

Fermilab Operations Department Training Program

B. Mau, B. Worthel

Fermi National Accelerator Laboratory

Abstract:

The Operations Department at Fermilab have over the years developed a formal training program that involves testing, formal sign-offs, and control room and in-the-field training. This was done due to the vast size of the laboratory and the length of time it takes to train operators. We have 13 miles of tunnels and 66,000 controllable parameters. The Fermilab operators operate all eight accelerators and storage rings from one central control room. Training takes around two years. In recent years the requirements by the Department of Energy have also mandated the ability to demonstrate a training program. This paper will discuss the challenges involved in keeping the training program current, updating it as new accelerators come on line, and ensuring that regulatory agencies don't drive the training program away from our own training needs.

INTRODUCTION

Why do we need a training program? Here are a few reasons.

- 66,000 controllable devices
- 150,000 read backs
- Five crews that consist of five operators and one Crew Chief
- Eight accelerators and storage rings
- One Main Control Room for operations
- Operators are the first responders for problems. There are no technicians on shift.

We need a constant flow of operators in our training program. Here are some basic statistics about our existing operators:

- Length of service from 20 days to 37 years
- An operator's average length of time in the group is 5 years
- We lose an average of 5 operators a year
- Every 5 years we have a new group
- Education background: most operators have a BS in Physics, but we have a few technicians, an engineer, an anthropology major, a history major, and others
- Operators work a 5 week rotating shift
- The shift has 8-hour week days and 12-hour weekends

Every five years we nearly have a new group of operators. Why do operators leave? Here are some of their reasons.

- Because of shift work
- Because they get married and shift work puts a stress on family life
- Because the operator gets pregnant
- Because of their children
- Because they go back to school
- Because other groups covet them and their skills and lure them away
- Because their spouse gets a better job
- Because they get tired of dealing with the bureaucracy
- Because they believe they can make more money else where
- Because they realize the job is just not right for them

Reasons for a Training Program

There are several reasons why we had to develop a training program. In the early days, due to the complexities of the machines and their control systems, some operators only learned how to tune one accelerator. Some of the experienced operators would only train people that they liked. Some of the machine experts didn't want to share any more of their knowledge than they had to.

In the early days of Fermilab it was up to the new operator to train him or her self. Out of this method of self-directed training came our structured process of On-The-Job Training (OJT). This structure ensured that all the operators received similar training that covered all the basics of accelerator operations. It also provided the proof of training documentation that the United States Department of Energy (DOE) wanted to see.

If you are losing experienced operators every five years you need a system that trains the new operators using the experienced operators.

Why We Chose this Type of Training

A new operator cannot learn how to operate the Fermi accelerators by reading a book. The best and really the only way to learn is by doing the job. The OJT system of training is composed of modules that turn new operators into contributing members of the department within the first couple of weeks. It is a self-paced, but structured system.

The training begins with an Introductory module that gives the new operators an overview of all the accelerators, the Operations and Accelerator Departments, their responsibilities as an operator, theory, terminology, and, in the process of going through this first module, it explains to the new operator how the OJT method of training works.

After the operator completes all of the training modules and passes all the tests that go with them, he or she gets promoted and becomes an "Operator 2."

On the Job Training

The OJT module directs the new operator through its subjects with checkpoints that requires an experienced operator 2, a Crew Chief, an Operations Specialist, or an expert to explain or train the operator on some aspect of the accelerator and then attests with a sign-off that the operator understood the training. It is up to the operator to make sure that she or he does understand the training.

The new operator must complete the "Introductory OJT" before receiving the other OJTs: the Proton Source, the Main Injector, Recycler, Tevatron, the Antiproton Source, Safety, and Controls.

Although we don't expect an operator to learn how to operate the accelerators from a book, we do have training books, called Rookie Books, which we expect operators to use as references: Accelerator Concepts, Linac, Booster, Main Injector, Recycler, Antiproton Source, Tevatron, and Swtichyard/External Beamlines. There are also many other reference books.

After the new operator completes the Intro OJT, he or she gets a series of Specialist walk arounds. Each Specialist explains what the new operator needs to know about one of the following: the Proton Source, the Main Injector, Recycler, Tevatron, the Antiproton Source, Safety, and Controls.

Each member of the operator's first crew act as mentors and guides, leading the operator through the huge amount of information needed to operate the complex. It is in the crew's own interest to get the new operator doing things as soon as possible, but always with an experienced operator around.

Problems with the OJT Program

We need to hire people who are motivated to complete the training. Operators cannot learn to operate the accelerators by reading books. Operators might only learn what we have required them to learn and never delve deeper into the information. There is a huge amount of information contained in the OJTs and in the beginning it can seem insurmountable to a new operator. Some experts want to continue to add more complexity than necessary to our training.

Keeping the Training Up To Date

Experienced operators and Crew Chiefs helped to create the original OJT Training. Since then the program has had to expand and be refined by need, experience, and operator input.

The training program has a full time administrator who tracks, monitors, and documents the operators in training. He, along with a Training Committee that consists of The Department Head, Deputy Department Head, two Crew chiefs, and four experienced operators, keeps the OJT training modules, tests, and Rookie Books as up-to-date as possible. They do this with assigned responsibilities, regular meetings, reports, and reviews that include the Operations Specialists.

All changes to the OJTs, tests, and Rookie Books are documented. The Department or Deputy Department head reviews all operator OJTs and tests. The operators keep a copy of the OJT and turns in the original, which is filed. Completed test are also filed. Dates that chart the new operator's training are all kept. The training committee examines the test results, comparing missed questions with past test results to determine trends, improve training, create new questions, and to eliminate misleading or inappropriate questions.

Summary

Our Operations group has a high rate of turn over. The average operator only last about five years. Fermilab has a large accelerator complex and experienced operators are expected to have the knowledge to run any and all parts of it. Our training program is the base for an overall understanding of our accelerators. Shift work is a difficult lifestyle to maintain. Part of our training includes instructions on how to adapt and cope with shift work.

The OJT offers a method of teaching the operators as quickly as possible so we can get as much use out of them as possible for as long as they stay. Some of that use includes helping to train the next batch of operators.

The OJT itself begins to document our training program for DOE.

Acknowledgements

The paper is based on information from Bob Mau, on information taken from the Fermilab Operations Introductory OJT, and from previously published work by Dan Johnson and Bruce Worthel.

Fermilab is managed by the Fermi Research Alliance under contract for the United States Department of Energy.