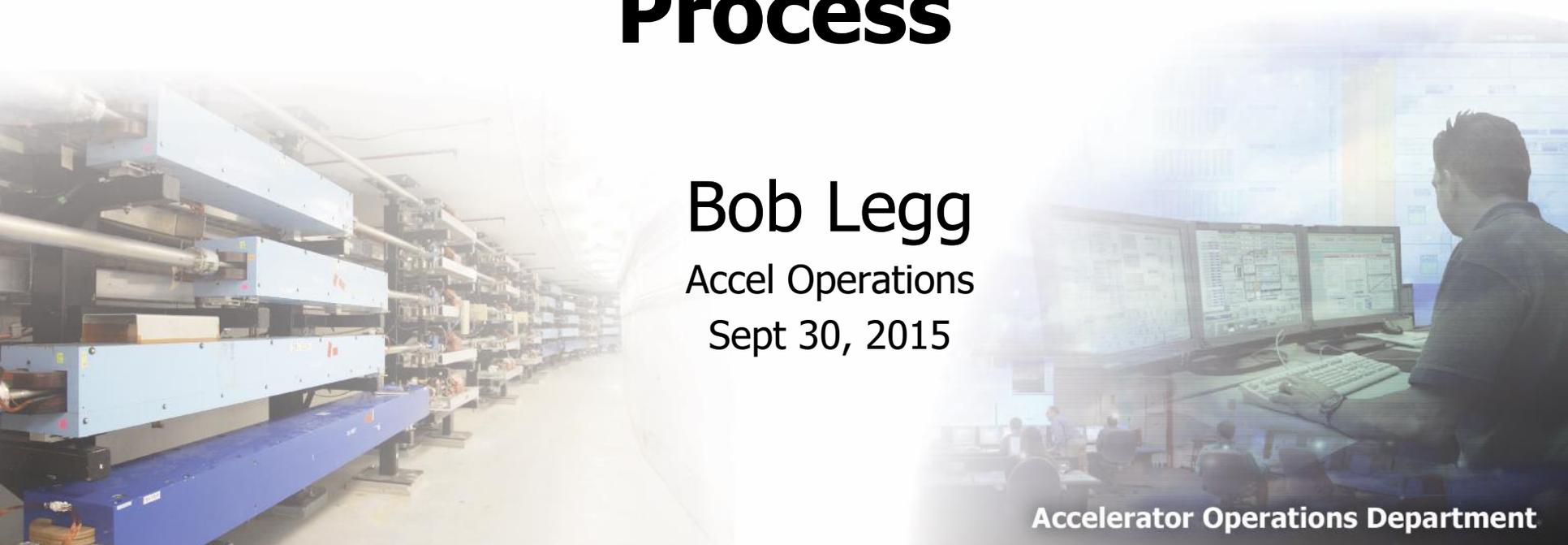


LERF Experimental Review Process

Bob Legg

Accel Operations

Sept 30, 2015



Accelerator Operations Department

Outline

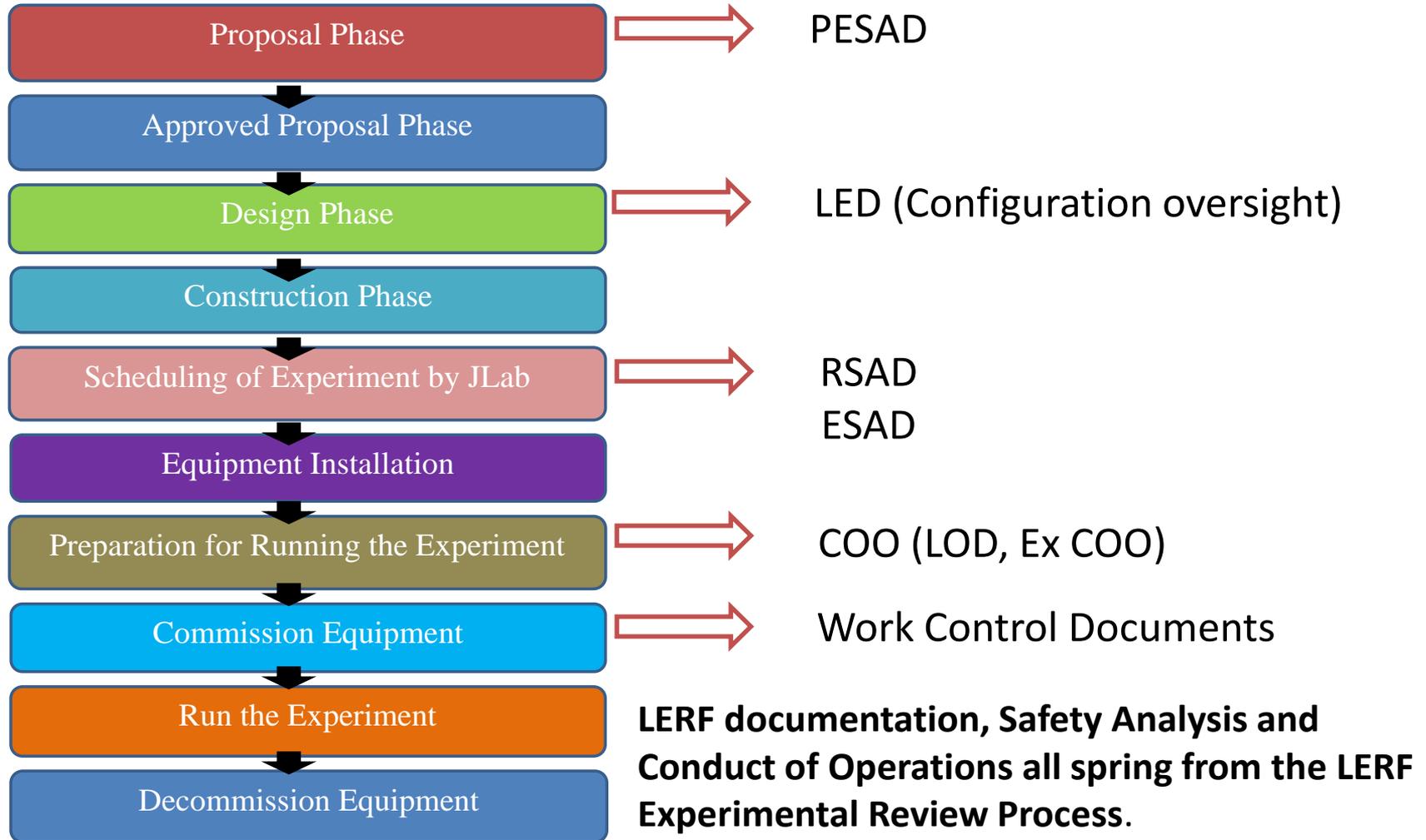
- **Experimental Review Process (ERP)**
- **Safety Documentation**
 - Preliminary Experiment Safety Analysis Document (PESAD)
 - Radiation Safety Analysis Document (RSAD)
 - Experiment Safety Analysis Document (ESAD)
 - Work Control Documents (OSPs, THAs, etc.)
- **Conduct of Operations (COO)**
 - Experimental COO (based on Physics Template)
 - LERF Operations Directives (LOD based on AOD)
- **Summary**

Experimental Review Process

- Two paths through the ERP,
 - NP proposals go through PAC, TAC, etc. just as any other NP proposal.
 - Outside funded proposals go through the LERF ERP procedure based on the NP version but allowing the Director flexibility in selecting proposals to bypass the PAC and TAC.
 - No Documentation or Safety steps are bypassed.

Experimental Review Process

LERF Experiment Review Process



ERP (Safety)

- Jefferson Lab holds the strong conviction that high standards in environment, safety, and health (ES&H) are fully compatible with accomplishing forefront research.
- To help ensure that safety is integrated into the planning and conduct of experiments Jefferson Lab has established an experimental review process. By including safety considerations in the early design stages of an experiment the experimenter reduces the risk that safety issues, that could significantly delay the experiment, will surface later.
- Safety follows the development of an experiment from proposal to clean-up and removal.

PESAD

 <small>Thomas Jefferson National Accelerator Facility</small>	LERF Preliminary Experiment Safety Assessment Document (See ES&H Manual Chapter 3130 Appendix T1 LERF Experiment Safety Assessment Document –Instructions)	Click For Word Doc
----------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------

LERF Experiment ID:	<input type="text"/>	<small>(Assigned by LERF Hall Leader)</small>	
<p>This form documents your experiment. The Lead Scientist completes ALL numbered questions (write "not applicable" or "none" where appropriate). If your experiment changes before the form expires, you must notify the LERF Facility Manager. Most changes are easily accommodated and should not result in significant delay.</p>			
1. Lab Number:	<input type="text"/>	2. Expected Start Date: <small>(Once approved, this form is valid for two years.)</small>	
3. Experiment Title:	<input type="text"/>		
4. Document Owner(s) <small>(Lead Scientist):</small>	<input type="text"/>	4a. Contact Information: <input type="text"/>	
5. List all Experimenters who will be working at the LERF:			
<small>First & Last Name (Print)</small>	<small>Affiliation:</small>	<small>Phone:</small>	<small>E-Mail:</small>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
6. Name of People who completed this form:			
<small>First & Last Name (Print)</small>	<small>Affiliation:</small>	<small>Phone:</small>	<small>E-Mail:</small>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

(When form is complete submit it DSO for review and approvals)

This part to be completed by Jefferson Lab SUPPLEMENTAL TECHNICAL VALIDATIONS Subject Matter Expert Review and Acceptance			
<small>Hazard Reviewed (per ES&H Manual 2410-TD):</small>	<small>Print</small>	<small>Signature</small>	<small>Date:</small>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
APPROVALS			
<small>Division Safety Officer:</small>	<small>Print</small>	<small>Signature</small>	<small>Date:</small>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<small>LERF Operations Coordinator:</small>	<input type="text"/>	<input type="text"/>	<input type="text"/>

This document is controlled as an on line file. It may be printed but the print copy is not a controlled document. It is the user's responsibility to ensure that the document is the same revision as the current on line file. This copy was printed on 9/15/2015.

Page 1 of 6

- Initial Safety Analysis
- Documents:
 - Name of Experiment
 - Names of Experimenters
 - Identify known hazards
- Accelerator is the experiment for commissioning.
- Addressed for commissioning during the safety walk throughs and the Hot Check Out process



Radiation Safety Analysis Document

- RSAD is not finalized for the October commissioning run
- RSAD configuration:
 - Recirculated Beam to 1G03 dump
 - Less than 10 mA of beam current
 - Beam energy in the dump of less than 15 MeV
 - Beam power in the dump not to exceed 120 kW (Final Safety Assessment Document, August 27, 2012, pp. 28-29)
 - Maximum beam energy in beam transport not to exceed 210 MeV
 - Injector operated at less than 15 MeV
 - Less than 1 microAmp of detected beam loss in beam transport
- LERF is not expected to produce measurable levels of radiation at the site boundary.
- RSAD addresses shielding configuration control and activated material monitoring in LERF.
- **Other Machine configurations will require specific RSADs.**

RSAD (cont.)

- RSAD addresses dose rate and shielding for three different loss configurations; 50 watt point loss, distributed 15 watt/m loss and loss at the dump. The shielding calculations are all based on the 1996 Radiation review and calculations performed by G Stapleton.
- The dose rates predicted in those calculations for the occupied areas outside the shielded enclosure have turned out to be conservative based on the on-going measurements made by the Radiation Control Department.
- The dose rates in the vault have also been measured by the ion chambers in the rapid access system, with a cross-correlation to measurements made during the Darklight tests. Those measurements show dose rates that are orders of magnitude less than the dose rates calculated in the RSAD.

Conduct of Operations (COO)

- Two sets of COO for LERF.
 1. Experiment COO to describe
 - Experimental groups' Responsibilities,
 - Collaboration Organization
 - Operations Personnel
 - Required Training
 - Emergency Response.
 2. Accelerator COO which takes the form of the **LERF Operations Directives (LOD)**.
 - It describes how the machine will be operated in a reliable and efficient manner within the safety guidelines laid out in the FSAD and ASE documents.

Two Types of Experiment COOs

- DOE funded experiments must go through the Nuclear Physics Experimental Review Process (Darklight will go through NP ERP).
- This process is detailed in chapter 3120 of the ES&H Manual.
- Outside funded experiments must still go through the LERF Experiment Review Process.
 - COO may vary slightly since experiment does not go through Physics division and there is no physical hall.

COO for Outside Funded Experiments

- Template based on NP template.

Jefferson Lab, LERF Conduct of Operations

Experiment Number: Experiment number
Experiment Name: Experiment Name.
Lead Scientist:: Lead scientist.
Date: [the date]
Expiration Date:: Max 180 days from Approval.

1 Preface

As part of its mission, JLab provides the resources necessary for international collaborations of scientists to carry out basic research in nuclear physics and related disciplines. This research must be conducted in a manner that ensures that environmental, health and safety (EH&S) concerns receive the highest consideration. At the same time the programmatic goals of the laboratory require that it produce the highest quality physics results efficiently.

Guidance on how to balance thoughtful, measured EH&S concerns with efficient operation has been taken from the Department of Energy (DOE) Order 5480.10, "Conduct of Operations," the JLab EH&S Committee, the JLab EH&S Manual, and the JLab Director's Office. A graded approach is followed in which the measures taken are matched to the scale, cost, complexity, and hazards of the operation.

This document outlines how approved experiment collaborations will conduct operations in a safe and effective manner during the time period that experiment Experiment number is on the floor. Installation and commissioning periods are not covered by this document. Furthermore, this document is directed to Experimental Users and Experimental staff rather than the LERF technical staff. It must be read, understood, and followed by all members of the collaboration.

Accelerator COO

- The LERF Operations Directives, based on the AOD, act as the LERF's COO for the accelerator. It is a blueprint for the Program Control, Operations, Maintenance and Configuration control of the machine. It puts in writing the:
 - Roles and responsibilities
 - Organization
 - Training requirements
 - LERF Element Database and configuration tracking
 - Hot checkout and maintenance
 - Emergency response guidelines

Roles and Responsibilities (Program Control)

- **The JLAB Director** or his designee is responsible for the review and approval or rejection of Outside funded experimental proposals.
- **The Director of Accelerator Operations (Freyberger)** provides LERF operations oversight, including participating in program development and scheduling, and authorizing beam and lasing operations.
- **The LERF Hall Leader (Benson)** is the designated spokesman for the facility. They coordinate with a variety of internal stakeholders and outside entities to ensure that the LERF facility best accommodates potential users and the operating program is well defined and supported with appropriate resources.

Roles and Responsibilities (OPS)

- **The LERF Operations Coordinator (Legg)** coordinates execution of the scheduled LERF program and addresses associated operational issues.
- **The LERF Run Coordinator (Legg)** is responsible for all shifts of the LERF program for a two week period and is expected to communicate with each shift on a daily basis to direct the scheduled program.
- **The LERF Accelerator-Physics Experiment Liaison (APEL) (Douglas)** is an accelerator scientist who is appointed by the Director of Accelerator Operations to serve as a liaison for the LERF program.
- **The Crew Chief** provides oversight responsibility for both the LERF and CEBAF accelerators. During LERF running, the Crew Chief determines which control room will be used for LERF operations (either the LERF or the MCC) and assigns LERF Operator, and LERF SSO duties.
 - For the fall run, we will run from the LERF Control Room.

Roles and Responsibilities (OPS)

- **The LERF Operator** controls and monitors the LERF acceleration systems to deliver the beam required for the scheduled and alternate LERF programs. The on-duty LERF Operator is supervised and directed by the Crew Chief, who, based on overall JLab priorities or emergency situations, may choose to redirect the LERF Operator to other, non-related duties at any time, provided the LERF is first placed in a safe state.
- **A LERF Scientist on Shift (LSOS) (Tennant, etc.)** is a qualified individual who requires access to the LERF control system during beam operations in order to help execute the LERF program. An LSOS works closely with and remains under the direction of the LERF Operator if changing accelerator parameters.
- An accelerator operator or Crew Chief is assigned as the **Operations LERF Liaison (Frierson)** in order to serve as a link between the experimenters and the Operations Group.

Roles and Responsibilities (Maintenance)

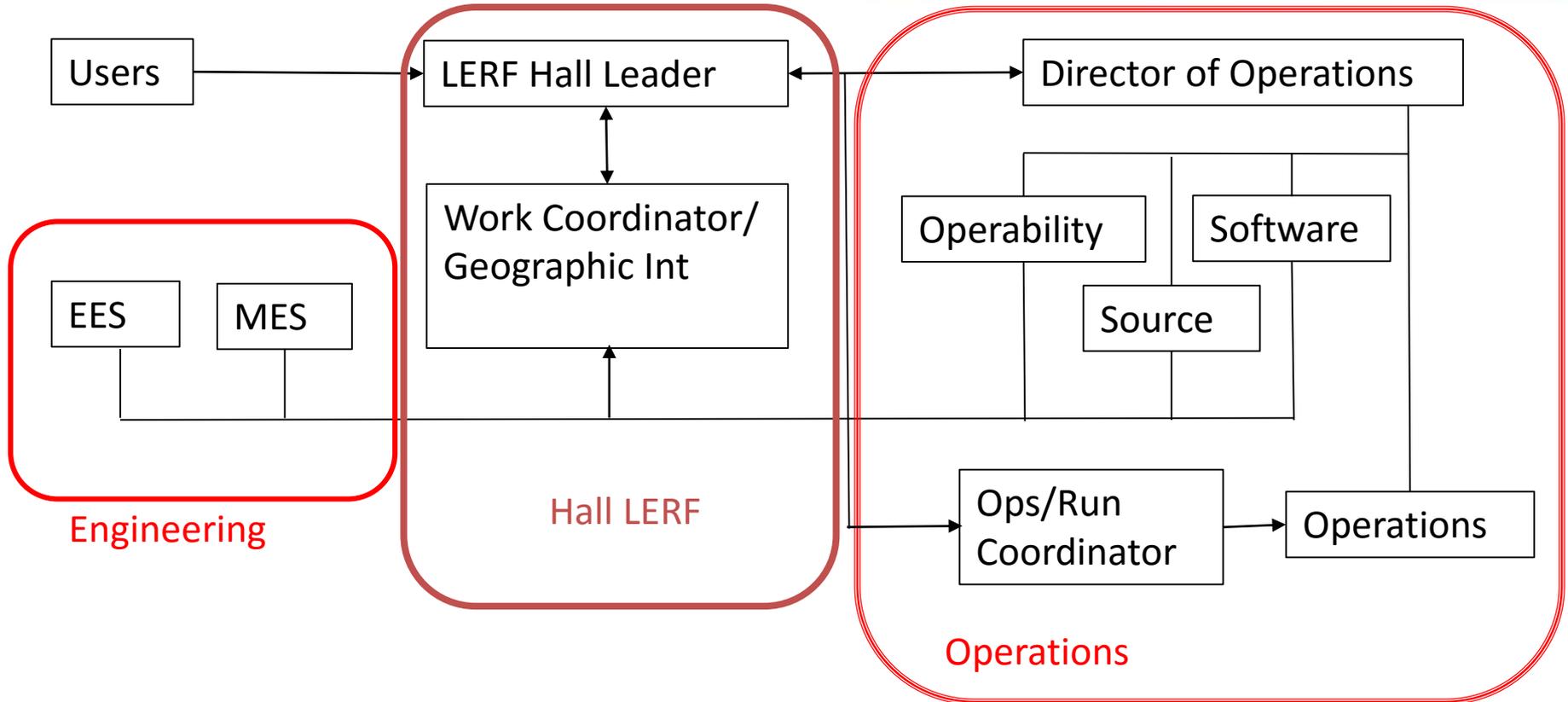
- **The Operability Manager (Suhring)** heads the Operability Group with responsibility for operability of the CEBAF accelerator and the close coordination of LERF operability activities.
- **The LERF Work Coordinator (Coleman)** responsibilities encompass the LERF facility and include coordination and scheduling of all maintenance and installation activities.

Interactions between the Crew Chief, LERF Operators, LASOs, Laser Operators, LERF APELS, etc. are specifically spelled out in the LERF Operations Directives.

Roles and Responsibilities (Safety)

- **The Division Safety Officer (Fanning)** reviews the experiment requirements and ensures the steps of the review process are followed. Schedules reviews and reviews the Experiment Safety Analysis Document.
- **The Radiation Control Department** reviews the experiment and produces a Radiation Safety Analysis Document. No measurable site boundary dose is expected, but shielding configuration control and activated materials procedures are addressed.

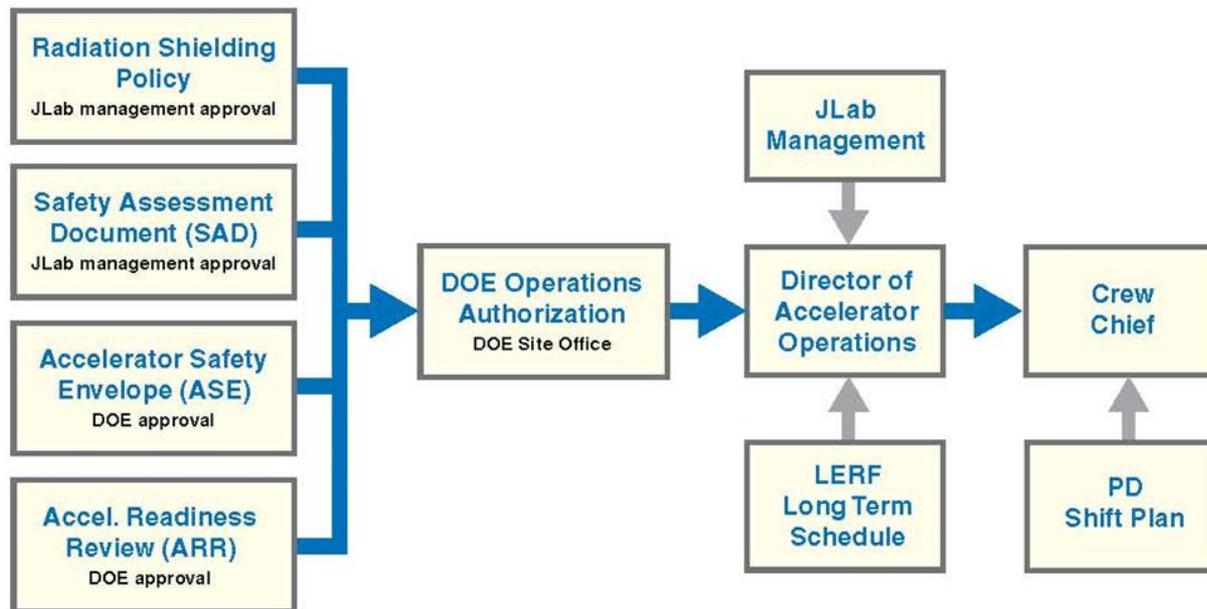
COO (Organization)



- Work Coordinator schedules all work in facility.
- Director of Operations issues beam authorization to Operations after all work and safety issues are complete
- Ops/Run Coordinator puts planned work in PD shift plan for Crew Chief

Program Authorization

- **The LERF program authorization** is conducted using credited controls to eliminate, control, or mitigate the accelerator-specific identified hazards. Credited controls are specified in the ASE (see Section 1.1.2 on page 1-4).



Beam Authorization

🔑 Beam Authorization

Permissions

Credited Controls

Control Participation

Help

Login (Auto)

Permissions

Beam Destination	Credited Controls Status	Beam Mode	CW Current Limit
500KeV Dump (IDL1D00)	👍	CW	100 uA
Inline Dump (SDL0R08)	👍	CW	100 uA
BSY Dump	👍	None	
Beam to Hall A	👍	None	
Beam to Hall B	👍	None	
Beam to Hall C	✖	None	
Beam to Hall D	👍	None	
LERF 1G Dump	✖	None	

Notes

Beam operations up to the Inline Dump and all dump lines between gun and inline dump are authorized. Authorization to all other destinations has been revoked. Special orders of Steady State Safety System Operator have expired.

Digital Signature

Authorized by Freyberger, Arne (freyberg) on 2015-05-21 11:20

- Same tool as CEBAF uses

Beam Authorization (cont.)

Beam Authorization

Permissions

Credited Controls

Control Participation

Help

Login (Auto)

Control Participation

Credited Control	Beam Destination							
	500KeV Dump (IDL1D00)	Inline Dump (SDL0R08)	BSY Dump	Beam to Hall A	Beam to Hall B	Beam to Hall C	Beam to Hall D	LERF 1G Dump
Permanent Shielding	✓	✓	✓	✓	✓	✓	✓	✓
Movable Shielding	✓	✓	✓	✓	✓	✓	✓	✓
PSS System Level Controls	✓	✓	✓	✓	✓	✓	✓	✓
PSS Critical Devices	✓	✓	✓	✓	✓	✓	✓	✓
PSS Access Controls	✓	✓	✓	✓	✓	✓	✓	✓
PSS Sweep Procedures	✓	✓	✓	✓	✓	✓	✓	✓
PSS Interlocks	✓	✓	✓	✓	✓	✓	✓	✓
PSS Multiple Safety Functions	✓	✓	✓	✓	✓	✓	✓	✓
PSS Alarm and Warning Devices	✓	✓	✓	✓	✓	✓	✓	✓
PSS ODH Monitoring and Alerts	✓							✓
Permanent Magnet (Tagger)							✓	
Beam Dump Cooling Building				✓		✓		
Locked Doors and Gates			✓	✓	✓	✓	✓	✓
Nitrogen Gas Supply Orifices	✓							✓
Moller Polarimeter Helium and Nitrogen Gas Vent to Hall C						✓		

- Same credited control as CEBAF uses

Staffing Requirements

LERF Operating Condition	LERF PSS State	Minimum Required Staffing
• Beam OFF	• <i>Restricted Access</i>	<ul style="list-style-type: none"> • Crew Chief (on call) • Accelerator-Site Security Guard (on site)
• Beam OFF	• <i>Controlled Access, Sweep Mode, Sweep Complete Mode</i>	<ul style="list-style-type: none"> • Crew Chief (on call) • LERF SSO (in MCC) • Accelerator-Site Security Guard (on site)
• Beam OFF	• <i>Power Permit</i>	<ul style="list-style-type: none"> • Crew Chief (on call) • LERF Operator or LERF Hot-Standby Operator (in MCC or LERF) • Accelerator-Site Security Guard (on site) <p>NOTE: The LERF Operator or LERF Hot-Standby Operator is not required if the Crew Chief is in the designated control room (MCC or LERF).</p>
• Beam ON (accelerator only)	• <i>Beam Permit</i>	<ul style="list-style-type: none"> • Crew Chief (in MCC, LERF, or on site) • LERF Operator (in designated control room, either MCC or LERF) • Accelerator-Site Security Guard (on site)
• Beam ON (lasing to Optical Control Room)	• <i>Beam Permit</i>	<ul style="list-style-type: none"> • Crew Chief (in MCC, LERF, or on site) • LERF Operator (in designated control room, either MCC or LERF) • FEL Laser Operator (in LERF) • Accelerator-Site Security Guard (on site)

Navigation icons: back, forward, search, etc.

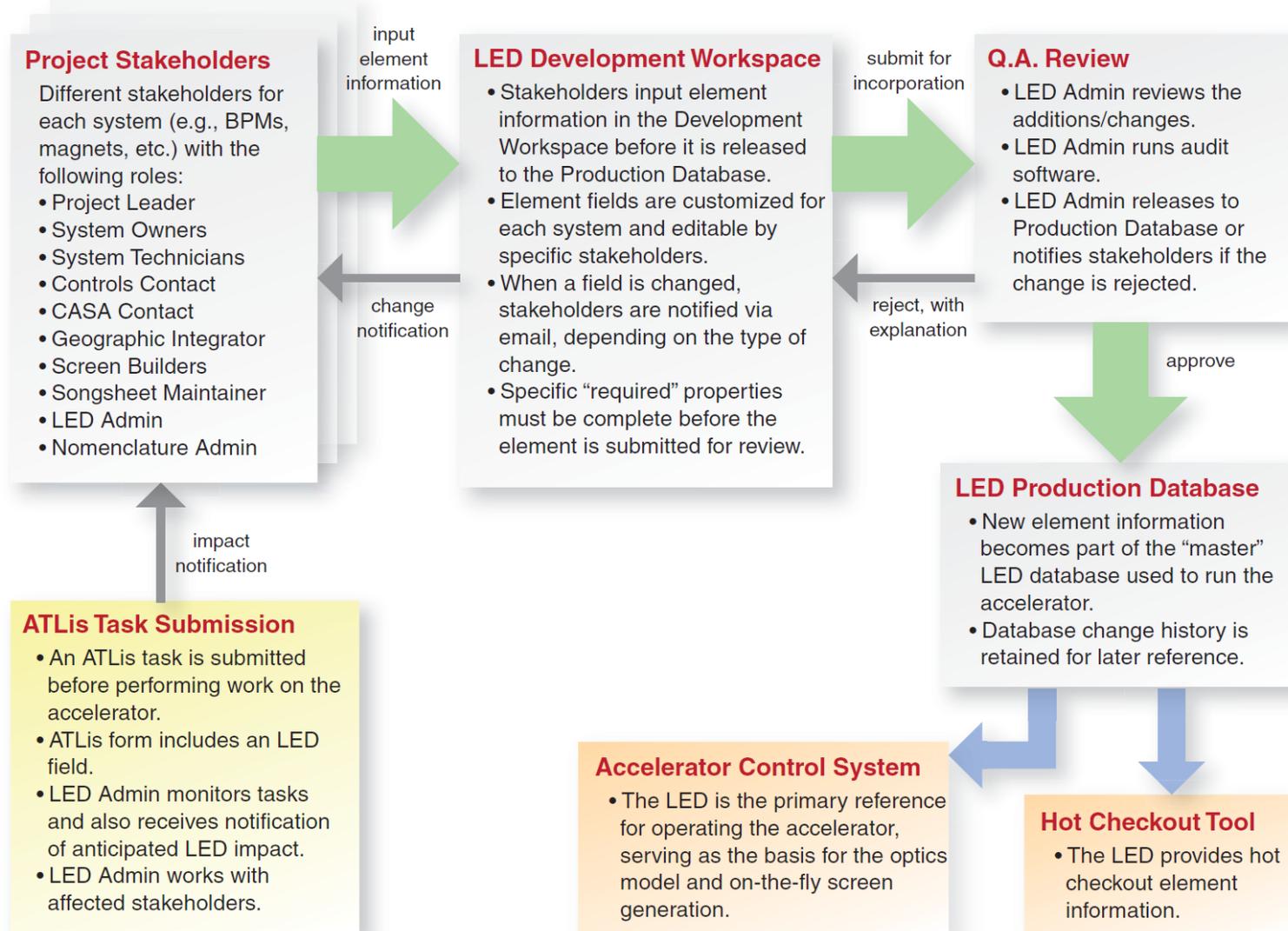
LERF Element Database (LED)

- **The LERF Element Database** is a database of machine components generated from the machine model and other component information.
- The LED is used to generate the Hot Check Out database, computer generated control screens and the OPS Problem Reports components.
- It is not available for the October commissioning run; Production is scheduled, but still verifying the songsheets match the machine and the control screens.
- Intent is to have LED fully implemented for the Darklight experiment in Spring.

LED Configuration Control

- **LERF Element Database changes come as part of accelerator upgrades or experimental proposals.**
 - **Accelerator upgrades are covered by the LOD (accelerator COO).**
 - **Experimental proposals go through the Review Process.**
 - **Both types of LED changes, are reviewed and documented prior to implementation.**
- **From a configuration management perspective, the LED is key for establishing and maintaining consistency between the physical accelerator configuration and the tools used to operate it.**

LERF Element Database (LED)



Hot Check Out Tool

- Ron will talk a lot more about this

The screenshot displays the 'Hot Checkout' tool interface. At the top left, there is a checkmark icon and the text 'Hot Checkout'. Below this, a navigation bar contains buttons for 'Readiness', 'Signoff', 'Checklists', 'Links', 'Reports', and 'Help'. In the top right corner, there is a 'Login (Auto)' button. The main content area is titled 'Readiness' and shows a tree view of components for 'Beam Destination "LERF 1G Dump" {71}'. The tree structure is as follows:

- JLAB
 - LERF
 - LERF Beam Dumps
 - LERF Beam Transport
 - LERF Control System
 - LERF Cryo
 - LERF Diagnostics
 - LERF Info Systems
 - LERF Magnets
 - LERF Operations
 - LERF RF Systems
 - LERF Cold RF
 - LERF Cryomodules
 - 1/4 CM
 - FL02
 - FL03
 - FL04
 - LERF RF Cavities
 - LERF Cavity RF
 - LERF Warm RF
 - LERF Master Oscillator
 - LERF Radiation Control
 - LERF Safety Systems
 - LERF Source
 - LERF Vacuum
 - Facilities

On the right side of the interface, there are two key legends:

Status Key

- Ready (Green checkmark)
- Checked (Yellow checkmark)
- Not Ready (Red X)
- Masked (Greyed out)
- NA Not Applicable

Node Key

- Category/System (Blue folder icon)
- Subsystem (Blue folder icon)
- Component (Blue gear icon)
- Group (Blue person icon)

Operations Training

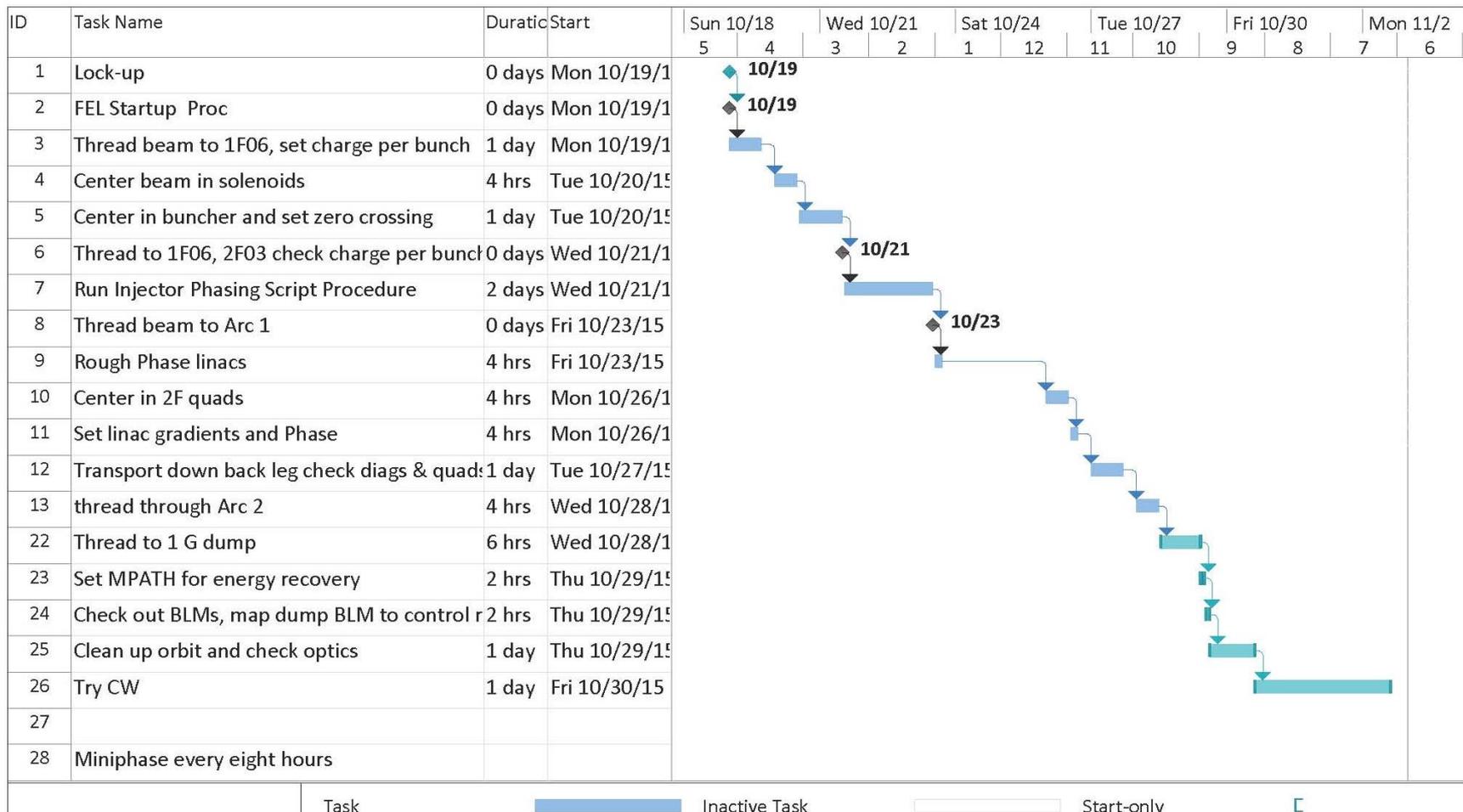
Brian will talk a lot more about this one.

LERF Operator Training

- MCC-501 Introduction to the LERF Facility
- MCC-502 LERF AOD Supplement
- MCC-503 LERF Accelerator Safety Envelope
- MCC-509 LERF Machine Protection System
- MCC-510 LERF Gun Operation
- MCC-511 Mini-phase
- MCC-512 LERF Arc 1 Setup
- MCC-513 Setup Back Leg Straights
- MCC-514 LERF Arc 2 Setup
- MCC-515 Phase/Pathlength for Recirculation and 10 MeV Dump
- MCC-516 LERF BLMs
- MCC-517 CW Beam Operations
- MCC-518 Operational Recovery and Troubleshooting
- MCC-519 LERF Optics and Diagnostics Tools
- MCC-520 LERF FSD Tree

Plan for October Run

- Steve will talk more about this



LERF Documentation Process

- Will use the same process and documentation infrastructure already in place for CEBAF.
- **The LERF Ops Liaison (Frierson)** will be the Technical Custodian for most procedures and will work directly with the **CEBAF Documentation Coordinator (Oren)**, the same model as used for CEBAF halls.
- Procedures will be accessed using a dedicated LERF Documentation web page.
- Existing FEL procedures will be vetted and annotated during the fall commissioning run.
- Plan to have a core set of procedures for machine operation available for the spring run.

Plan, Communicate, Execute and Report

- For the commissioning run:
 - We will use the two week White board to schedule on a daily basis at an 08:30 meeting.
 - The Run Coord will communicate the plan to the Crew Chief through the “Standing Orders” section of the PD shift plan.
 - The Crew Chief, LERF operator and LASOs will perform the task.
 - The Crew Chief will note the result in their shift summary as they would a Hall. Results will go in the LERFLOG.
 - If the machine breaks, the Crew Chief will direct the use of the Web on-call to arrange repairs.

Summary

- Experimental Review Process requires Safety analysis and a Conduct of Operations (COO) to be completed before operation of the LERF.
- Although several of the things in the LOD are not complete, LED, HCO database, Operation Procedures, etc., the documentation is at a level which should allow recommissioning of the machine with beam, so long as there is no intent to operate it in a production fashion.
 - Sub-system level HCO
 - MPS checklists
 - RSAD
 - PSS certification current

Controls are in place to protect personnel and the machine.