

FS Integration Costing

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Outline

- 131.04 Integration
- Cost composition
- Actions

131.04 WBS – Integration Project

131.04	Integration Project
131.04.01	Integration Project Office
131.04.02	Far Site Integration
131.04.02.01	FS Facility Support & Services
131.04.02.02	Far Detector Installation
131.04.03	Near Site Integration
131.04.03.01	NS Facility Support & Services
131.04.03.02	Near Detector Installation

I&I Elements

- Material and assembly on top of the cryostat
 - Services Racks in CUC
 - Internal cryogenics
 - Detector Support System (DSS)
 - Mechanical structures + material handling equipment
 - Infrastructure (bridge, mezzanine, stairs)
 - Control rooms (underground)
 - Transport tools (surface & caverns)
 - Detector installation, including tools and clean rooms
 - Storage and local transport
 - Labor to support underground activities: cryostat, detector, cryogenics
 - Buildings modifications, if required
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- *I&I elements are categorized as either Host Lab or Integration responsibility*
 - *Items that persist beyond Installation of two detectors are Host Lab Operational Support (non-Project)*
 - *Collecting detailed costing information in EDMS*
 - *Summary document in draft provides overview of costing elements*

Next Steps for I&I Costing

- Resolve variances on cost review – now
- Capture any additional I&I that was omitted from first estimate - now
- Incorporate all I&I estimates and activities into P6 – 31 August
- I&I risk workshop – 12 September
- Complete all BOEs – 27 September
- Practice talks & practice drill downs – 1 October
- Review talks and documents posted – 15 October
- DOE IPR review starts – 29 October
- Host Lab will be part of Operational Support review – November / December
- FS CD2/3 Directors review ~ February
- FS CD2/3 DOE review ~ April

I&I Basis of Estimates

- A well-documented estimate with documentation. All steps of the cost estimating process included in the project's Basis of Estimate (BoE).
- Required regardless of funding source
- Standard LBNF/DUNE BOE form; will utilize cost review information collected in EDMS by reviewers
- Supporting documents required, including assumptions & quotes, P6 schedule print-out & cost tables
- Core cost & labor hours; Estimate uncertainty is assigned at the activity level
- BOE form is in docdb#2018

LBNF BASIS of ESTIMATE (BoE)		Date of Estimate: 10 April 2015 Updated 17 Oct 2018
		Prepared by: Elaine McCluskey
		Docdb #: 10428
WBS number: 130.01.01		WBS Title: LBNF Project Office
WBS Dictionary Definition: Personnel in the Project Office to administer and manage activities that encompass the entire project, such as liaison with DOE, DUNE, and Laboratory management, project management, reporting, regulatory compliance, quality assurance, risk, budget, procurement, document management, safety, project controls, etc. Also included is M&S and travel to support the project office team and the office functions, as well as M&S for project-wide activities such as contracting for the NEPA process. Per agreement with DUNE, some project office members also support DUNE. Includes activities for SDSTA Hoisting Services after Ross Shaft rehab and contracted effort by CM/GC for logistics coordination after CF construction. Specifically for each control account:		
131.01.01.01 Project Management LOE Personnel in the Project Office to administer and manage activities that encompass the entire project, such as liaison with DOE, DUNE, and Laboratory management, project management, reporting, regulatory compliance, quality assurance, risk, budget, procurement, document management, safety, project controls, etc. Also included is M&S and travel to support the project office team and the office functions, as well as M&S for project-wide activities such as contracting for the NEPA process. Per agreement with DUNE, some project office members also support DUNE.		
131.01.01.02 Alignment Support Includes alignment services and alignment Quality Assurance for Near and Far Sites, including installation of monuments, establishing benchmarks, conducting field survey and updating the FNAL network		
131.01.01.03 Ross Shaft Hoisting Services Includes SDSTA staff providing hoisting services, including operating the cage and skip hoists. This does not include any logistics or rigging.		
131.01.01.04 CM/GC Services after FSCF Includes contracted effort by CM/GC for logistics coordination for Cryogenics and Far Detector Installation (contractually, CMGC Option 2).		
Estimate Type (check all that apply -- see BOE Report for estimate type by activity): <input type="checkbox"/> (0) Work Complete <input type="checkbox"/> (1) Existing Purchase Order <input type="checkbox"/> (2) Catalog Listing or Industrial Construction Database <input type="checkbox"/> (3) Documented Vendor Estimate based on Drawings/ Sketches/ Specifications <input type="checkbox"/> (4) Engineering Estimate based on Drawings/ Sketches/ Specifications <input checked="" type="checkbox"/> (5) Engineering Estimate based on Similar Items or Procedures <input type="checkbox"/> (6) Engineering Estimate based on Analysis <input type="checkbox"/> (7) Expert Opinion		
Supporting Documents (including but not limited to): found in lbne-doc-10428: BOE-Project Office Backup spreadsheet, LBNF SDSTA Ross Shaft crew backup		

Details of the Base Estimate (explanation of the Work)

WBS 131.01.01:

This BoE includes the labor needed to run the LBNF Project Office with the associated M&S. This includes resources at Fermilab and from other institutions who are supporting the project. Fermilab labor includes resources in the LBNF Division organization as well as resources matrixed to the project from other Fermilab Divisions/Sections. This work is essentially level of effort for specific durations for specific

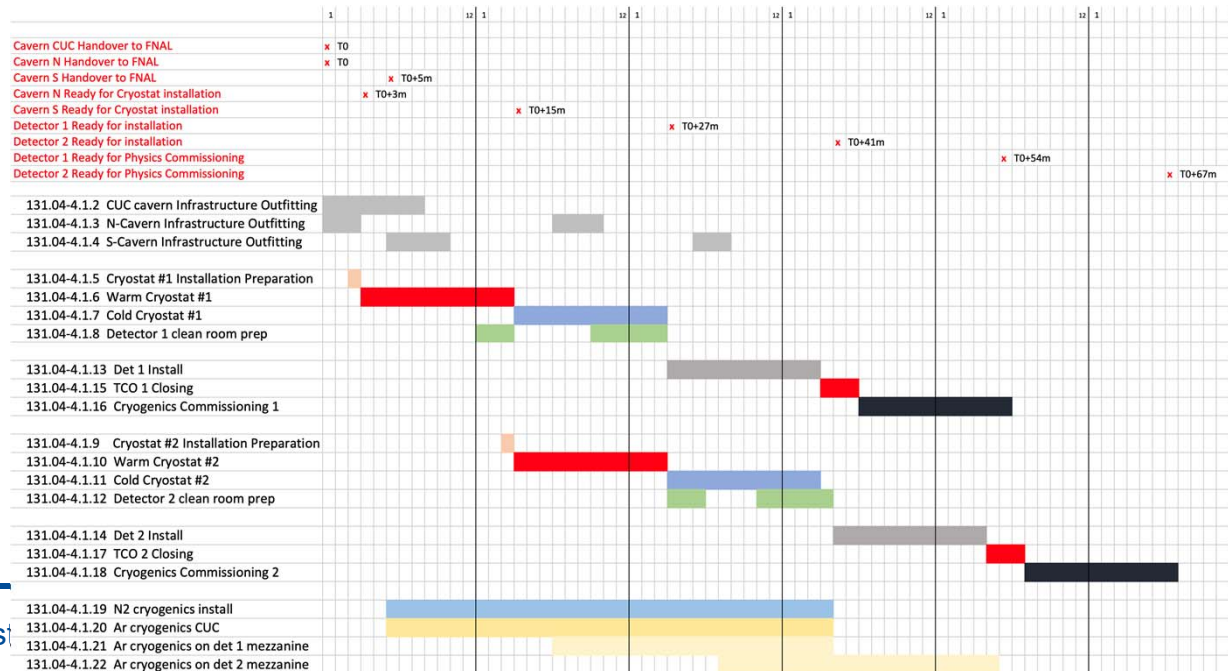
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I&I Risks currently in the LBNF/DUNE Risk Register

- Membrane Cryostat damaged during Detector Install (Med)
- Detector failure during cooldown (Low)
- Logistics Interfaces at SURF (Low)
- Scope is missing due to poor interface definition at Far Site (High)
- Customs delays (High)
- Complications with international supply chains and logistics (Low)
- Lack of Agreement on international codes/standards affects partner design work (Low)
- *I&I Risk Workshop planned for 12 September – will incorporate any relevant action items from this meeting*

Summary

- I&I cost detail prepared & under review
- I&I costs mostly on Project with operational-type activities categorized as Operational Support
- Basis of Estimate documentation required for all items
- Incorporating into P6 to present full cost profile and integrated activities



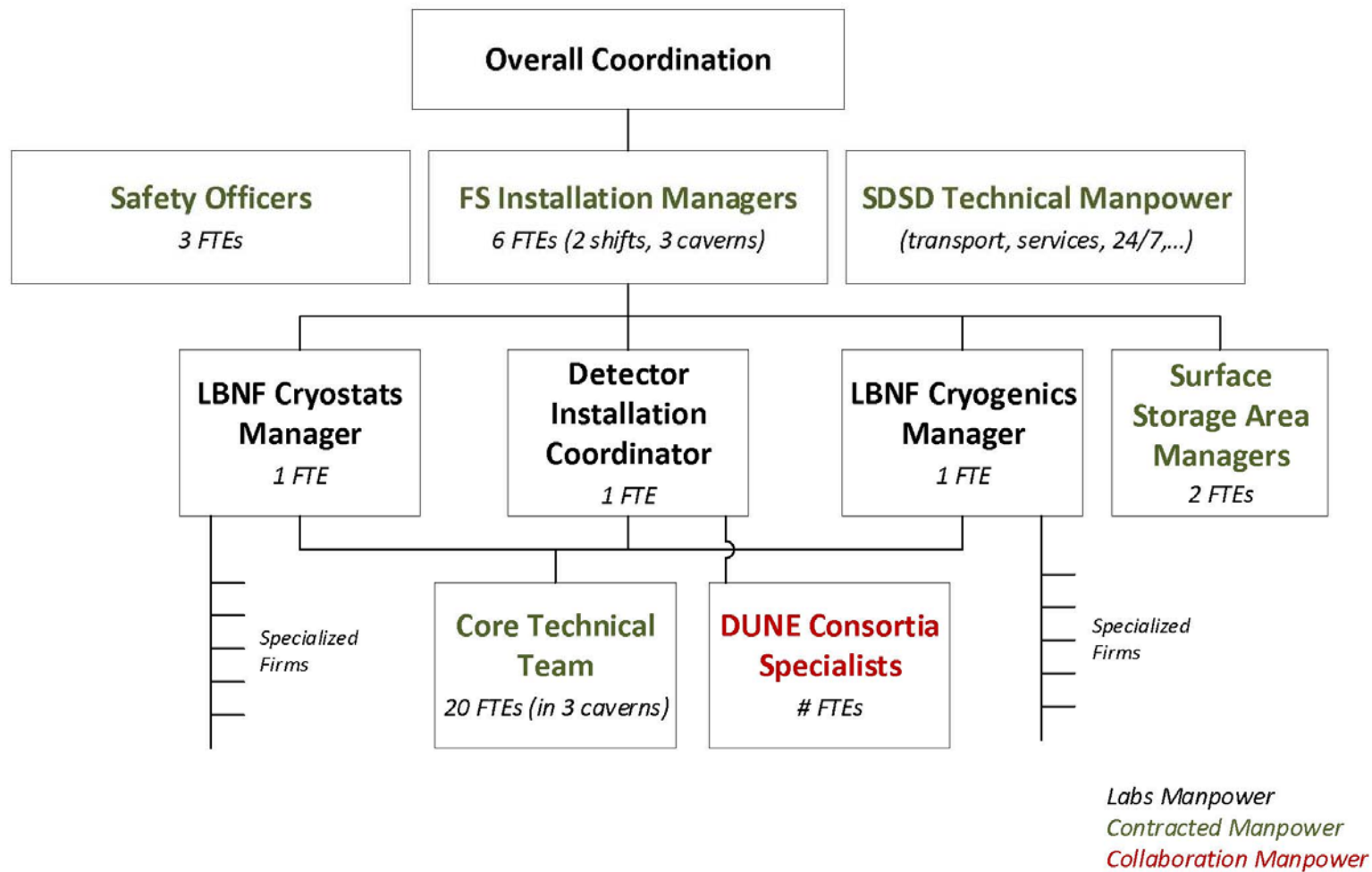
Thank you

Backup

I&I assumes deliverables from LBNF and DUNE :

- ✓ All caverns and drifts (BSI, EXC) from LBNF/CF
- ✓ N2 main cryogenics in CUC, surface and LAr proximity and in CUC cryogenics from LBNF project
- ✓ APAs including support yoke from the APA consortium
- ✓ All cold electronics + cold cables to feedthroughs, signals feedthroughs + warm electronics and power suppliers(PS) from CE consortium
- ✓ Photon detectors + electronics + cables to racks + PS from Photon consortium
- ✓ CPAs, field cages, HV system and cables, HV feedthroughs from HV consortium
- ✓ Felix DAQ system, CPUs, DAQ local network, trigger system, Slow control CPU and electronics from DAQ consortium
- ✓ Temperature probes, purity monitors, calibration systems from calibration consortium
- ✓ Specialized manpower in ITF and for final installation from consortia manpower assisted by a core technical group centrally organized

Installation in situ coordination (far site)



Host Lab responsibilities – labor

Transport / Riggers

Surface Shaft
transport/rigging
8 FTEs (2 shifts)

Lower Shaft & Drift
transport/rigging
8 FTEs (2 shifts)

Caverns
transport/rigging
10 FTEs (2 shifts)

Surface
storage/rigging
2 FTEs

Experts

Surveyors
2 FTEs

Welders (cryo) and
special
3 FTEs

Safety officers
3 FTEs

24/7 on call services

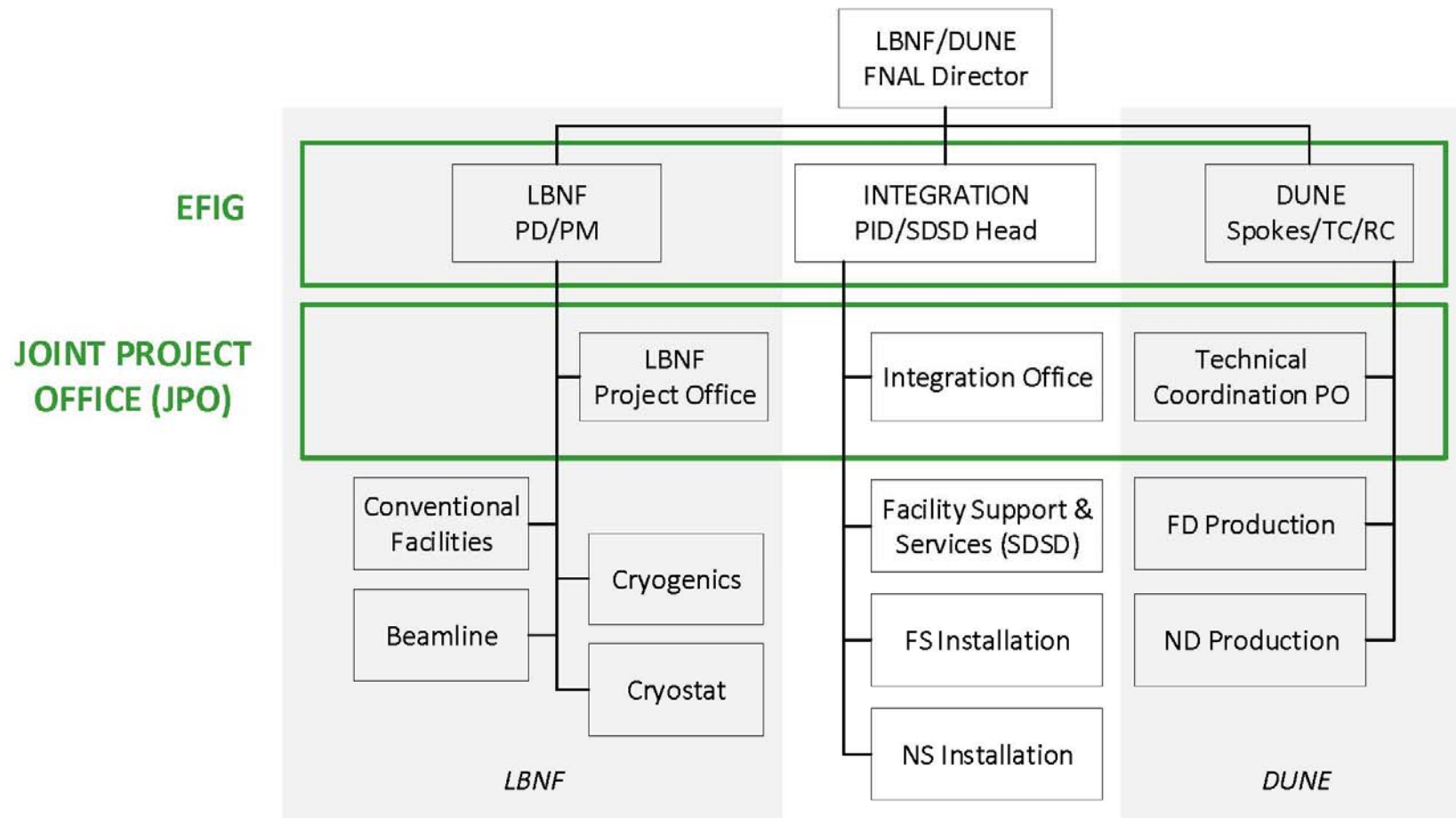
Electricians
3 FTEs

Ventilation
& Network
3 FTEs

Logistic services

Logistics
management
1 FTE

LBNF/DUNE Project Organization



I&I Risks

Risk Rank	Title	Probability	Cost Impact	Schedule Impact
2 (Medium)	Membrane Cryostat damaged during Detector Install	5.00%	0 -- 1000 -- 5000 k\$	0 -- 3 -- 12 months
1 (Low)	Detector failure during cooldown	3.00%	0 -- 500 -- 2000 k\$	0 -- 3 -- 12 months
1 (Low)	Logistics Interfaces at SURF	20.00%	0 -- 150 -- 1000 k\$	0 -- 0.5 -- 6 months
3 (High)	Scope is missing due to poor interface definition at Far Site	50.00%	0 -- 1000 -- 5000 k\$	0 -- 1 -- 6 months
3 (High)	Customs delays	50.00%	200 k\$	0 -- 6 months
1 (Low)	Complications with international supply chains and logistics	10.00%	k\$	0 -- 0.5 -- 3 months
1 (Low)	Lack of Agreement on international codes/standards affects partner design work	25.00%	k\$	0 -- 0.5 -- 6 months

BOE detail – template in DUNE docd#2018

Labor:

- -Discuss the types of resources selected.
- -Discuss the quantities selected and why.
- -Are there specific key personnel necessary to complete the work?

Also:

- Provide a description of what the deliverables are and its relationship to the project.
- Discuss the work scope included in the BoE and the resources necessary to complete it.
- Are there lessons learned from previous work? How were “the lessons learned” applied?
- Discuss dependencies (e.g. Are there any inter-project dependencies? (Counting on another project to do)

M&S:

- Is there a prototype or pre production process?
- Discuss any major planned procurements.
- Confirm that the quotation clearly states the base year used for the contractors estimate and that it is the same assumption reflected in the schedule.
- Is any equipment “re-used” from other projects?
- Have specific provisions been undertaken to earmark specific pieces of equipment.
- Have costs been considered for refurbishment?