Mechanical Systems Performance and Plans

M. Baumgartner

Mechanical Systems and Operations Group Leader

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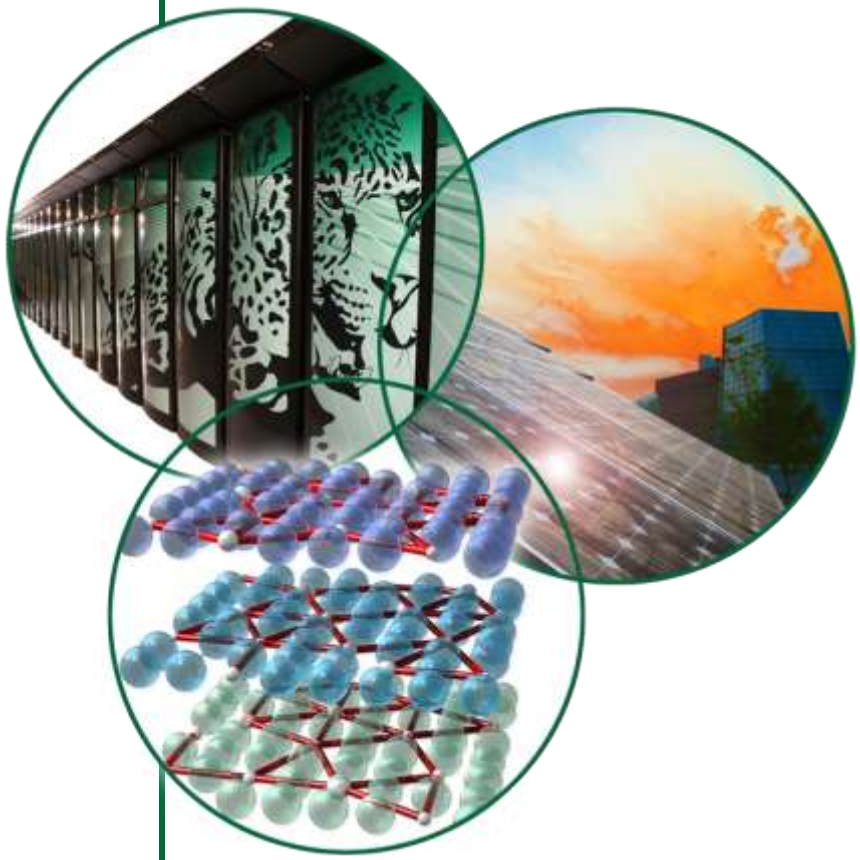

U.S. DEPARTMENT OF ENERGY

OAK RIDGE NATIONAL LABORATORY
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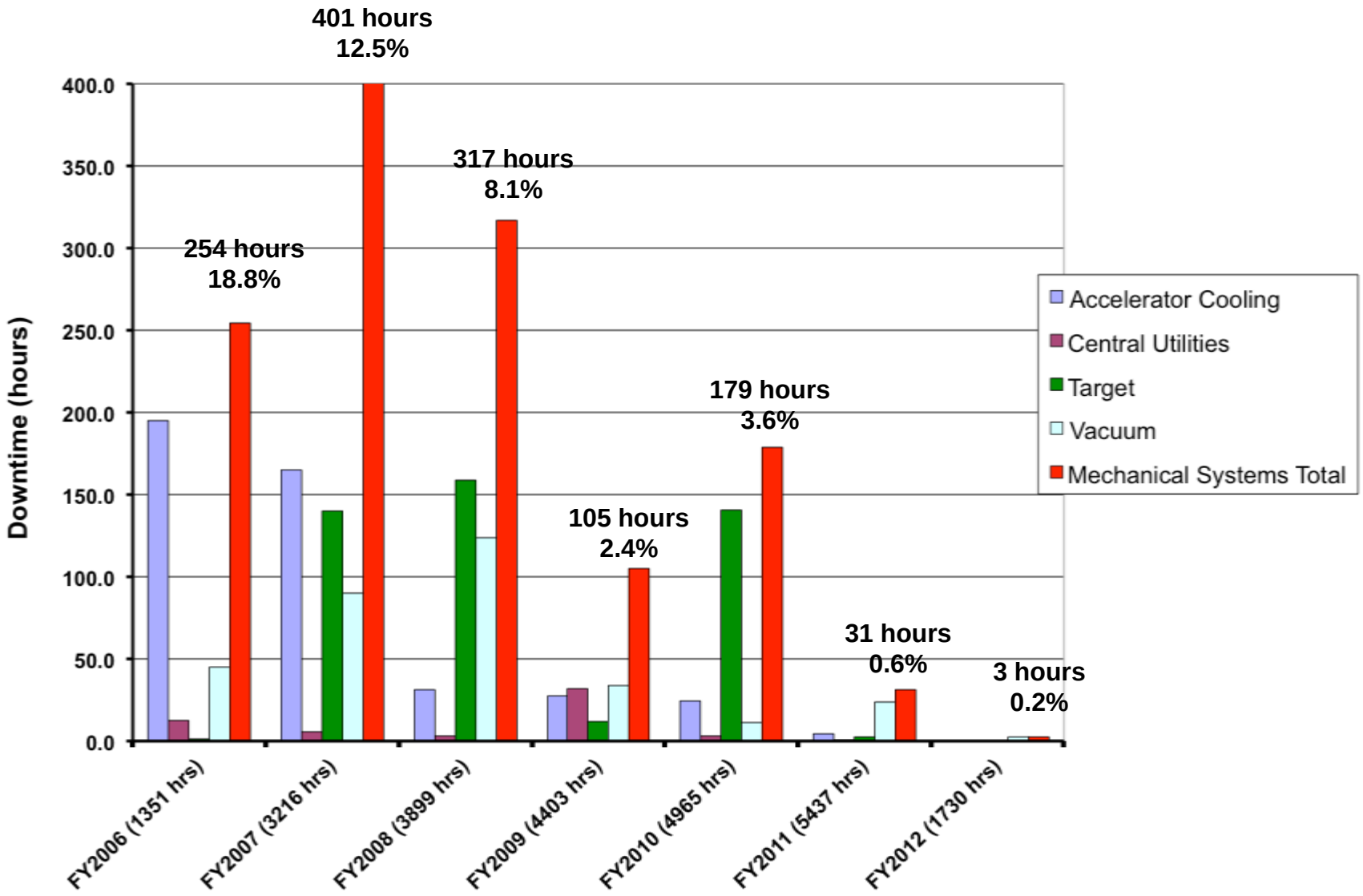
Overview of Topics

- Mechanical Systems Downtime—No Fundamental Technical Issues (except for target module cavitation damage)
- Target System Performance Update, Corrective Actions, and Successes
- Remote Handling Successes and Challenges
- Accelerator Cooling Initiative

Mechanical Systems Downtime



Cryogenic Moderator System (CMS) Oil Contamination Source of FY10 Downtime (140.5 hours)

- Helium Compressor bulk oil separator failed and overloaded downstream oil removal skid

Oil Removal Skid

Bulk Oil Separator

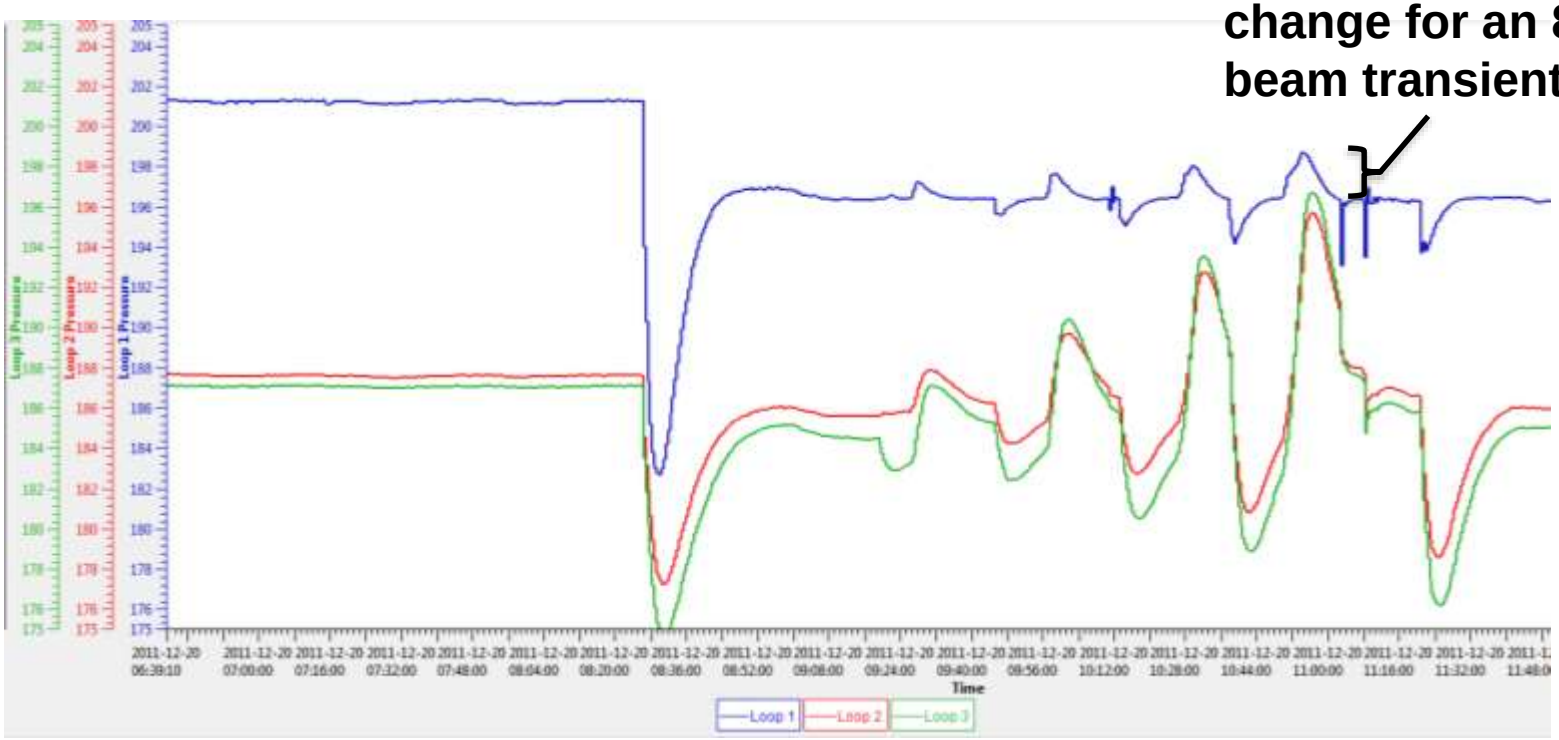
FY10 CMS Corrective Action Eliminated Oil Problem

- 140.5 hours in FY10 to zero hours since
- Cleaned system with heated dry nitrogen
- Replaced the skid coalescer elements, charcoal, and final filter
- Inspected and returned the bulk oil separator elements to original design
- Switched cooling on the oil cooler and after cooler from tower water to chill water
- Switched to another PAO-based oil known to have far less light hydrocarbons and purified oil before use.
- Installed calibrated Linde gas monitoring system & now monitor helium impurities in real time

Successful CMS Pressure Mode of Operation

- Previously reported in 2010 that the mode had been validated on Loop 3--validated on Loop 1 last month
- Provides more rapid transient response and avoids dependence on more vulnerable diodes

2.2 psia vs. ~15 psia change for an 800 kW beam transient



Target Water System Resin Replacement a Reality

- Two resin beds replaced last year, 4 scheduled for 2012

IX Column	In-Service Date	Date < 1.5 Mohm-cm	Removed From Service Date	Months Service
IX-9350A			12/2005	0
IX-2560A	4/1/2006		6/8/2009	38
IX-1550A	4/1/2006		9/2/2009	41
IX-2020A	4/1/2006		8/16/2010	52
IX-1040A	4/1/2006		2/7/2011	58
IX-2560B	6/8/2009	3/2/2011	7/8/2011	21
IX-2560A-R1	7/27/2011			
IX-1550B	9/2/2009	11/17/2011		26

Remote Handling Successes and Challenges

- Successes
  - 1st Core Vessel Insert (CVI) replacement
  - 1st "mid-cycle" target replacement
  - Creative support of Target #3 Post-Irradiation Examination (PIE)
- Challenges
  - Remote handling resources versus maintenance outage durations (target lifetime driven)
  - Remote handling space requirements vs. PIE needs vs. TN-RAM cask availability; future mixed waste disposal
  - Service Bay servo-manipulator use vs. unknown component useful lifetime vs. recent Telerob support notification vs. remote handling workload still ramping up

Remote Handling Successes

- 1st Core Vessel Insert (CVI) Replacement

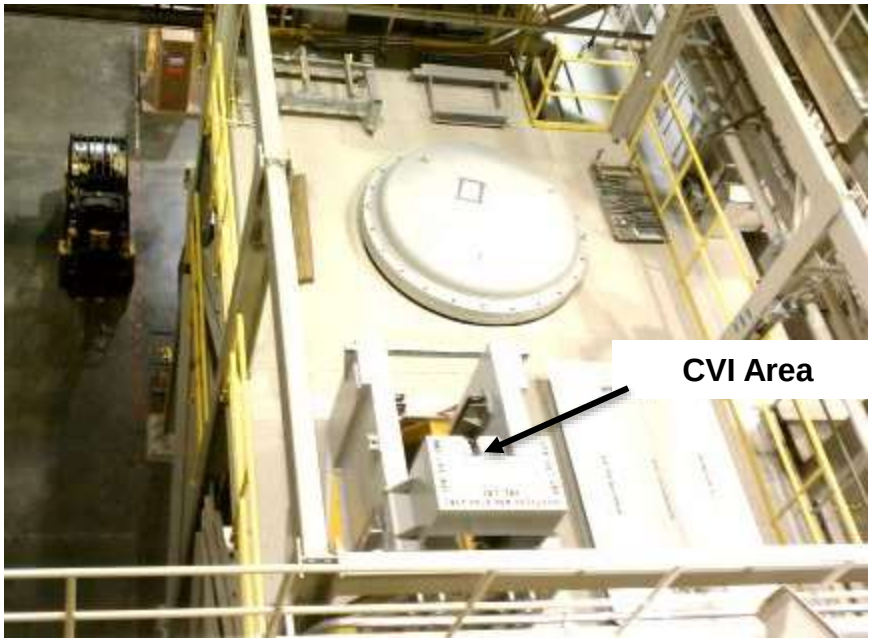
Installation of CVI Robot

Installation of CVI Plug Cask

New BL16 CVI Loaded into Robot

Remote Handling CVI Keys to Success

- Team member expertise and creative problem solving skills
- Excellent Conduct of Operations
- Excellent team communication
- Completion and use of the Target Building mockup test stand

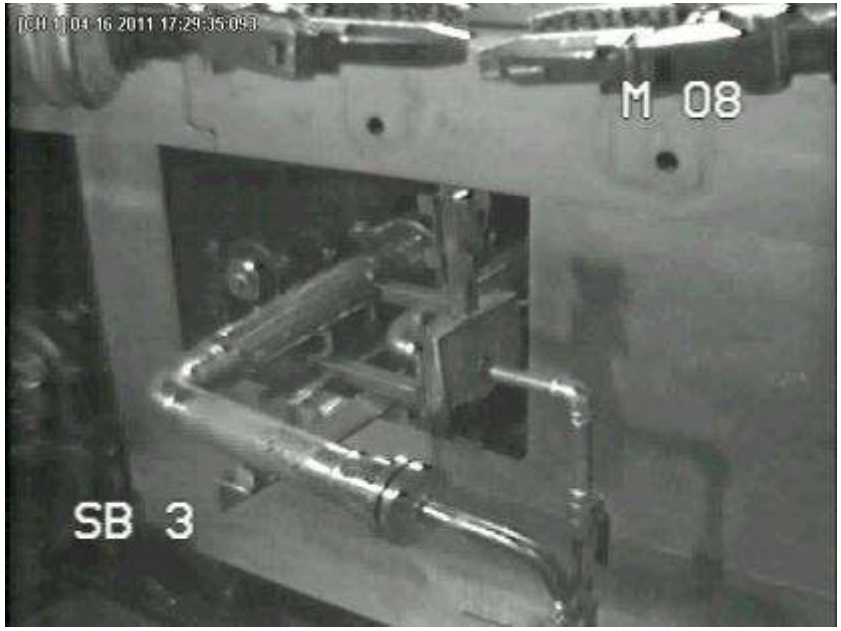


Mockup Test Stand

CVI Robot Lowered to the Base of the mockup test stand

Remote Handling Successes—Target #3 replacement

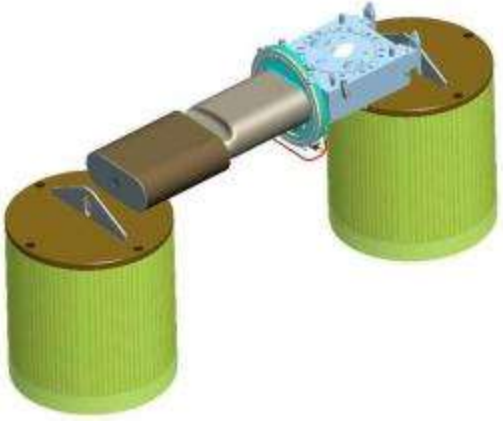
- Mid-cycle replacement
  - Target out of commission: 4/3/11
  - New target in beam permit: 4/19/11
- Post-installation water leak created a challenge

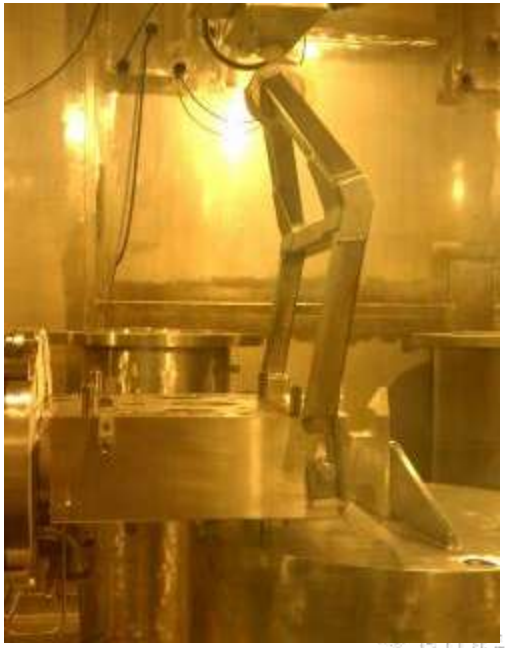


- In 2 days (over a weekend):
- Concept to test water circuit with target carriage extracted developed, fabricated, installed, used, and problem fixed

Remote Handling Successes—Creative Support of Target #3 PIE

- The need: Inspect the inside of target #3 using a boroscope before nose cutting potentially damaged the leak site
- When vertically suspended (only way spent targets could be handled), mercury puddles obscure the inside of the target nose.
- The solution:
  - Use storage cask lids as “saw-horses”
  - Design a fixture to restrain target nose movement as the target module is rotated through the vertical to the horizontal (and back again)



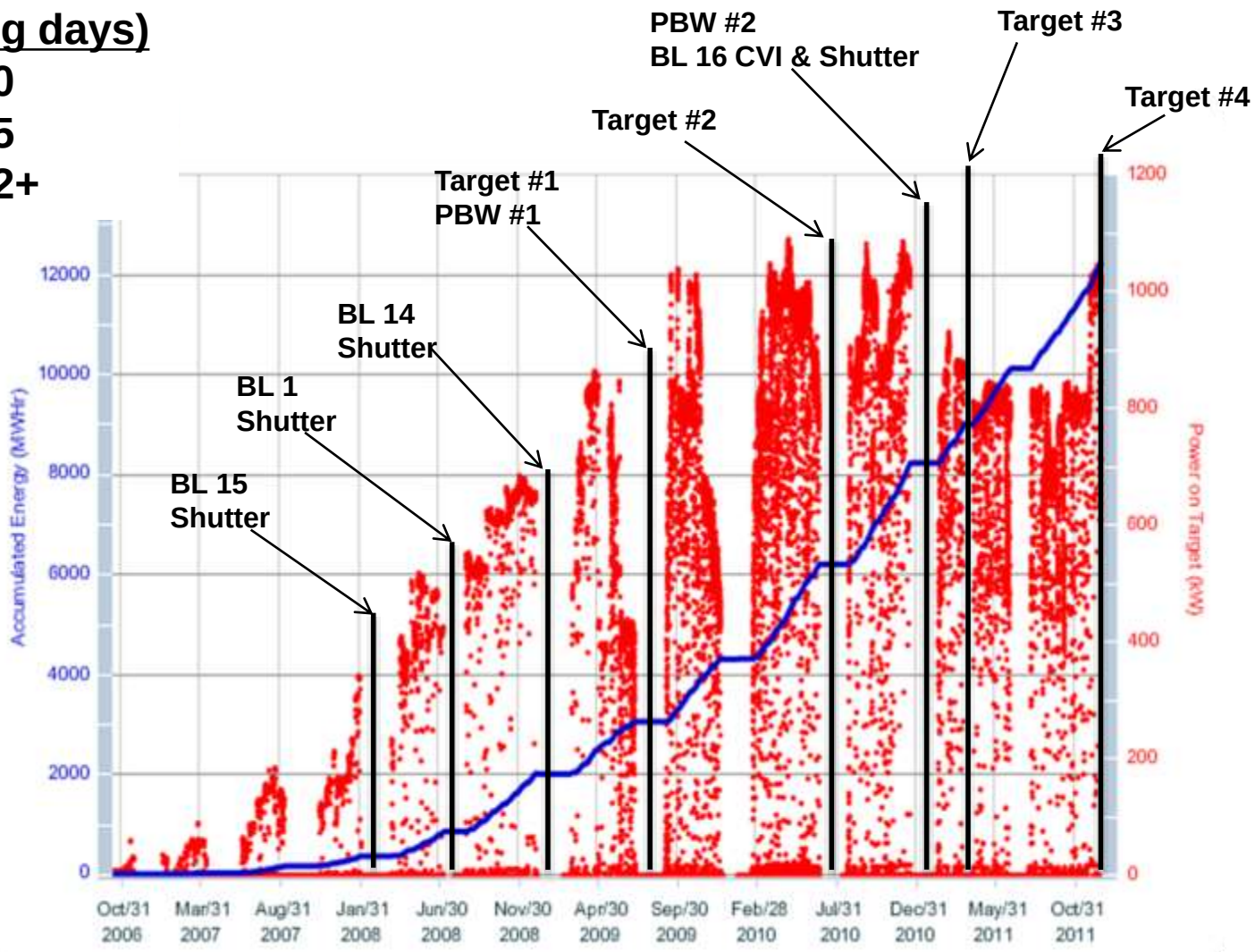


Remote Handling Component Replacements

Durations (working days)

PBW	10
CVI /Shutter	15
Target	12+

36 day outages required for a single remote handling crew to perform multiple replacements



Remote Handling Challenges: Remote Handling Resource Constraints

- Minimum of 5 Technicians needed for Service Bay work (target changes, mercury loop repairs)
- Minimum of 4 Technicians needed for High Bay work (PBW or CVI replacement)
- Remote Handling Team has 5 members = one job at a time
- Future constraint: Target lifetime at higher beam powers is undefined; 3 or more replacements a year (≤24 day maintenance outages) will require parallel remote handling activities
- Plan:
  - Augment the team with two experienced Instrument Hall Coordinators (in place)
  - Train Operations Shift Technicians (underway); identify and train mechanical resources

Remote Handling Challenges: Limited Service Bay Floor Space

Service Bay View from WW #2

View from Mercury Loop Looking East

- Necessary PIE activities compete with mandatory remote handling maintenance floor space requirements
  - Analysis of PIE floor space needs performed for new proposals
  - Management approves new activities, balancing the operational risk
  - Example: Wachs saw use disapproved

Limited Floor Space: TN-RAM Cask Availability

- The issue:
  - One TN-RAM cask exists and is used nation-wide by other labs and the nuclear power industry--operated by Energy Solutions
  - No licensed alternative cask exists
  - Target and PBW disposal method designed for use of the TN-RAM cask
  - Contractually we get the cask upon request if available; last year we got it once.
  - We perform two target changes/year and a PBW change/year; with 2 targets in storage, we need the cask at least 4 times per year.
  - Currently, targets stay in the Service Bay until disposition
  - Reliance on a single TN-RAM cask represents a vulnerability

TN-RAM Cask Availability Actions

- **Actions:**
  - Learned how to request the cask: Stop asking, start telling. We have the cask 4 times this year (maybe 5).
  - A Waste Disposition & Feasibility Analysis began October, 2011 to identify the range of casks that could be used for SNS needs, relative costs and availability, and TN-RAM alternatives that could be used for PBW disposal.

PBW Liner used with TN-RAM cask

Limited Floor Space: Mixed Low Level Waste (MLLW) "Debris"

- Issue:
  - Disposal of highly activated mercury contaminated material has not been exercised
  - A method needs to be established before Service Bay components reach end of life

  (Note: Target modules are disposed of as "empty process tanks.")
- Path Forward
  - Steve Trotter working with ORNL, NNSS (formerly NTS), and other agencies to have mercury contaminated material accepted as MLLW debris
  - NNSS can accept the material; Clive Utah can accept material depending upon activity.
  - Material must be macro-encapsulated—normally by welding a liner shut and this is difficult to do remotely
  - An alternate, accepted, macro-encapsulation option ("nuclear grade ziploc bag") is being procured to test with remote handling equipment

Remote Handling Challenges: Service Bay Servo-manipulator Reliability

View of the Service Bay Looking West

Servo-manipulator Reliability

- Issue:
  - Equipment is frequently used for target maintenance and PIE activities
  - Last month the vendor (Telerob) announced it was no longer going to support the equipment—not cost effective.
- Only minor issues with the equipment to date but
  - we have limited operating experience
  - Service Bay radiological conditions will become more severe as power increases continue
- Actions:
  - Telerob provided a list of remaining spare parts available for purchase ($125K). List is being reviewed and proprietary components will be purchased.
  - Telerob documentation of our configuration will be requested.
  - Inventory of spare parts will be conducted and alternate sources of parts that are not Telerob unique will be identified.
  - Long term: Build our own parts or install of new servo-manipulators

Accelerator Cooling Initiative: Copper Corrosion Control

- Supplied instrumentation (dissolved oxygen, resistivity) “de-scoped” during initial installation.
- Water chemistry maintained using resistivity alone.
- Actions
  - Current operating practices have been independently reviewed and recommendations provided
  - Review of the recommendations is in progress
  - A plan is being developed to restore oxygen and resistivity measurement capability, at a minimum.

Conclusions

- I have an excellent workforce
- Mechanical systems are running reliably
- Challenges exist due to
  - "Growing pains" associated with the transition to a mature operating facility
  - New technology
  - Budget versus scope decisions made during construction
  - Budgetary decisions being made in response to today's fiscal climate

Questions?