

Accelerator Operations Safety Audit of  
**NLCTA / ESB**  
**2006**

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# Scope of Audit

- Assessment of the facility's safety systems
- Assessment of compliance with SLAC safety policies and procedures
- Evaluation of safety training programs and records
- Evaluation of conduct of operations
- And more...



# Cast of Characters and Expertise

Committee Chair

Radiation

PPS and Operations

Laser

Seismic

Pressure and Vacuum Vessels

Electrical

Fire

Hoisting and Rigging

Environmental

Occupational

Industrial Hygiene

Carsten Hast

Hesham Khater

Paul Miller

Gary Bower

Scott DeBarger

Richard F. Boyce

Perry Anthony

Bob Reek

Linda Knutsen

Mike Hug

Tom Rizzi

John Shepardson

NLCTA Staff

Keith Jobe

NLCTA Safety Officer

Richard Swent

ESB Building Manager

Mark Ross

Operations Manager

Erik Colby

E-163 representative and systems laser  
safety officer

# Some Pictures





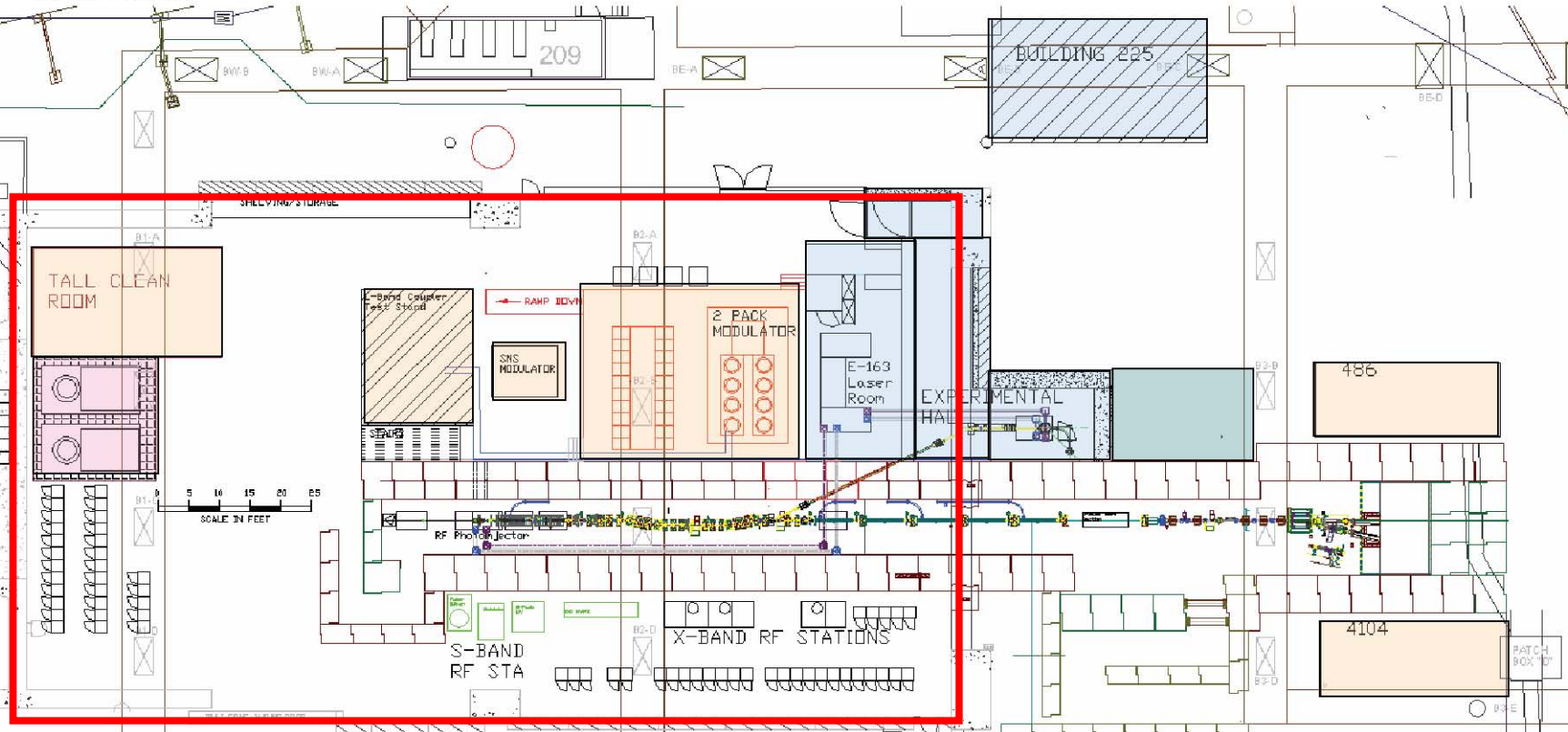






# End Station B

- ILC Present
- ILC Future
- E163 Present
- E163 Future
- Mixed Use



END STATION "B"  
BLDG. 062  
FL. EL. = 245'

NCTA CONTROL ROOM  
(BUILDING 128)

SUBSTATION  
(BLDG 504)

4105  
485

486

4104

BUILDING 225

TRAILER  
BLDG 128

483

484

VALVE R014  
VALVE R016  
CONCRETE  
VALVE R002

# ESB and NLCTA Programs

- X-Band RF Structure and Device testing in NLCTA tunnel
- 2 Pack X-Band standalone power supply, modulator, klystrons
- L-Band Stand alone power supply, modulator, klystron (future expansion to 3 systems)
- E-163 Laser Acceleration
  - S-Band klystron station for the RF gun cavity with Photocathode, X-Band Accelerators, all in NLCTA tunnel with future beam to E-163 Experiment Hall
  - LASERS in E-163 laser room; E-163 Experiment Hall, and NLCTA tunnel
- Other projects in the pipeline (more klystrons)

# ESB and NLCTA Personnel

## Qualified operators of NLCTA;

### Under ILC, Tor Raubenheimer;

- Doug McCormick
- Janice Nelson
- Toni Smith
- Keith Jobe (Trains Operators & Authorizes NLCTA programs, NLCTA Safety Officer)
- Chris Adolphsen
- Marc Ross (Trains Operators & Authorizes NLCTA programs)
- Richard Swent (Area Manager, NLCTA operation w/o Beam, L-Band operation)

### Under AARD, Robert Siemann;

- Eric Colby- not yet authorized to operate alone as Engineering-Operator-In-Charge (EOIC).
- **LASER operators for E-163** (qualified to operate Lasers in NLCTA tunnel, E-163 Laser room, and E-163 Experimental Hall);
- Bob Noble ( and 5-6 others)

# Operations

- Due to budgetary changes the operations structure with many dedicated operators has changed. Currently only 6 people operate NLCTA. Scheduling is now only running during dayshifts and for a few weeks at a time.
- At the same time E-163 is coming online and many new permits and operation guidelines, readiness reviews are needed.
- The klystron/modulator programs are ongoing (as much as budgetary constraints permit)
- Up to a few weeks ago there were daily operations meetings (7:45am) which organized the ongoing work in the complex. These have been replaced with a once per week meeting due to the cut backs in operations

## Conclusions:

- We feel that due to the present set of people, who are in charge of operations, the facility is safely run, all needed operation permits are obtained and current before operation commences, but:  
**“NLCTA operations are under pressure to carry out a diverse set of programs with the same or fewer personnel resources as in the past. Personnel, scheduling, and budget constraints are putting negative pressure on the operational oversight that NLCTA used to maintain. This will continue to be a challenge for maintaining safety at NLCTA.”**

# PPS and LSS

- ESB engineered safety systems are expanding in number.
  - NLCTA previously had only one PPS for the NLCTA tunnel,
  - now there will be two PPS systems, NLCTA tunnel and E-163 Experimental Hall
- These need to interact with one another in addition to LSS systems that overlay these in all areas
- So far these systems have been adequately reviewed and are being tested by the PPS group before they are brought into operation
- The ESB staff will need to expand their training and safety documents to include these new safety systems such as:
  - search procedures
  - interlock checklists
  - safety inspections
  - access control logging
  - management of keys
  - etc.
- They will need time to gain experience and demonstrate the effectiveness of these new systems

# Radiation

- In 2005 there was a large review of “NLCTA Safety Readiness for Return of Operation” which is still current
  - That included the tunnel with its acceleration structures (gun, cavities, etc.)
  - Klystrons in the hall
- The new E-163 experimental hall is not in operation yet
- The Safety Analysis Document (SAD) needs to be updated before E-163 operation inside of the E-163 experimental hall can start

# Lasers

- E163 Ti:Sapphire Laser
  - generates electrons from a photocathode gun in NLCTA
  - powers the laser accelerator structures that will be tested
- It's a Class IV laser
  - one oscillator (1 W)
  - two regenerative amplifiers, providing (2.25 W and 1.0 W))
  - are pumped in the green by three high-power doubled solid-state lasers
    - 5 W Class IV Millennia laser
    - 20 W Class IV Evolution laser
    - 10 W Class IV Merlin laser
    - In the next year the system will be expanded to include an Optical Parametric Amplifier that provides Class IV radiation in the 1-2 micron range with powers up to 100 mW.
- The E-163 laser system has been developed and reviewed over the past years and is operating safely
- The latest review is from November 2005
- Laser operation within the E-163 experimental hall hasn't started yet and will be reviewed as soon as they are ready

# Seismic

In the experimental complex only minor concerns were found, which will be rectified in the coming month

Three BIG Problems (and the cure is simply money...)

1. The shielding wall between B-Target room and ESB is seismic unstable
  - Currently just roped off to limit access to it
  - The space would be valuable real estate for staging new experiments and to reduce the crowdedness in some areas (clutter), which would increase the general safety for the occupants.
  - The roped off space will be needed in 2007 for installation of additional to klystron test stands
  - Approximately \$150k
2. ESB building walls
  - Many wall blacks at the North and South side need to be better secured
  - Approximately \$175k
3. NLCTA housing needs additional connections from roof blocks to wall blocks and better attachment to the ESB building floor
  - Approximately \$240k

In April 2006 the latest report by an outside engineering firm was released which noted all these findings and moreover, that's all known to the directorate since a long time and is awaiting appropriate money distribution to rectify the situation

# Pressure and Vacuum Vessels

- We attached a rather complete documentation of existing pressure and vacuum vessels.
- There is nothing special to remark and all vessels have been tested and documented as appropriate.

# Electrical

- All Post Restart Items have been addressed and only 4 items have been found during the walk through of this audit
- The general house keeping concerning electrical equipment could be improved
  - protection of extension cords on the floor
  - conversion of extension cords to permanent wiring

# Fire

- The biggest item in my opinion is that actually the fire techs didn't label fire extinguishers properly after maintenance (which happened in April 2006) and that one larger extinguisher was found rotated in such a way that one couldn't use it.
- On the other hand: The monthly walkthroughs are not conducted as thoroughly and regularly as they should be done.

# Hoisting and Rigging

## Is in good shape:

- All slings, lifting fixtures etc. are current with their inspection and ready to use.
- The 50t crane had its certification recently this year and the one item which was left to be fixed has been addressed in June
- PM is current
- They installed a legal crane out of UniStrut (200lbs capacity) in the E-163 experimental hall
- Lift plans are written and only trained operators are using cranes (even the small one in E-163 experimental hall)
- Some labeling and a crane log book were missing (for the 200lbs crane)

**Nevertheless, the 50t crane is old and repairs are rather costly due to the lack of existing spares. A rebuild to a variable frequency drive is proposed by the CEF Crane Maintenance Group in order for the crane to properly support the amount of experiments happening in the building. (\$70,000)**

# Environmental

- Oil (lots of it) in the klystrons
  - After a fire in 2005 the secondary containment system was revisited and modified
  - Now in good shape
- Storm Water
  - Parts of the water drains go to the storm drains and have been identified as “unauthorized discharges” since the water could be contaminated by the research activities.
  - There is a DOE funded project underway which will remedy the situation by January 2007
  - Everybody responsible (hall crew, onsite fire department) have been made aware of that situation

# Occupational

- In general well managed facility where a conscious effort was made to ensure that safety on all levels is taken seriously
  - Special note are improvements of fall protection issues on the 50t crane and on the roof of NLCTA
- There were a few non critical items of general nature which will be addressed in **the near future** (unlabeled oil bucket, unlabeled storage tanks, cleaning equipment in front of an electrical panel, etc.)

# Industrial Hygiene

- Beryllium in the copper/beryllium fingers in the gun modulator caused beryllium contamination due to sparking
  - Has been cleaned up and warning signs have been posted (and some more need to be posted)
  - ES&H and ESB are in contact to set up a regular inspection schedule to monitor the situation
- Asbestos warning has been posted for the ESB roof, since it hasn't been surveyed, as a precaution in case of roof work in the future

# Summary

- As a whole the ESB/NLCTA facility is well managed and in a safe state to occupy and operate.
- The complex went through extensive scrutiny during the NLCTA Restart Validation early 2005. Most items noted then have been mitigated.
- The NLCTA staff is knowledgeable about SLAC rules and safety procedures, which are fully implemented in the facility.
- Of concern are the wealth of programs and small projects, which create an ever-changing environment in the buildings, which poses occupational hazards to the people working there or entering the building. Continued safety oversight, internal and via reviews and involvement of the citizens committees is important
- Vigilance to good housekeeping practice is of the essence and in this field the facility has improved.
- This audit was supported very well by ESB/NLCTA personnel