Q&A with an Industry Leader

Uptime: As the reliability manager, what are your primary areas of responsibility at NIF?

Nick Jize: I am the facility and operations manager at the NIF. In my role, I ensure all conventional facility equipment and utilities are ready for laser shot operations on a 24/7 basis. NIF uses 192 of the world's most powerful lasers to focus energy on a target the size of a peppercorn in an effort to ignite a fusion reaction.

This facility is a very complex machine with interdependencies between virtually every system. As an example, if the HVAC system temperature varies by more than 0.25 degrees F within a span of 30 minutes, it could cause misalignment of the laser with significant operational delays. In a facility the size of three football fields, holding this temperature specification is one of our daily marvels.

Uptime: With the high tech equipment utilized at the NIF, what type of preventive/predictive practices do you have in place to ensure the equipment all performs reliably?

Nick Jize: We are using vibration analysis to assess the health of our critical pumps and motors in order to mitigate failures and plan for repairs with as much notice as possible. We also use our vibration analyzer to perform precision alignment and balancing whenever we replace motors or fans. We also use oil analysis to monitor the health of our pumps and as a way to confirm any diagnoses from our vibration analysis data.

We use ultrasonic lubrication for all our rotating equipment. This technology alone has doubled the mean time between failures of our bearings. In addition, we plan on using our ultrasonic device for electrical cabinet inspections.

Uptime: What types of root cause analysis and/or reliability centered maintenance (RCM) analysis do you utilize?

Nick Jize: We use classical RCM for our 80/20 systems; that is any system that is causing the majority of recorded downtime or requiring a majority of our resources to maintain. For the other 20/80 systems, we use either an abbreviated classical approach of experience centered maintenance (ECM).

Our field technicians are a critical part of the analysis process. We have found that their input is a substantial part of our decision process. In addition, it helps them understand the required functions of each asset, the consequences of the failure modes and why they are performing the preventive maintenance that results from the analysis.

Uptime: With NIF being a secure site, do you have problems planning and scheduling maintenance/reliability work and meeting the security requirements?

Nick Jize: Security issues rarely create any scheduling problems for us. Our biggest planning and scheduling challenges are access to the facility between laser shot campaigns. We usually get around this by planning all our work a week ahead of time and coordinating with shot directors to understand where we can fit in our work. In addition, the facility has two days a week that are dedicated to maintenance.
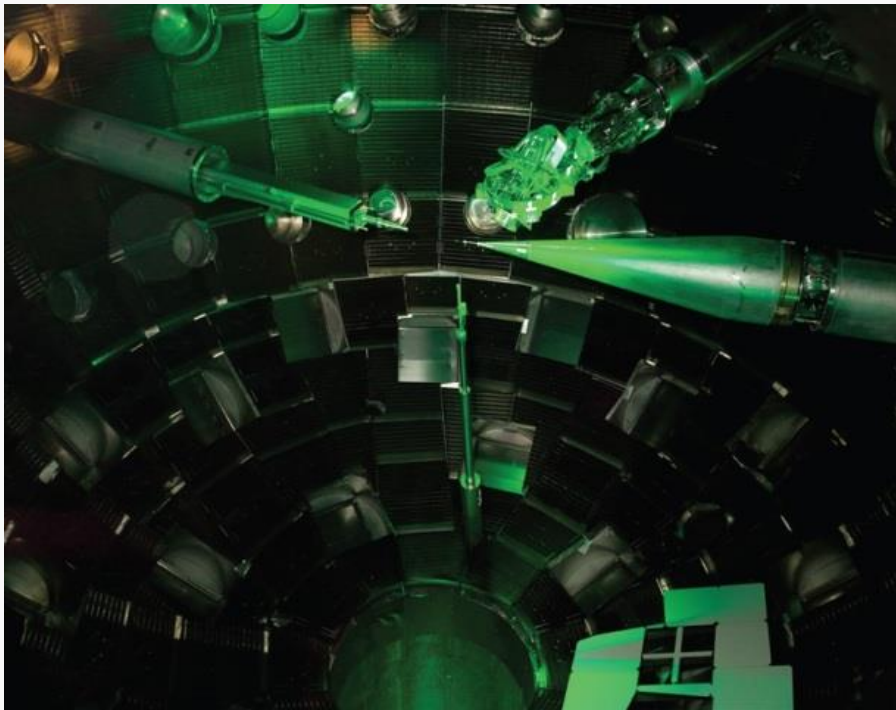
Inside of NIF Target Chamber, showing target positioner and several alignment diagnostics

NIF Target Chamber View Port

Uptime: With the high tech equipment that you have at the NIF, do you have problems recruiting properly skilled maintenance personnel?

Nick Jize: Although the project is high tech, our conventional facilities, equipment and maintenance needs are fairly standard. The difficulty arises with the interdependencies of all the systems and the exacting specifications that we have to meet. It takes over a year for newly hired individuals to understand the impacts of system shutdowns and failures on the overall facility.

On the other hand, our beam line equipment is not conventional and very unique. Precision maintenance and cleanliness are of critical importance. Laser optics have to be swapped out frequently due to the damage created by the high powered laser. These operations require highly trained technicians.

Exterior of the National Ignition Facility at Lawrence Livermore National Laboratory

NIF Laser Bay 1, showing a portion of the 192 laser tubes heading to the target chamber

Uptime: Do you have an internal training program for the maintenance technicians? If so, could you give us an idea of what some of the training involves?

Nick Jize: We have a maintenance "qualification card" that outlines all the skills needed for the various tasks being performed. Technicians need to read and understand a system level maintenance plan before they are qualified to work on a system and they also must be trained by other qualified technicians. Technicians must then demonstrate their proficiency and knowledge to the engineering subject matter expert (SME) responsible for the system.

Uptime: What performance metrics do you use to evaluate your maintenance program?

Nick Jize: Our most important metric is the preventive maintenance (PM) to reactive maintenance (RM) ratio. We try to maintain a ratio of four or better and use that to adjust where our resources are spent. Initially, we had to do significant training so our engineers understood the difference between corrective (planned) maintenance and reactive (unplanned) maintenance.

On time PM performance is another very important metric we have been able to use to justify to management when we need additional resources. We define on time as the work being completed within 10 percent of the periodicity of the PM. For example, a 30 day PM has to be completed within 33 days of the previous PM and a 180 day PM within 198 days, and so on.

Uptime: What is the next development for your maintenance program?

Nick Jize: We are currently working on going mobile with our maintenance procedures. We believe this will allow our technicians to directly enter data into our computerized maintenance management system (CMMS) and alert SMEs about any issues they see in the field in almost real time.