Near Detector Risk Workshop
131.ND.02 ND-LAr Top Risks

Dan Dwyer (ND-LAr L2/CAM/Technical Lead), Andrew Lambert (ND-LAr Lead Engineer)

Near Detector Risk Workshop

04-06 December 2023

v1 – posted DD Month

ND Risk Thresholds & Guidelines

- Risk thresholds apply to the entire LBNF-DUNE project, and are not adjusted for individual sub-projects.

LBNF-DUNE Risk Impact Scoring	Low Impact	Medium Impact	High Impact
Technical Impact	Somewhat sub-standard	Significantly sub-standard	Extremely sub-standard or KPP in jeopardy
Cost Impact	(0.2 – 1) M$	(1 – 10) M$	> 10 M$
Schedule Impact	(2 - 6) months	(6–12) months	> 12 months

Maximum value of all impacts (above) determines overall risk impact (below)

LBNF-DUNE Risk ranking (Probability vs. Impact)		Low Impact	Medium Impact	High Impact
Very High	64 - 100%	Medium Rank	High Rank	High Rank
High	39 - 64%	Medium Rank	High Rank	High Rank
Medium	21 - 39%	Low Rank	Medium Rank	High Rank
Low	9 - 21%	Low Rank	Medium Rank	Medium Rank
Very low	0 - 9%	Low Rank	Low Rank	Medium Rank

ND Risk Register:

ND-specific views

- ND risks by technical area (Open/Proposed, Low/Medium/High)
- ND risks by owner (Open/Proposed, Low/Medium/High)
- ND risks - Table view (Open/Proposed, Low/Medium/High)

Overview

The "Perform Qualitative Risk Analysis" process [PMBOK, section 11.3] estimates the probability of the risk occurring and the impacts on cost, schedule, and technical performance. The risk probability and impacts are then used to rank the risks.

Based on an existing or preliminary Qualitative Risk Analysis:

- What are the top 5 technical risks for the ND-LAr L2 system?
  - *Determined by the SMEs, using results from the engineering risk assessment and project's technical requirements, specifications, and quality criteria of deliverables. Worst case: high impact technical risks may jeopardize the project's KPPs.*
- What are the top 5 cost risks for the ND-LAr L2 system?
  - *Includes the direct cost due to the risk event and the costs of risk response plans. May also include standing army and escalation costs due to collective schedule impacts (as computed by MC analysis)*
- What are the top 5 schedule risks for the ND-LAr L2 system?
  - *Directly impacted activities in the RLS are identified and the risk delay is estimated, including the risk event and the risk response plans.*

What are the top 5 technical risks for the ND-LAr L2 system?

(Include top technical risks to the L2 system. Determined by the SMEs, using results from the engineering risk assessment and project's technical requirements, specifications, and quality criteria of deliverables. Worst case: high impact technical risks may jeopardize the project's KPPs)

Risk ID *(if exists)*	Description or Summary	Probability *(%)*	Schedule Impact *(months)*	Cost Impact *(k$)*
RT-131-ND-084	ND-LAr: TPC module performance loss post-installation at Near Site	35%	6-9-12	1250
RT-131-ND-078	ND-LAr: Electric Field Uniformity	15%	1-5-9	48-239-429
RT-131-ND-121	ND-LAr: Alternative Field Structure concept does not meet performance	20%	2-3-6	200-250-500
RT-131-ND-128	ND-LAr: ASIC does not meet noise requirement	15%	3-6-12	150-600
RT-131-ND-080	ND-LAr: Fluid flow across the module	25%	3-4-6	400

What are the top 5 cost risks for the ND-LAr L2 system?

(Include top cost risks for the L2 system schedule. Includes the direct cost due to the risk event and the costs of risk response plans. May also include standing army and escalation costs due to collective schedule impacts (as computed by MC analysis))

Risk ID *(if exists)*	Description or Summary	Probability *(%)*	Schedule Impact *(months)*	Cost Impact *(k$)*
RT-131-ND-106	ND-LAr: ASIC foundry access for engineering runs	35%	6-12-24	500-1000-2000
RT-131-ND-111	ND-LAr: ASIC foundry access	10%	6-12-24	500-1000-4000
RT-131-ND-273	ND-LAr: Significant failure during ND Component Quality Control	30%	1-12	0-200-1000
RT-131-ND-274	ND-LAr: Technical Labor at Near Site Exceeds Estimate Uncertainty Margin (should have similar risk for TPC Assembly & Test?)	25%	3	0-650-1300
RT-131-ND-148	ND-LAr: Unclear Operations Requirements	35%	3-6-12	592-1058-2117

What are the top 5 schedule risks for the ND-LAr L2 system?

(Include top risks to the L2 system schedule. Directly impacted activities in the RLS are identified and the risk delay is estimated, including the risk event and the risk response plans.)

Risk ID *(if exists)*	Description or Summary	Probability *(%)*	Schedule Impact *(months)*	Cost Impact *(k$)*
RT-131-ND-106	ND-LAr: ASIC foundry access for engineering runs	35%	6-12-24	500-1000-2000
RT-131-ND-087 / 119	ND-LAr: Uncosted Labor (Charge Readout & Field Structures)	30% / 35%	3-6-12	0
RT-131-ND-111	ND-LAr: ASIC foundry access	10%	6-12-24	500-1000-4000
RT-131-ND-138	ND-LAr: TPC module production delays due to component shortages	10%	3-6-12	0
RT-131-ND-149	ND-LAr: Stop work order	20%	3-6-12	110.5-221-441

What risks are you worried about or think should be covered elsewhere?

ND-LAr organization/maturity

- Team has been very successful in prototyping environment, but now must ramp up toward production environment. Requires more formality, organization, and discipline. ***This is our greatest worry; likely need to work on QC related risks for all ND-LAr L3 WBS elements.***

LBNF/DUNE, DUNE Collaboration communication and decision-making processes:

- Significant decisions made without considering implications for ND-LAr, impact to international partners (JINR suspension) - should we have a “Communications” related risk?

Comment on ND-LAr Technical Maturity

- Significant time spent addressing technical concerns, not always effective in communicating the technical progress made. Do have some remaining technical issues to address, but they are small in comparison to the technical maturity we have achieved over recent years.
- Successful in this effort by maintaining pressure on the technical teams, and avoiding serialization of development. Must be wary of allowing the *perfect* to be the enemy of the *done* -> allow and support parallel activities.

General notes:

- Too many ASIC specific risks, would suggest rolling these up into 2-3 broader risk categories (i.e.; ASIC does not meet requirements, loss of ASIC foundry, additional ASIC design cycle required)
- Uncosted labor risks are listed by L3 WBS, should this be rolled up to L2?
- Some of our most significant “open” risks have been realized - how will these be handled? can we pull contingency prior to baselining?
- How are risks that might be realized post CD-4 handled (during operations)? for instance a risk does not impact KPPs but might impact long-term operations of ND.

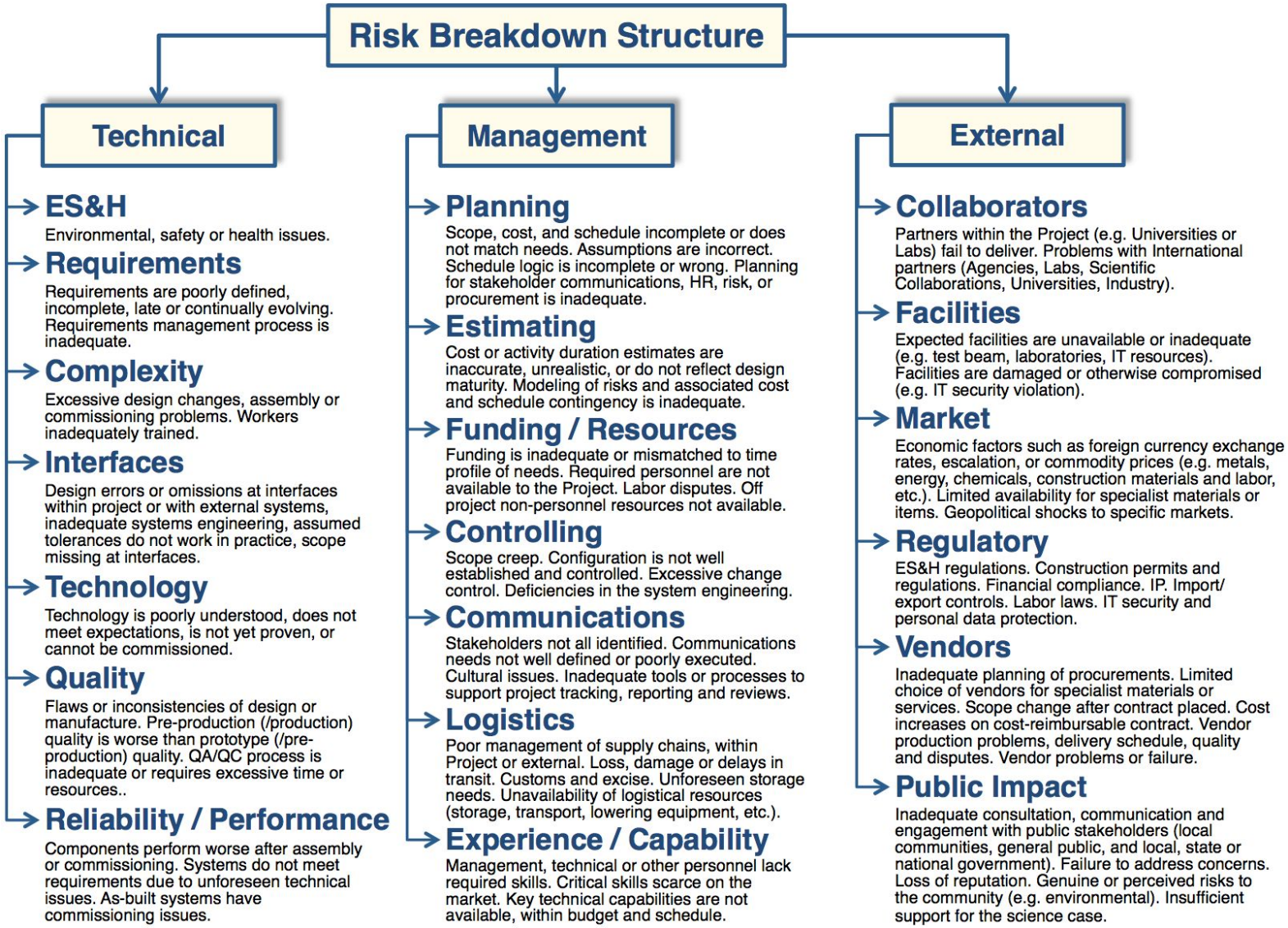
What assumptions are being made for the ND-LAr L2 system?

- Costs presented are burdened direct costs only, no escalation or FNAL overheads applied
  - Assumed an hourly rate for labor costs, dependent on the resource
- Technical risks tend to be specific which is good in theory but add more overhead w.r.t management
- Material costs/quotes are largely based on 2021 / 2022 data
- Generally speaking, delays with electronics based components are based on COVID era supply chain issues -> possible that these could be reduced given relaxation of supply chain constraints

REFERENCES

LINKS

FNAL Risk Management Site	Sharepoint Link
Risk Management Plan	Sharepoint Link
ND Risk Registry	Sharepoint Link
	DocDB Link
NDLAr Risk Registry	EDMS-2589288



Summary of Changes to ND-LAr Risks, Lessons Learned, Next Steps

Reduced number of ND-LAr risks from 67 to 39 (some of these (4-5?) are operations, wasn't able to filter):

- Accomplished by moving some risks to the PM level
    - Export/Import Restrictions, Procurement Delays, Loss of Key Personnel, Uncosted Labor, Stop Work Order, etc.
- Consolidated some risks into single risk
    - ASIC does not meet requirements
        - Noise, dynamic range, ESD, etc
    - ASIC foundry access
        - engineering runs, production runs
- Retired some risks that are "obsolete"
    - SLAC FSD
    - Lariat Vessels
    - Risks that are better handled by Estimate Uncertainty
- Reduced durations on several risks to more reasonable numbers (i.e. 24 months -> 9 months); still have a few long duration maximum impact risks that should be further evaluated
- Moved some risks for LBNF/DUNE Operations

Lessons Learned for Future Risks:

- Write risks to be as close as possible to the source of delay/cost increase (i.e. instead of saying "late components delivery delays assembly" make sure that the risk that drives the components to be late is captured (don't double count delays)
- Utilize Estimate Uncertainty to capture fluctuations in effort / cost for planned activity (i.e. instead of "design changes cause delay" increase the EU on the activity to handle this.

Next Steps / Action Items:

- Need to meet with all ND-LAr L3's on US project and make sure current risks cover their concerns and also add any risks that might be missing from their perspective
- Probably need to consider further risk consolidation to get # of ND-LAr risks down to a reasonable level, < 30 (management overhead)
- Evaluate remaining high schedule impact risks (> 6 months)
- Handover risk for each deliverable (in-kind contributions, installation)