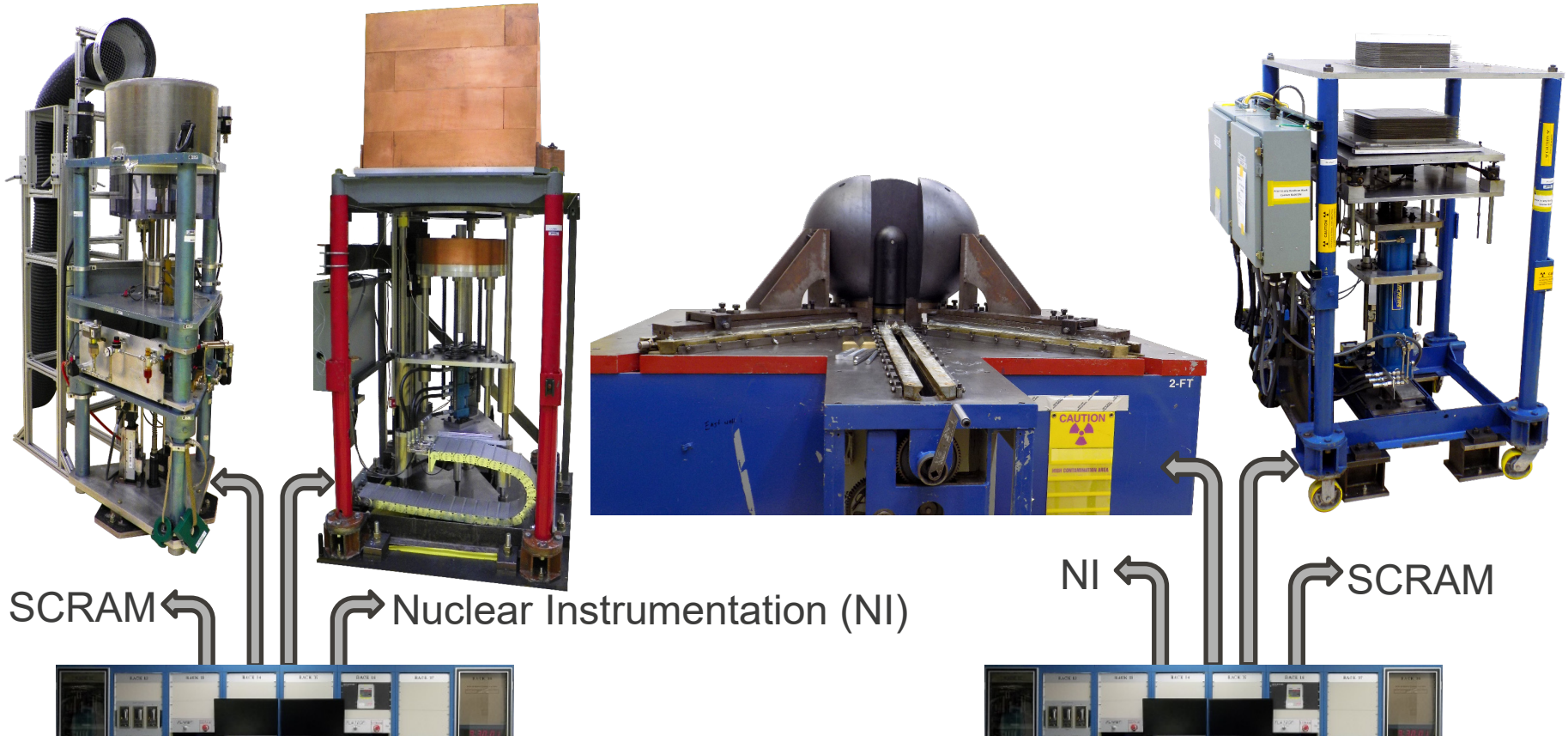
Los Alamos NATIONAL LABORATORY

NCERC Control System Upgrade Status: Challenges and Accomplishments

Eloura Phelps and Chloe McMath

February 21, 2024

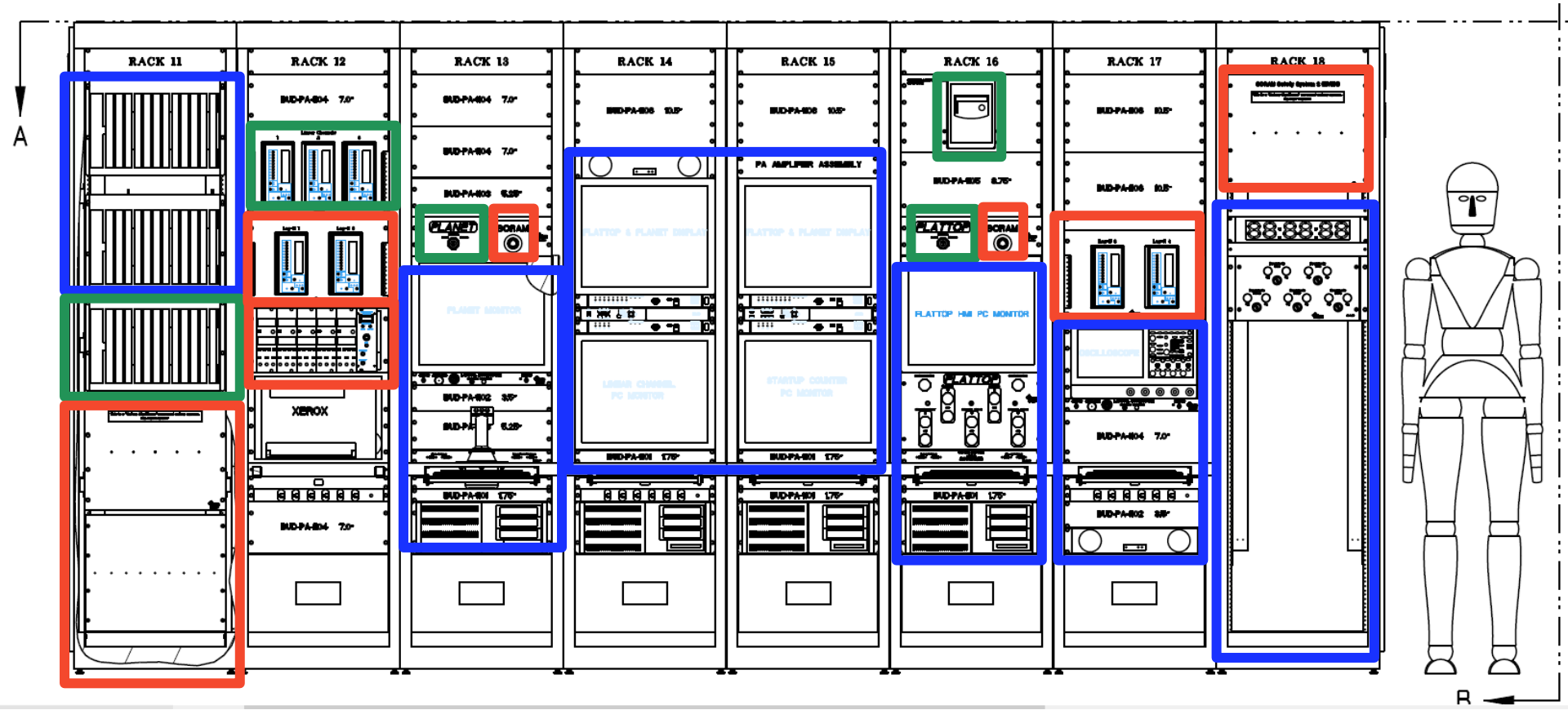
Overview: What do the NCERC Control Systems do?



Overview: Why do we need to update these systems?

- 17+-year-old system
- Obsolete components
- Unable to maintain adequate spare parts inventory
- Component lifetime
- Incorporate 12+ years of lessons learned
- Improve NCSP class engagement and experience
- Complete upgrade funded by NA-19

Old Configuration



Safety Significant **Defense-In-Depth** **General Service**

Old Configuration

Original Project Scope

Affects equipment in NCERC buildings 302, 304, 310

Safety Significant

- Update SCRAM Safety System Programmable Logic Controllers (PLCs)
- Update Startup Counter Systems
- Update Log-N Instrumentation NMP-1000's (downgraded to DID in DDRP)

Defense-In-Depth

- Update Operational Interlock System (OIS) PLCs

DAF Interface

- **Task 1**: Update networking infrastructure between control room and cell
- **Task 2**: Installation of AFS Mounting and Exhaust (interface with task exhaust)
- **Task 3**: Electrical reconfiguration
- **Task 4**: Mount camera track in assembly cells

General Service

- Update Critical Assembly Machine PLCs
- Update display programming for Linear Channel, Startup counter, and Godiva Burst Acquisition
- Update Human-Machine Interface (HMI) Graphical User Interface (GUI)
- Update HMI Consoles
- Audio-Visual system improvements
- Incorporate 12+ years of lessons learned

Project Status: February 2024

Only Control Room 2 (Comet/Godiva) components have been installed.

Safety Significant

- ✓ Update SCRAM Safety System PLCs and input components
- ✓ Update Startup Counter Systems
- ↑ Update Log-N Instrumentation NMP-1000's

Defense-In-Depth

- ✓ Update Operational Interlock System PLCs

DAF Interface

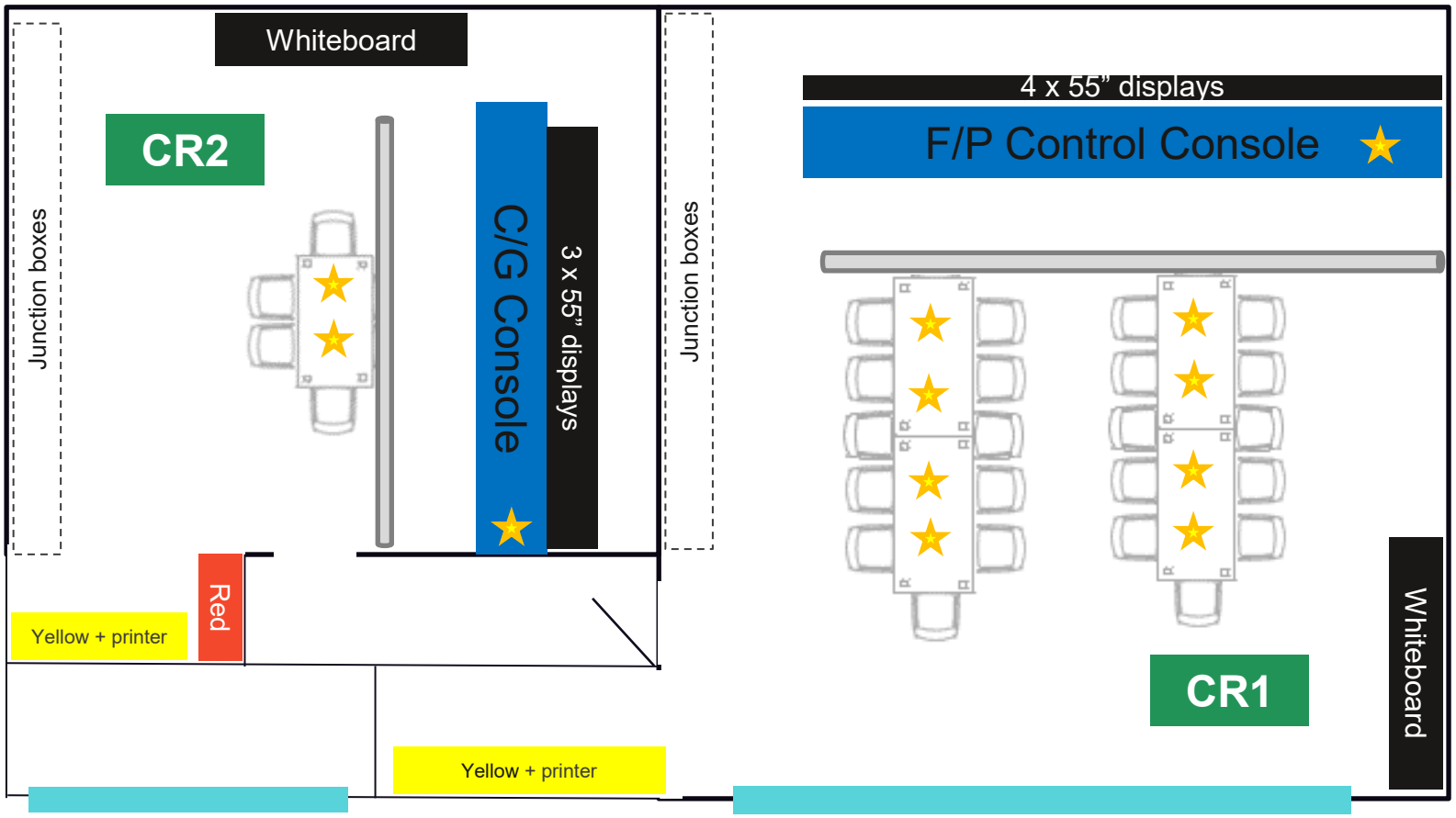
- → 1: Update networking infrastructure between control room and cell
- ↓ ~~2: Installation of AFS Mounting and Exhaust (interface with task exhaust)~~
- ✓ 3a: Remove tile
- ✓ 3b:Relocate console power receptacles
- ↑ 3c: Re-route Log-N +Linear detector conduit and cabling
- ↑ 3d: Reconfigure junction boxes
- ↑ 3e:Remove cable trays
- ↓ ~~4: Camera track in assembly cells~~

General Service

- ✓ Update Critical Assembly Machine PLCs and all control modules that interface with motors, encoders, etc.
- ↑ Update ladder logic program for Linear Channel, Startup counter,
- ✓ Update Godiva Burst Acquisition hardware and program
- ✓ Update HMI GUI
- ✓ Update HMI Consoles
- ✓ Audio-Visual system improvements
- ✓ Incorporate 12+ years of lessons learned

New Configuration

New Configuration



= drops for LANL network and power

FYI, any federal employee/contractor can get set up with a guest account on the LANL network and get their work laptop approved for use in DAF.

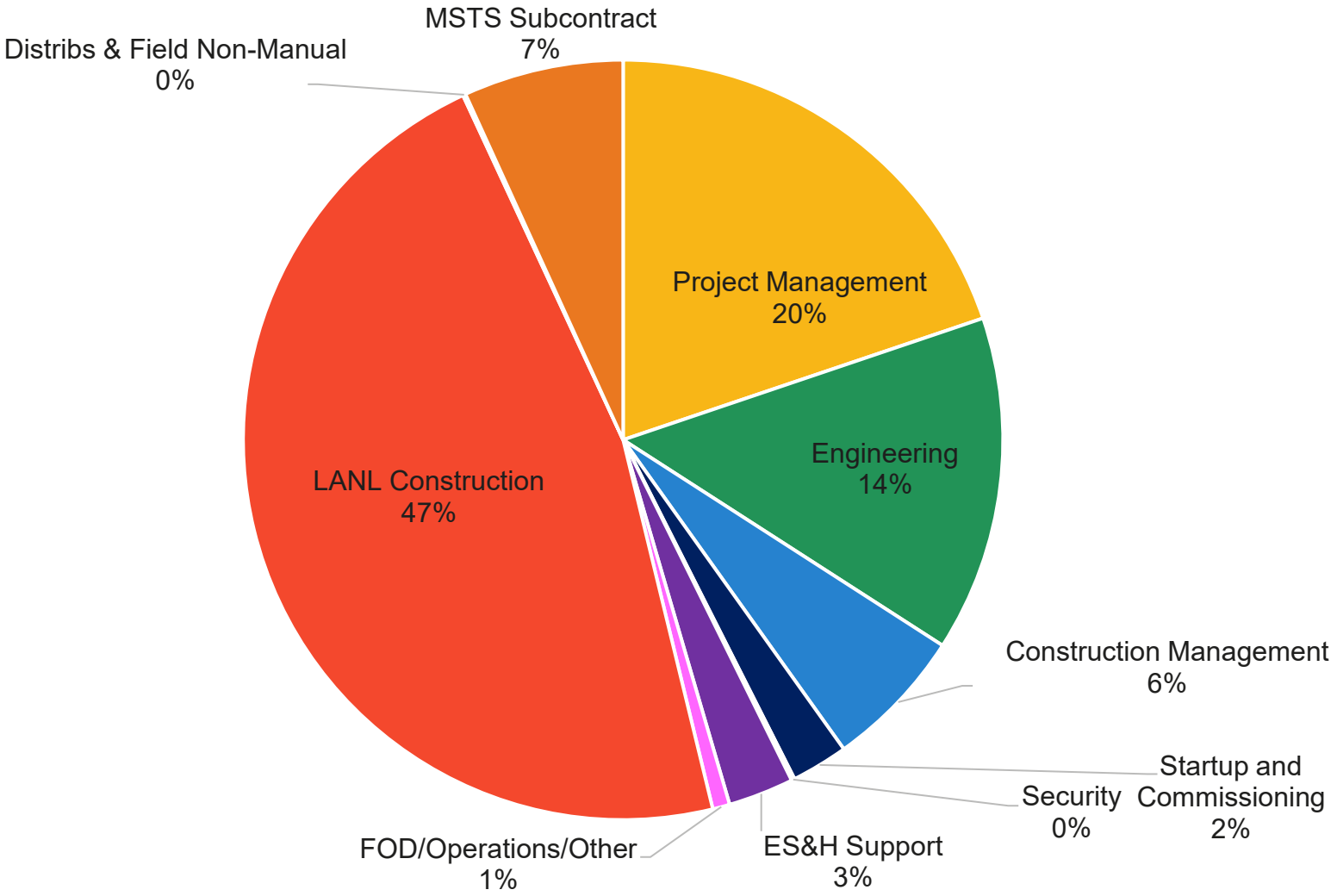
OK, How Much Will This Cost?

- **Execution Strategy:** Mission Support and Testing Services (MSTS) will perform design and construction of networking infrastructure, camera system anchoring to facility, and air filtration system. LANL NCERC group will perform design and construction of all other portions of the project.
- **Procurement Strategy:** MSTS contract was negotiated using Integrated Contractor Order (ICO), similar to a subcontract. LANL NCERC group will self-perform all design, procurement, and build aspects of their respective scope.

The point estimate for the entire project made by the LANL finance group in 2020 was **$7,291,384**, with actual cost estimated between $6,197,676 and $10,937,075.

2020 Estimate: $7,291,384

Cost Estimate Breakdown



Labor Costs to Date

FY	NCERC-FO	LANL PM	LANL Design	Other LANL	MSTS
21	$67,254.16	$26,414.48	$39,427.19	$23,646.16	-
22	$180,359.52	$106,872.70	$764,782.49	$1,747.84	-
23	$676,295.32	$129,304.36	$818,605.95	$5,044.62	$7,975.49
24	$384,759.74	$111,083.83	$252,963.22	$19,290.90	$266,171.13
	$1,308,668.74	**$373,675.37**	**$1,875,778.85**	**$49,729.52**	**$274,146.62**

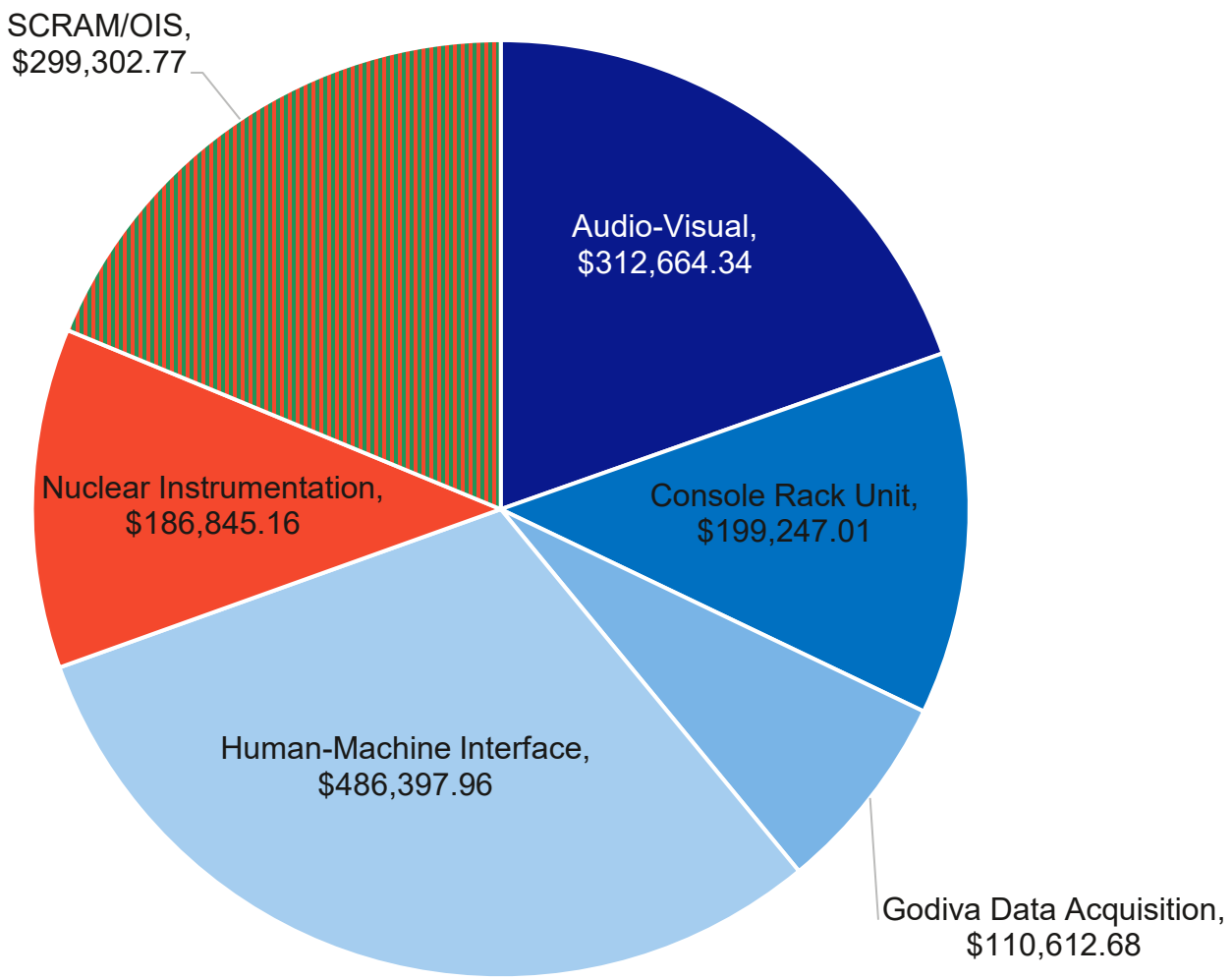
Total Labor Costs (as of January 2024): $3,881,999.10

Over $1.5M in Procurements to Date

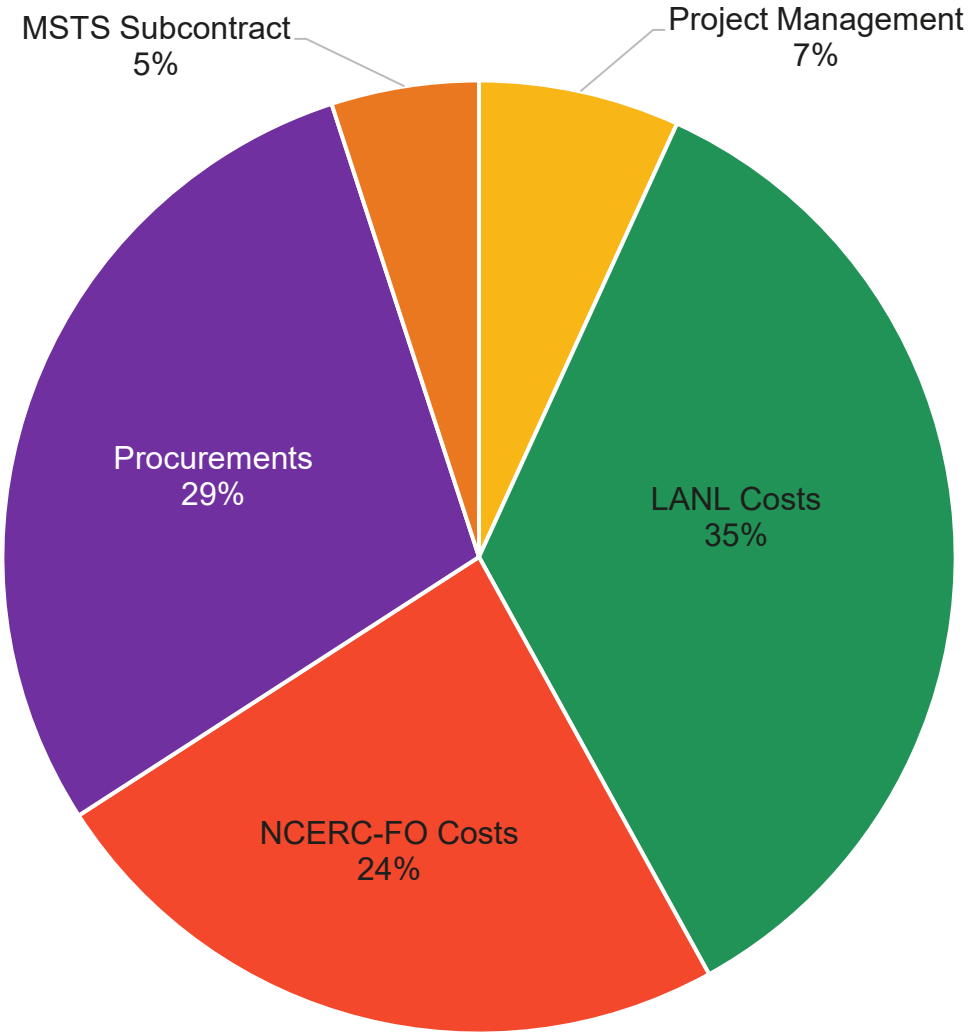
Safety Significant
- SCRAM
- Nuclear Instrumentation

Defense-In-Depth
- SCRAM
- Operational Interlock System

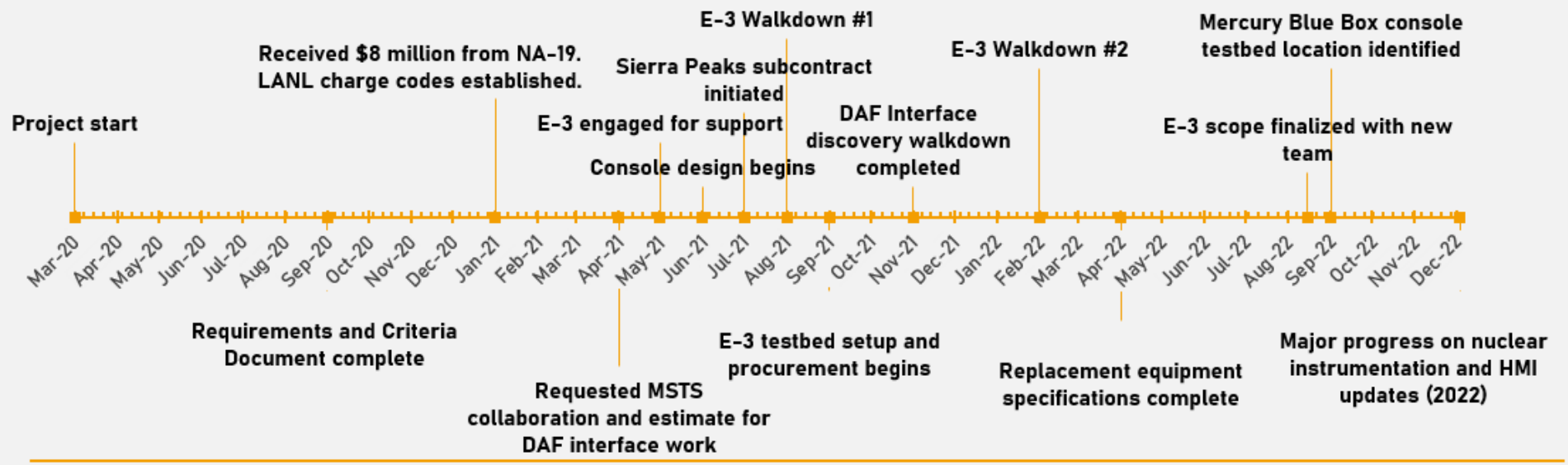
General Service
- Audio-Visual
- Console Rack Unit
- Godiva Data Acquisition
- Human-Machine Interface



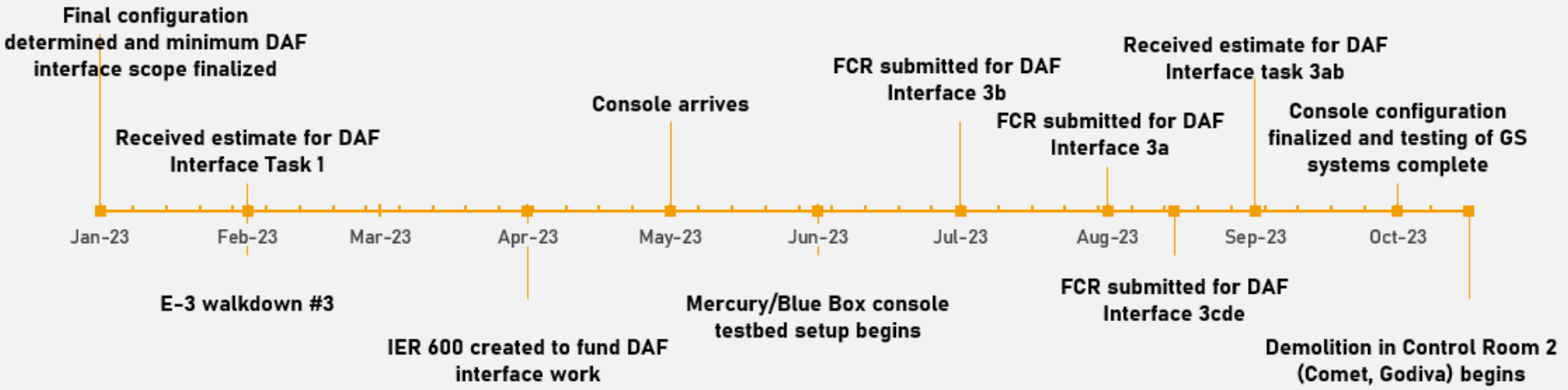
Cost Breakdown to Date: $5,477,069



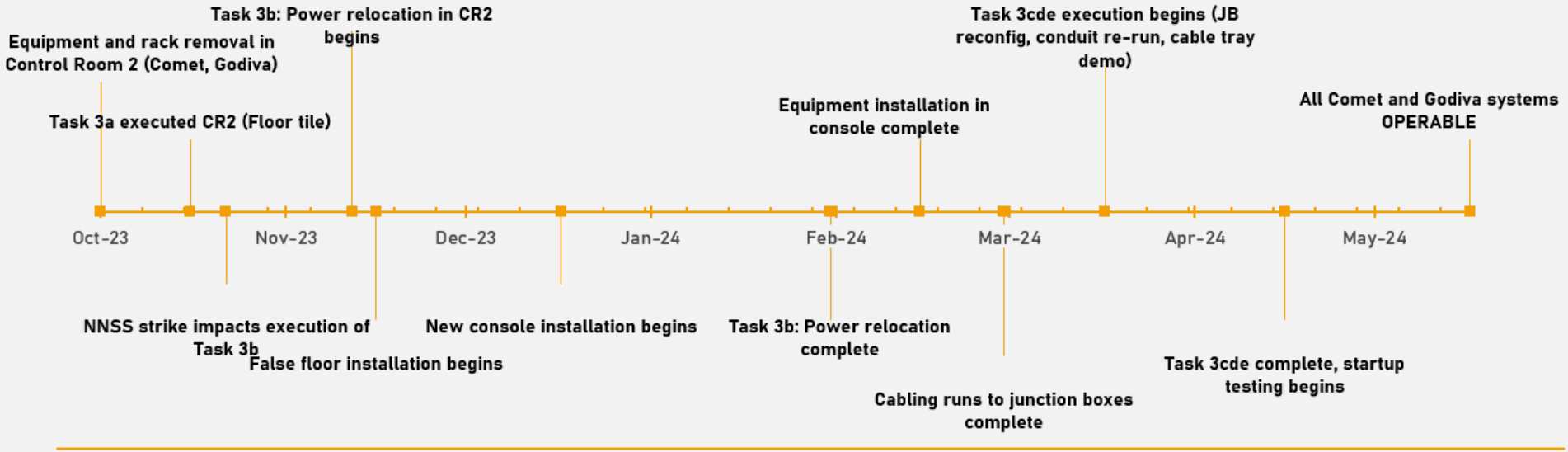
PROJECT TIMELINE: March 2020 - Dec 2022



PROJECT TIMELINE: Jan 2023 - Oct 2023



PROJECT TIMELINE: Oct 2023 - Jun 2024



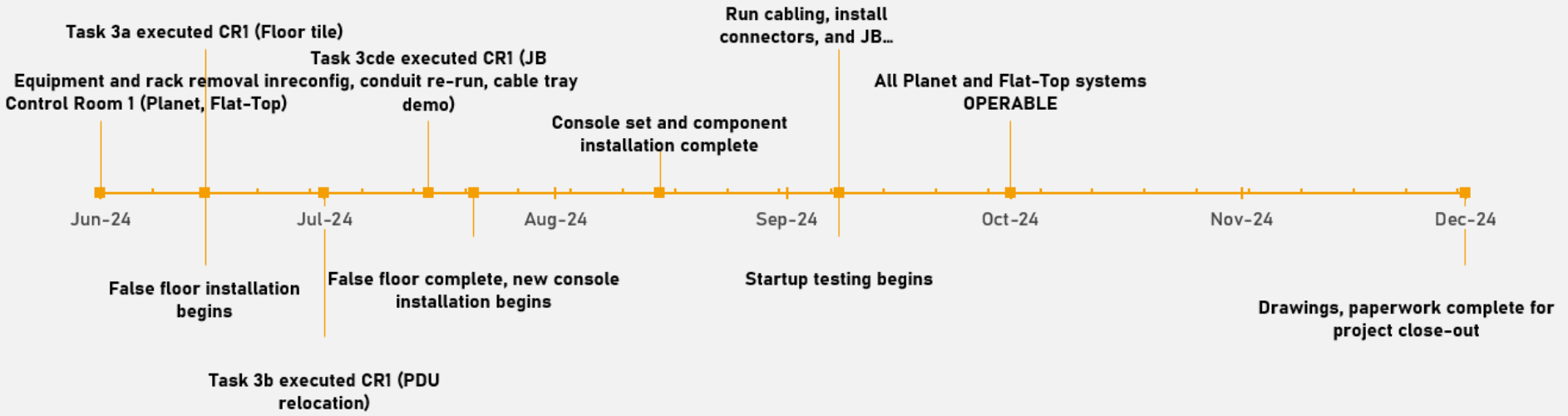
Challenges & Lessons Learned

- **Inter-Organizational Communication**
  - Information gets stove-piped within groups
  - NNSS process for requesting work was not available or advertised with laboratories
  - “The Great Resignation”
  - MSTS/JLON processes are being developed to execute site-wide facility modification requests at a more reasonable timeframe and cost
- **Procurement and Supply Chain**
  - Safety significant specifications and procurements
  - Unresponsive vendors, supply chain issues, long lead times
    - “Please bear with us as we navigate challenges caused by the unprecedented COVID pandemic”
  - Brand new LANL procurement system (Ariba) rolled out as this project was beginning
  - LANL procurement system rejections and re-submittals and rejections and re-submittals
  - Brief Ariba approvers on a procurement before it is submitted
  - Include LANL QA early in discussions with vendors for quality procurements
- **Project Management**
  - No defined schedule or milestones until January 2023
  - NCERC-FO will qualify a LANL project engineer to support future projects in developing schedules and milestones, helping track budgets, and interfacing with outside organizations.
  - Detailed and iterative scoping is key

Questions?

LA-UR-24-21146

PROJECT TIMELINE: Jun 2024 - Dec 2024



Integrated Project Team

1. Requirements & Criteria Development

- NCERC NEN-2 Crew
- NCERC-FO Cognizant Systems Engineers
- LANL Project Engineering
- LANL finance/estimating

2. Establish Organizational Interfaces

- MSTS Project Management
- DAF Construction
- MSTS USQ
- MSTS Engineering
  - Design, System, Field
- LANL CoE
- LANL QA/DPR
- LANL NEN-2 and FO
- LANL E-3

3. Design & Construction

- MSTS Engineering
  - Design, System, Field
- LANL E-3 Process Controls and Automation
- LANL NEN-2 Design Engineering
- Subcontractors

4. Procurement/QA

- LANL E-3
- NCERC-FO CSEs
- NEN-2 Design Engineering
- LANL QA
- LANL DPR
- Subcontractors

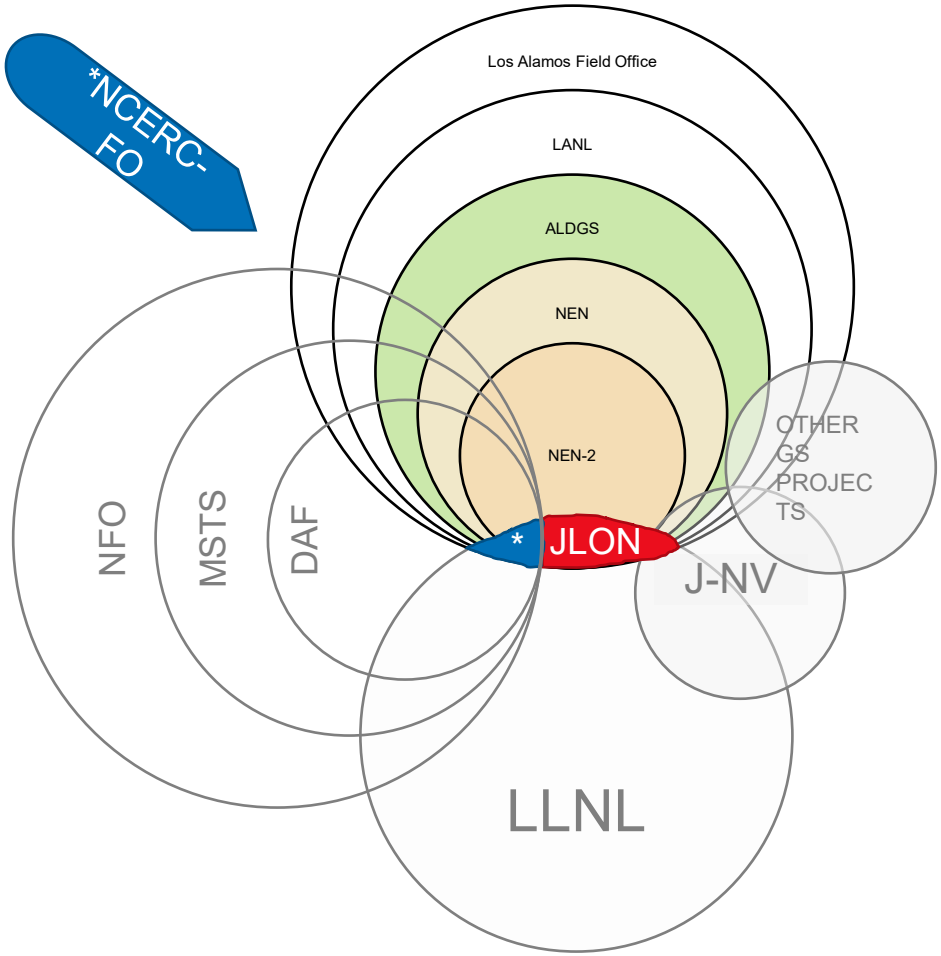
5. Testing

- LANL E-3
- NCERC-FO CSEs
- NEN-2 Crew

Details: DAF Interface

Task	Status	Date	Estimate	Cost-to-Date
Task 1: Update networking infrastructure between control room and cell	100% design complete. Shelved until additional funding can be secured. Next steps: material procurement and work package development.	Sep 2023	$1.1-1.6 million	$130k
Task 2: Interface AFS into facility HVAC	30% design complete. Shelved until additional funding can be secured. Next steps: Continue design.	Aug 2023	Shelved before this point	Shelved before this point
Task 3a: Remove tile to prepare for false floor	Completed in CR2.	Oct 2023 (CR2) June 2024 (CR1)	$51k	
Task 3b:Relocate console power receptacles	Demo complete. Install scheduled for Feb 2024.	Nov. 2023 Feb. 2024	$260k	
Task 3c-d-e: Re-route Log-N +Linear detector conduit and cabling, reconfigure junction boxes, remove cable trays	90% design in progress, promised March 2024.	Execution April 2024	$586k	
Task 4: Camera track in assembly cells	Shelved until additional funding can be secured	N/A	N/A	N/A

Reminder: NvE Organizations




LANL & LLNL
JLON
Drowning in even more paperwork and processes than we already do
NNSS-DAF

WHICH CODES, STANDARDS, ORDERS, POLICIES, PROCESSES, PROCEDURES APPLY?

DOE

- 10 CFR 830 Nuclear Safety Management
- ANSI/ANS-1-2000 Conduct of Critical Experiments
- ANSI/ANS-14.1-2004 Operation of Fast Pulse Reactors

NFO/LAFO

- DOE-STD-3009 Preparation of Nonreactor Nuclear Facility DSA
- DOE O 420.1 Facility Safety
- DOE-STD-3024 Content of System Design Descriptions
- DOE-STD-1027 Hazard Categorization of DOE Nuclear Facilities
- DOE-STD-1073 Configuration Management

NvE

- NFO O 421.X1 Nuclear Facility Safety Management
- JLON-PRO-900 REOP and Work Control Process
- MSTS CDs

LANL

- 11 SMPs Crit safety, CoM, ConOps, P840
- LANL P300 Integrated Work Management
- LANL P341 Facility Engineering Processes Manual
- AP-341 Facility Engineering Administrative Procedures
- LANL P342, Engineering Standards Manual