

MAINTENANCE AT JEFFERSON LAB

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Abstract

Maintenance at Jefferson Lab is largely driven by the experiment schedule: two or three major maintenance and/or upgrade periods are generally scheduled each year. Unscheduled maintenance involves critical repairs that cannot be deferred to a Scheduled Accelerator Down (SAD). Scheduled maintenance includes deferred and preventative maintenance as well as planned modification and upgrades to the accelerator.

1 INTRODUCTION

Maintenance refers to work performed on the hardware or software of the Jefferson Lab accelerators to maintain and improve availability. Examples of accelerator maintenance activities include:

- Making repairs after a failure
- Periodic replacement of high-wear parts
- Fixing inspection deficiencies
- Post repair testing
- Calibration
- Alignment
- Equipment and software upgrades

2 RESPONSIBILITIES

2.1 Program Deputy

Program Deputies are Jefferson Lab staff who are appointed to serve for two-week periods. During his or her period of service, the Program Deputy is responsible for the accelerator program for all shifts. The Program Deputy communicates with all shifts on a daily basis, and additionally:

- Conducts the Daily Summary Meeting each workday morning where the Crew Chief Shift Summaries for the previous 24 hours (or weekend) are presented, develops any necessary short-term schedule modifications, and assures that the appropriate laboratory resources are utilized as necessary to keep the program on schedule.
- Conducts the Weekly Accelerator Planning Meeting to define the short-term operating schedule for the upcoming two-week period.

2.2 Operability Manager

The Operability Manager heads the Operability Group and is responsible for maintenance oversight of the accelerator. The following are the general responsibilities of this group:

- Identify immediate maintenance needs based on the experiences of the twenty-four hours prior to the Daily Summary (8:00 a.m.) Meeting.

- Follow up on action items initiated at the Daily Summary Meeting.
- Assist in planning and scheduling maintenance days, scheduled long-term off times, and accelerator hot checkout and start-up activities.
- Conduct the weekly Maintenance Meeting, which is used to plan, schedule, and coordinate upcoming maintenance and installation activities.
- Participate in the distribution, collection, and review of system checklists for accelerator readiness after long-term off times.
- Apprise the Program Deputy of proposed maintenance tasks and the potential impact on machine operability.
- Identify major causes of downtime, recommend methods for improvement, review project descriptions for upgrades that will improve accelerator availability, and track those projects to conclusion.
- Collect, distribute, track repair escalation reports.
- Oversee safety, workmanship, and documentation of maintenance activities in conjunction with the Accelerator Site Safety Warden.
- Review and initial the weekly Walk-Through and track any noted discrepancies to closure.

2.3 Accelerator Operators

Accelerator operators are the first responders to any malfunction impacting beam delivery. They will identify, document, and initiate corrective action. They may perform repair work as specified by approved troubleshooting procedures and play an important role in identifying when specific repair work is required, e.g. Daily Activity Log, Operations Problem Reports (OPS-PRs), Crew Chief Shift Logs, and Walk-Through Checklists.

2.4 Lab Support Groups

Maintenance activities are supported by the Jefferson Lab system support groups, who perform the maintenance tasks:

- Electrical Engineering Support (EES)
(Repair Response)
- Accelerator Engineering Department
(Cryogenics, Installation, Magnets, Power Supplies, High Power RF)
- Center for Advanced Study of Accelerators
(Diagnostics, Beam Dynamics)
- Institute for Superconducting RF
(Cryomodules, Low Level RF)
- Facilities Management
(Water, Power)

- Polarized Gun Group
(Electron Source Redundancy)
- Radiation Control Group
(Radiation Control)
- Safety Systems Group
(Personnel Safety/Machine Protection)
- Software Group
(Applications, Alarms, Archivers)
- Vacuum Group
(Beam Transport and SRF Vacuum)

3 MAINTENANCE

Maintenance tasks can be divided into three categories:

- Immediate
- Scheduled
- Standby

3.1 Immediate Maintenance

Immediate maintenance consists of repairs to correct conditions that impede the scheduled program or are identified as safety hazards.

Immediate maintenance repairs are requested by the Crew Chief at the time of the failure. Downtime entries are made in the appropriate computer-based logs (e.g. *Daily Activity Log*) and include as much of the following information as possible:

- When the problem was first recognized
- A thorough description of the problem
- When the problem was resolved
- When beam was re-established

3.1.1 Repairs

Repairs are performed by on-duty maintenance personnel whenever possible, but other staff, including EH&S and Radiation Control Group staff, may be called in as needed to evaluate work requirements, provide support, or expedite resolution of the problem.

When a problem occurs, standard practice is for the Crew Chief to immediately evaluate the situation and take appropriate action using available resources, including on-call help. Before requesting on-call help the Crew Chief will use his/her best judgment as to whether the problem can be corrected by the control room staff using available system knowledge and troubleshooting guides. If a problem persists longer than two hours, the repair escalation process is initiated.

The following guidelines are used whenever an accelerator repair is necessary:

- The Crew Chief notifies the Program Deputy immediately if interruption to the program is anticipated to be longer than one hour.
- The Crew Chief determines when the problem cannot be corrected by the control room staff and on-call help is required. The Crew Chief then contacts the appropriate on-call group according to the information in the on-line call-in lists.
- The Crew Chief generates a *Downtime Log* and OPS-PR entry.

- If the problem is not solved two hours after *the original program interruption*, the Crew Chief initiates the repair escalation process.

3.1.2 Repair Escalation

The Crew Chief can call for outside assistance any time there is a problem with the accelerator. However, when a problem cannot be solved by control room staff, on-site maintenance personnel, and/or on-call help within two hours of the original program interruption, the repair escalation process is initiated by the Crew Chief.

NOTE: The repair escalation process serves as a mechanism to identify recurring problems, educate and draw on the knowledge of the entire Jefferson Lab staff and, ultimately, improve availability.

The following guidelines are used in the event of a repair escalation:

- Two hours after *the original program interruption*, the Crew Chief will notify the following designated escalation contacts:
 - The responsible maintenance Group Leader or designee
 - The Systems Integrator
 - The Program Deputy
(This is to occur even if on-call help has had only a portion of the two hours to correct the problem. The Crew Chief must record the details of the repair escalation in the *Daily Activity Log*.)
- The Crew Chief notifies the contacts that there is a problem, describes the problem, reports the present repair work status, and may suggest a course of action.
- The escalation contacts can decide to provide additional resources, undertake an alternate course of action, or continue on the present course. In order to optimize its response and to make the best use of available personnel, a maintenance group can develop its own internal escalation policy to assure that the appropriate people are notified in a timely manner.
- Four hours after *the original program interruption*, the Crew Chief will notify the appropriate Department Head (or his/her Deputy), the Operability Manager, and the Program Deputy of the problem and the present repair work status. The Crew Chief must record the details of these calls in the *Daily Activity Log*.
- The Crew Chief notifies the Operability Manager immediately if interruption to the program is anticipated to be longer than four hours.

3.1.2.1 Repair Escalation Report

The Repair Escalation Report (RER) is a written report that summarizes escalated repair incidents. The Operability Manager can call for an RER for any repair activity that exceeds four hours.

3.2 Scheduled Maintenance

Scheduled maintenance consists of maintenance activities that are planned in advance and approved by the Operability Manager.

As each maintenance task is completed, the work is documented in the *Daily Activity Log*, and a problem report solution entered in the on-line problem reporting system (*OPS-PR*) when appropriate.

Two or three major Scheduled Maintenance Downtimes (*SAD's*) are scheduled each year according to the accumulated maintenance and upgrade requirements of the accelerator and the experimental halls.

3.3 Standby Maintenance

The Operability Manager compiles a list of pending maintenance tasks. Two subsets of this list include planned and preventative maintenance tasks that could be performed opportunistically in the event of an unscheduled down, and deferred repairs for items not impeding the scheduled program.

The Operability Manager, in consultation with the Program Deputy, uses the Standby Maintenance Task List to initiate work through the Crew Chief when there is an unscheduled accelerator down. The Program Deputy can, at any time, curtail or cancel tasks that may threaten the scheduled program.

Tasks performed during an unscheduled down period include: correction of the problems(s) that caused the program interruption, and scheduled maintenance that can be performed ahead of schedule.

Currently, 10 to 12 hours per week are reserved for deferred maintenance. If there is not sufficient cause to

use these hours for maintenance, they are scheduled and utilized for Beam Studies (BS) for the development of the accelerator.

4 WORK PLANNING PROCESS

Operability Manager maintains a list of pending maintenance and upgrade tasks. The primary sources for these tasks are:

- OPS-PRs
- Crew Chief Shift Logs
- Daily 0800 Summary Meetings
- Weekly Maintenance Scheduling Meetings
- Preventative Maintenance Procedures
- Direct requests to the Operability Manager

The Operability Manager is the *gatekeeper* for all work performed on the accelerator. As such he evaluates each task request for criticality, impact to accelerator systems, and schedule.

Task requests may be approved, disapproved, returned for further review, scheduled, or placed on the Standby Maintenance List.

The present work request system is presently being defined, refined and will soon be implemented via an on-line Accelerator Work Request system.

6 REFERENCES

- [1] Accelerator Operations Directives, Thomas Jefferson National Accelerator Facility.