are balancing this with higher priorities during this timeframe. LBNF PM milestones have been added into the schedule to trigger decisions about proceeding with design related to non-DOE LAr cryogenic items 24 months before design start is required.*

# Recommendations-progress :

No changes since last review

- **From Oct 2016 Review:**

- **Rec #4:** “Cryogenics: Fermilab should proactively engage with CERN in the commissioning of this first 1 kTon scale LAr purification system”

*Agreed, we are engaged. David Montanari is at CERN to serve as liaison and interface between CERN and Fermilab. There is also a cryogenic working group that is looking at the detector and instrumentation. David provides an interface for them as well to the CERN cryogenics group.*

- **From Jan 2016 Review:**

- **Rec #1:** “Confirm assumptions used for the Ross shaft utilization and optimization (shift schedule, restrictions during blasts)”

*Agree, this will be done as part of logistics planning with the CM/GC.*

- **From Sep 2015 Review:**

- **Rec #5:** “During final design, examine a comprehensive seismic instrumentation system to be installed prior to and during excavation”

*Agree, a test blast program was completed to better understand issues associated with peak particle velocity and air blast over pressures. Results can be found in DocDB #1655. The results of this effort will be input to the design of a monitoring program to be defined as part of excavation final design.*

- **Rec #6:** “During final design, consider the robustness of the electrical supply system both nominal and backup”

*Agree, this will be completed as part of the 60% final design submittal.*



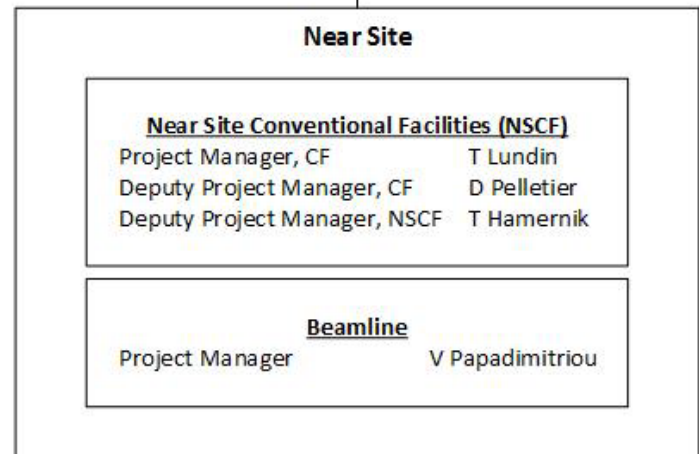
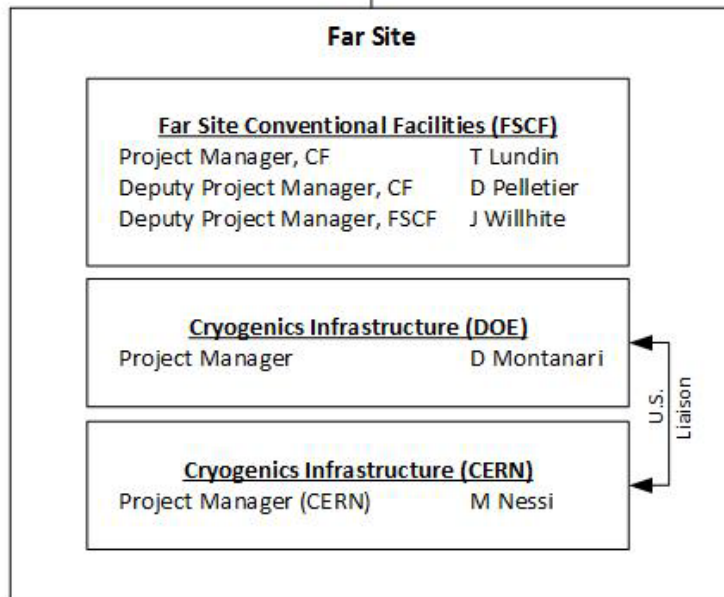
# Risk Update

- LBNF is actively managing 96 risks in project Risk Register, focusing on the 12 high-ranked and 25 medium-ranked risks. Risks reviewed monthly at LBNF Risk Management Board.

Risk Rank	RI-ID	Title	Probability	Mean Cost Impact (k\$)*P	Mean Schedule Impact (months) * P
3 (H)	RT-131-CFNS-020	CF NS -- escalation rate greater than predicted	50%	8801	0.0
3 (H)	RT-131-CFFS-4850L-018	CF FS -- escalation rate greater than predicted	50%	4906	0.0
3 (H)	RT-131-CFNS-1000	Subproject changes impact the near site facilities layout	50%	3875	1.5
3 (H)	RT-131-BEAM-008	Tritium mitigation design is found to be inadequate	75%	2344	2.3
3 (H)	RT-131-CR-103	LAr market risk	50%	2200	2.3
3 (H)	RT-131-CFNS-007	Insufficient rock cover for Near Detector requires more cavern support	50%	1500	2.0
3 (H)	RT-131-CFFS-4850L-010	Specialized construction labor is unavailable	40%	1200	1.6
3 (H)	RT-131-CFNS-030	Second Main Injector shutdown period delayed	50%	825	4.5
3 (H)	RT-131-BEAM-051	Promised reuse of NuMI components is not possible	40%	640	0.0
3 (H)	RT-131-CR-100	Fermilab has insufficient labor for specialized cryogenic engineering	50%	250	2.3
3 (H)	RT-131-PM-013	Changes to the DOE funding profile before CD-2	75%	0	4.0
3 (H)	RT-131-CR-119	Cryostat Design delays due to lack of requirements input	50%	0	3.2

- Risk updates related to change to N2 in target chase:
  - Retired: Beam-081 Coolant of the decay pipe must be nitrogen or helium instead of air
  - Retired: Beam-093 Change in Target Chase gas medium from air to inert gas
  - New: Beam-095 Radiation influenced corrosion study
- Schedule risk initiative: Performed preliminary Monte Carlo analysis on duration estimate uncertainty to evaluate overall schedule float to CD-4, based on recommendation from Feb 2017 DOE IPR
  - Schedule impact of 1.5 years is still being reviewed, including associated costs
  - Analysis is still in progress, including related Monte Carlo analysis on cost estimate uncertainty

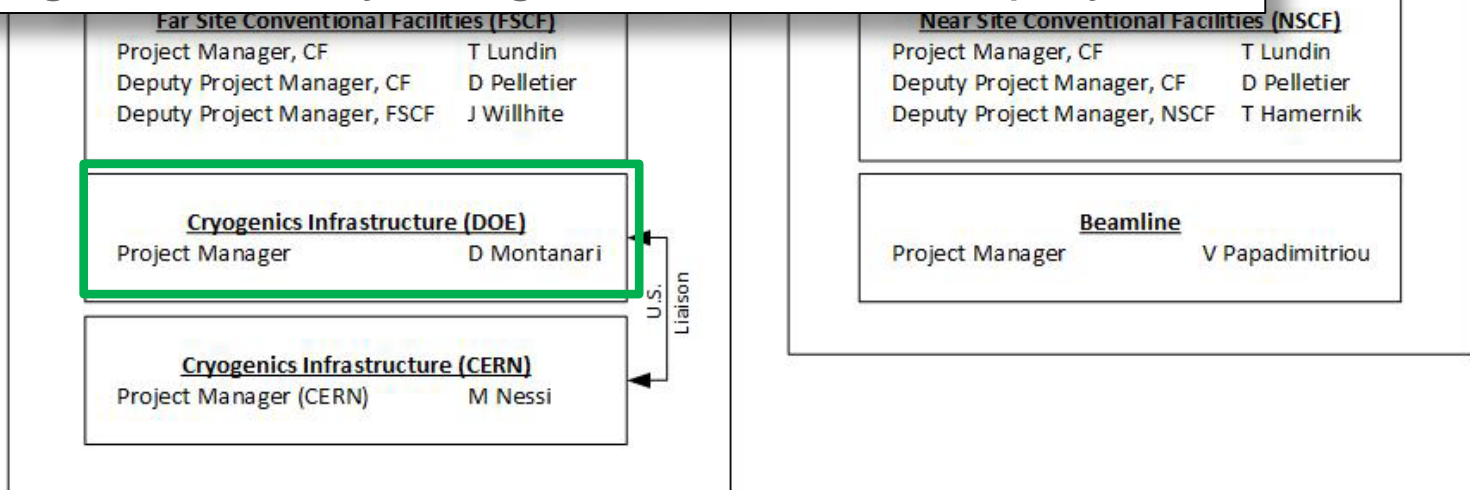
# Organization Update



# Organization Update



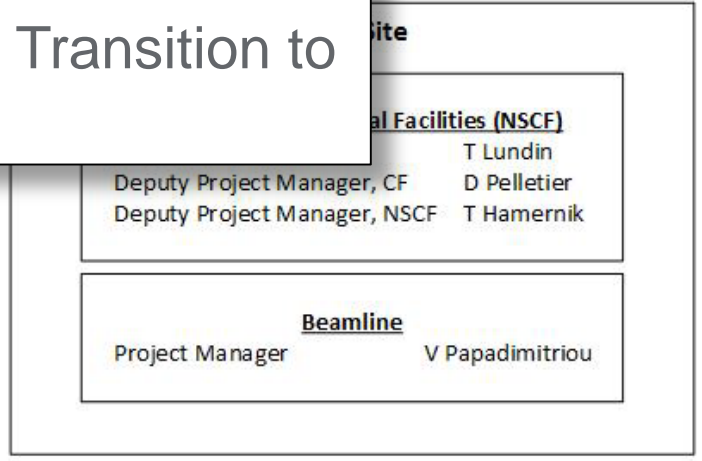
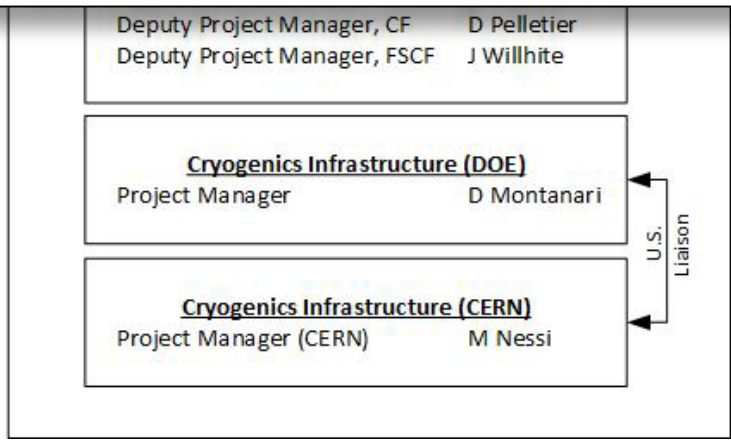
**Replacement:**  
- Hiring contract cryo engineer as FNAL employee



# Organization Update



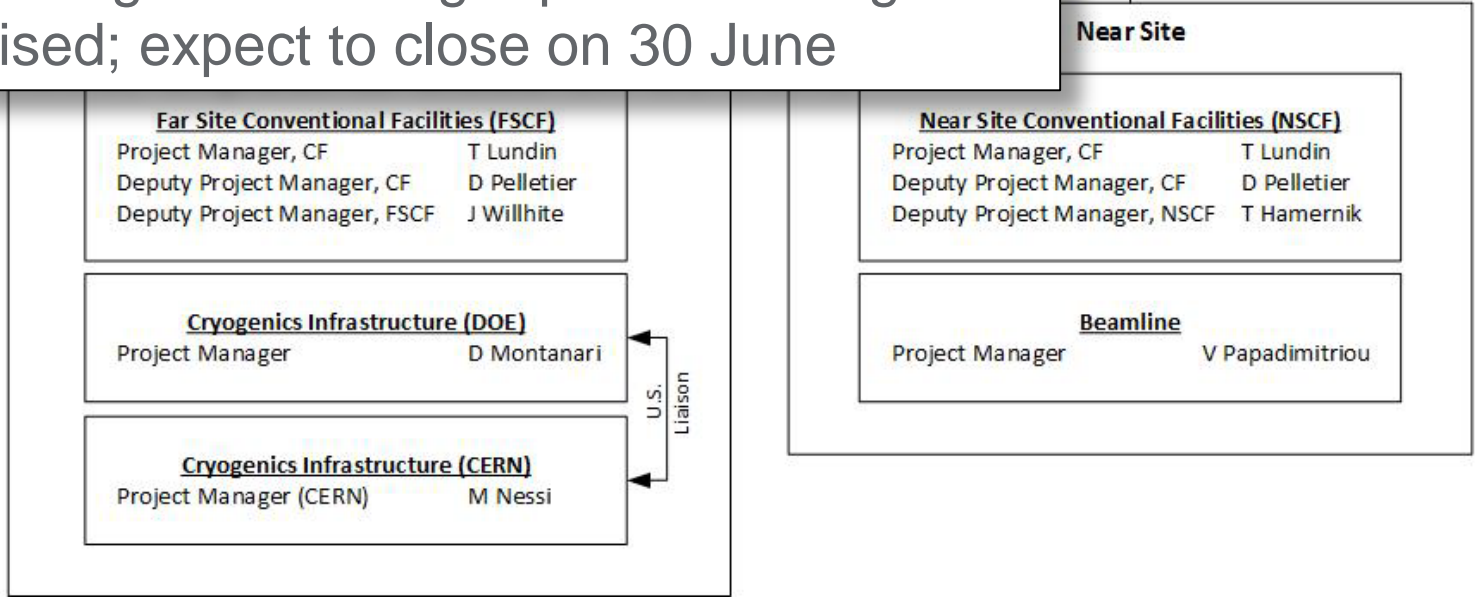
New assignment:  
- Jack Fowler transitioning from DUNE to be LBNF/DUNE Systems Engineer. Transition to be complete o/a May 2018



# Organization Update



Hiring action:  
- Far Site Logistics Manager position being advertised; expect to close on 30 June



# Update on Significant LBNF Procurements

Procurement Description	Scheduled Award Date	Status	Est. Value
<b>FSCF - Ross Shaft Refurbishment</b>	FY17 1Q	Work is currently funded through the end of June. Modification to fund work through the end of July pending.	~\$6M
<b>FSCF - – Construction Manager/General Contractor (CM/GC) (phase funded)</b>	FY17 3Q	Award package submitted to FSO on 5/2. Responded to DOE comment matrix 6/14. Package forwarded to IRB 6/16. Contract award objective is June, subject to FSO/IRB/HCA approval.	\$250M to \$300M
<b>Waste Rock Handling Pipe Conveyor-Engineering &amp; Fabrication</b>	FY17 3Q	Award documents and procurement file documentation were approved/signed by FRA 6/16. Review and signature by subcontractor is pending.	~\$5M
<b>SURF Reliability/ Refurbishment &amp; Work in Support of LBNF CD-3a Pre-construction</b>	Various, beginning FY17 3Q	Basic Ordering Agreement (BOA) has been put on hold pending resolution of FSO-identified issues.	~\$20M
<b>SURF Ross Shaft Operations in support of LBNF Construction</b>	FY17 4Q	(No change) Developing scope/acquisition plan.	~\$20M

# Update on Significant LBNF Procurements

Procurement Description	Scheduled Award Date	Status	Est. Value
<b>Near Site Preliminary Design</b>	FY18	(No change) Will be placed as an order against an existing Master Agreement. Requirements package to be developed.	~\$5M
<b>Cryo Infrastructure - LN2 Refrigeration System</b> Design, Fabrication, Installation, and Commissioning	FY18 3Q	(No change) Acquisition plan has received first FSO review. Developing responses to review comments/questions.	~\$60M
<b>NSCF – Construction Manager/General Contractor (CMGC) (phase funded)</b>	FY18 4Q	Acquisition Plan submitted to FSO 6/6. Next steps are to appoint an SEB and develop the RFP.	\$250M to \$300M
<b>Cryo Infrastructure - LAr Procurement</b>	LAr needed in 2023	Second RFI amendment released 6/7. Due date for submission of industry capacity information, which will inform acquisition strategy development, has been extended to 7/6.	~\$40M

## Strategy for Engaging other Labs

- Working to further engage other DOE labs in LBNF, recognizing that ~60% of project is planned to be executed by contract (conventional facilities, LN2 cryo systems, and LAr) and that 25% is expected to be non-DOE in-kind contributions
- Opportunities exist, primarily in beamline
- Laboratory engagement status:
  - FNAL senior management met with SLAC 14 January
  - **Travel to meet with BNL staff on 29 June**
  - Other labs to engage include Berkeley, PNNL, Los Alamos, Argonne, and JLab



## International Codes and Standards

- As an international project with major in-kind contributions, LBNF/DUNE needs the ability to accept non-U.S. design standards within DOE 10 CFR 851 construct.
- Fermilab has finalized and implemented new FESHM Chapter 2110 – *Establishing Code Equivalency with International Codes and Standards*.
- Working with SBN project team, have developed priority sequence to review non-U.S. mechanical, electrical, and structural design standards proposed for equipment coming from CERN.
- Expert panels have been formed to complete focused reviews. Panels complete safety equivalency analysis and submit white paper for safety subcommittee(s) review and concurrence.
- Fermilab submits to DOE site office for review and then incorporates into appropriate ESH Safety Manual chapter.

# International Codes and Standards – Status 1 of 2

Description	Standard	Approval Status
<b>Mechanical/Cryo</b>		
Unfired Pressure Vessels	EN 13455	Complete
Pressure Relieving Devices	EN ISO 4126, including verification of EN764-7 and EN13648 against similar US standards	Complete
Process Piping	EN 13480	Complete
<b>Electrical</b>		
Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use	IEC 61010	Complete
Electrical equipment for measurement, control and laboratory use	IEC 61326 EMC Requirements	Complete
Information Technology Equipment	60950-1	No analysis started, no confirmation of need
Adjustable Speed Electrical Power Drive System	61800-5.1	No analysis started, no confirmation of need

# International Codes and Standards – Status 2 of 2

Description	Standard	Approval Status
<b>Structural</b>		
Basis of structural design	EN 1990	Equivalency review complete, currently incorporating peer review comments. Early July to FSO
Actions on structures	EN 1991	Equivalency review complete, currently incorporating peer review comments. Early July to FSO
Design of steel structures	EN 1993	Equivalency review complete, currently incorporating peer review comments. Early July to FSO
Design of aluminum structures	EN 1999	Equivalency review complete, currently incorporating peer review comments. Early July to FSO
<b>Other</b>		
Design and manufacture of site built, vertical, cylindrical, flat-bottomed steel tanks for the storage of refrigerated, liquefied gases with operating temperatures between 0 degrees C and -165 degrees C	EN 14620	Note: Certain aspects acknowledged in FESHM5031,7 “Membrane Cryostats”; A full review does not appear to be necessary.

Meanwhile...

# Addendum I to Neutrino Protocol I

ADDENDUM I

to

NEUTRINO PROTOCOL I

between

THE DEPARTMENT OF ENERGY  
OF THE UNITED STATES OF AMERICA (DOE)

and

THE EUROPEAN ORGANIZATION  
FOR NUCLEAR RESEARCH (CERN)

to

THE CO-OPERATION AGREEMENT

concerning

SCIENTIFIC AND TECHNICAL CO-OPERATION  
IN NUCLEAR AND PARTICLE PHYSICS

2017

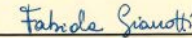
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other legal or contractual rights, issue an order stopping all or any part of the Participating Organization's or its contractor's activities at its premises.

DONE at Geneva, Switzerland, in duplicate in the English language.

FOR THE DEPARTMENT  
OF ENERGY OF THE UNITED  
STATES OF AMERICA:

FOR THE EUROPEAN  
ORGANIZATION FOR NUCLEAR  
RESEARCH:



Theodore Allegra

Fabiola Gianotti

Chargé d'Affaires a.i. of  
the United States of America  
to the United Nations and Other  
International Organizations in  
Geneva

Director-General  
European Organization for  
Nuclear Research

Date: 2nd May 2017

Date: 28th April 2017



# Addendum I to Neutrino Protocol I

- 4.7 Components, assemblies and other items (hereinafter “deliverables”) shipped from Europe to the United States, or from the United States to CERN, shall be designed and constructed in accordance with the European safety standards and codes (including, as the case may be, the CERN safety standards and codes) if constructed or procured in Europe, and of the United States if constructed or procured in the United States. European and U.S. safety standards and codes shall be accepted as equivalent under the principle of reciprocity, it being understood that, with respect to non-standard components and assemblies, each Party shall, within available resources, provide reasonable assistance towards the other Party’s efforts to establish equivalent levels of safety.

# Beamline Optimization Update since March 2017 LBNC review

- Completing engineering analyses and starting cost/schedule estimating for optimized target, three horns, and supporting infrastructure, including conventional facilities
- Following a documented decision process (DocDB 1900), working to answer these questions by October:
  1. Should the target and horns in the present plan be changed to the optimized designs, including immediately impacted systems like the decay pipe, beam windows, and remote handling?
  2. Can the target/horn optimized system and immediately impacted systems be staged for implementation and if so, what could be the staging, if any, for the initial beam-on in 2026?
- Decisions on absorber is deferred to post-target/horn decisions
- Planning for:
  - External Project reviews of optimized design by late August
  - EFIG discussions to consider specific questions and set the configuration by September

# Miscellaneous Issues/Updates

- South Dakota taxes

- SD does not provide government or government funded contract exemptions and is one of only two states in the U.S. that applies a “contractor excise tax” in addition to more common use tax and sales tax

“A 2% excise tax is imposed on the gross receipts of all prime contractors engaged in construction services or realty improvement projects”

- Complex issue:

- Excise tax: SDSTA is executing some LBNF work (e.g., Ross Shaft; reliability projects; other work) and has certain exemptions – issue has arisen whether SDSTA or FRA LLC is the “prime contractor” for this work
- Use tax: not included in in project estimates for non-conventional facilities work

- **Update: Met with Deputy Director of the SD Department of Revenue and staff to describe project and modes of work accomplishment. Presented him with a letter asking for clarifications on application of taxes.**

- Bottom line: Will have to pay more taxes than anticipated and have created a change request for “Additional SD Taxes”

## Miscellaneous Issues/Updates

- Far Site Insurance
  - In discussions with SD and SDSTA on insurance structure for work at far site.
  - GM/CC contract has all legal and sufficient insurance requirements; issue is whether an insurance “wrap” structure (vs. requiring each individual entity to provide its own insurance) would be beneficial
  - **Update: Awaiting further action until have CM/GC onboard to understand their insurance strategy**



# Finally, LBNF Ground Breaking...

- Date set for 21 July at Sanford Lab
- Will be hosted by Governor Daugaard
- Expect many other VIPs
- Developing event plan now
- Will be live streamed

*You are cordially invited - Please RSVP*

## Groundbreaking

for the **Long-Baseline Neutrino Facility**  
that will support the **Deep Underground Neutrino Experiment**

Friday, July 21, 2017

2 p.m. MDT, Sanford Underground Research Facility, Lead, South Dakota  
3 p.m. CDT, Fermi National Accelerator Laboratory, Batavia, Illinois

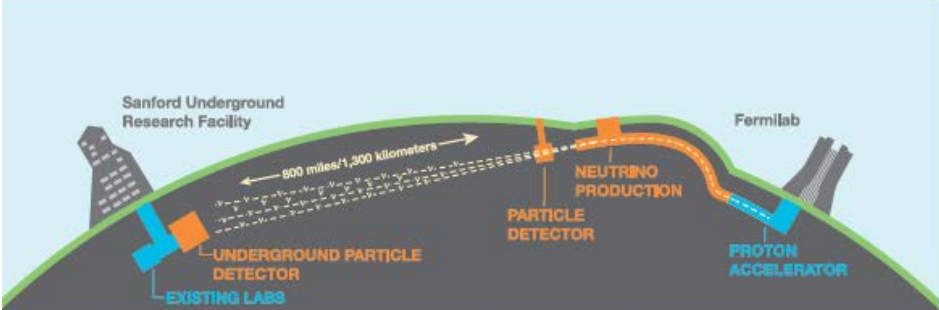
Please join us to celebrate the start of the mile-deep construction for the world's flagship science project to unlock the mysteries of neutrinos.

Please RSVP by July 17 at

[lbnf.fnal.gov/groundbreaking](http://lbnf.fnal.gov/groundbreaking)

Representatives from the U.S. Department of Energy, U.S. Congress, state of South Dakota, South Dakota Science and Technology Authority, Fermi Research Alliance and local, national and international partners are expected to attend this momentous occasion in Lead, South Dakota. Directions and a list of nearby hotels are posted on the RSVP website.

For more information, please email [lbnf-event@fnal.gov](mailto:lbnf-event@fnal.gov) or call Amanda Mall at 630-840-8699.



## Summary

- Project is at inflection point, and transitioning from planning to execution
- Continue to actively manage risk, organizational staffing, and project management systems
- Significant procurement planning underway and aligned with execution schedule
- Project continually reviewing strategy to optimize “stake in the ground milestones” and support of DUNE collaboration in dynamic funding environment

# Questions?

