

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

June 26, 1998

MEMORANDUM FOR: G.W. Cunningham, Technical Director
FROM: T. Dwyer and H. Waugh, Pantex Site Representatives
SUBJECT: Pantex Plant Activity Report for Week Ending June 26, 1998

DNFSB Activity Summary: Timothy Dwyer was on site all week. Harry Waugh was on site Monday thru Thursday. Outside Expert David Boyd was on site Monday thru Friday, and Charles Keilers was on site Wednesday thru Friday, observing the Building 12-116 DOE ORR.

Building 12-116: The SNM Component Staging Facility (Building 12-116) DOE ORR commenced on Monday. The operational phase of the ORR is complete, and, overall, the ORR is progressing satisfactorily. Several potential issues have emerged:

- Maintenance work control is problematic. During the ORR, a condensate line penetration through an exterior wall was discovered to be lacking the required fire stop. This was contrary to the work package, which had been signed off as complete. Also, an electrician closing a junction box inadvertently cut a 277-volt wire, resulting in an arc. The junction box may have been over-filled. Inspections for compliance with National Electrical Code (NEC) requirements are planned. Further, potential inadequacies have been identified with regard to maintenance procedures satisfying surveillance requirements.
- Building cooling system reliability still appears marginal. HVAC balancing problems persist.
- Stage Right shielded forklift operators are still having pallet alignment difficulties in the vaults when landing the top pallet on the bottom pallet. The bottom pallet may also be landed with very little overlap on the rails, possibly leading to stability questions.

W84 D&I Program: The 2 W84 weapons with PAL problems were the subject of several meetings between M&H, DOE, LLNL, and SNL over the last 2 weeks. LLNL/SNL management have apparently agreed to recommend remote C/D activation, then disassembly. However, AAO is expecting a letter from DOE-AL that will acknowledge this recommendation, but direct that these 2 units be set aside for the foreseeable future. Partial motivation for the delay may be related to the fact that the W84 NESS has expired, and it is not clear that the contemplated NESS extension would adequately address all aspects of disassembly of these units after C/D activation.

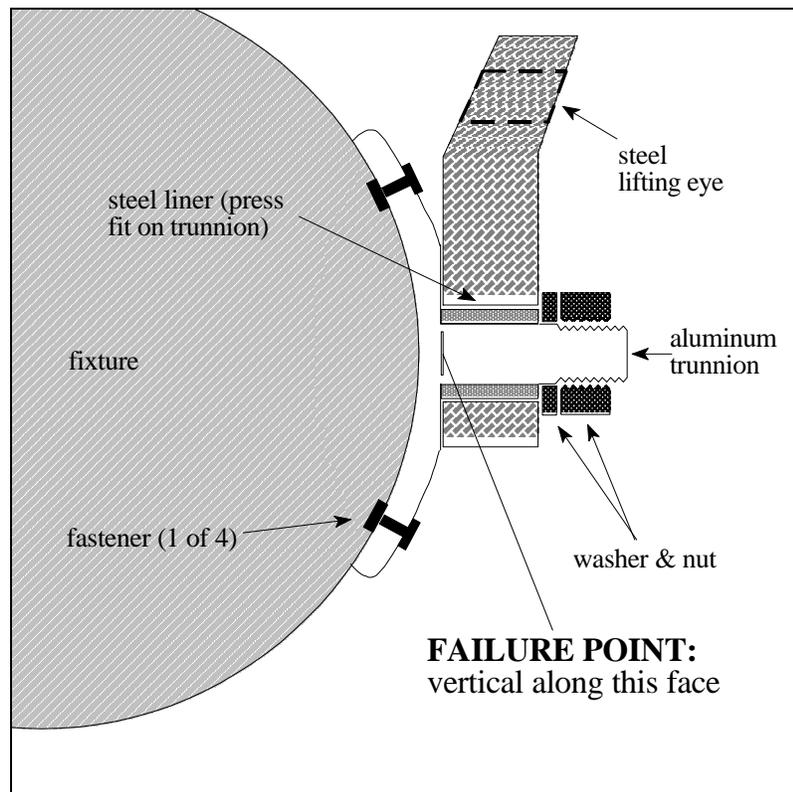
W79 Cell Dissolution: Dissolution of the 3rd W79 Dismantlement Program unit remains on hold. The Design Agencies have agreed on an investigative path forward that will result in a final report to be delivered by July 2nd. Beyond that point, assuming a favorable conclusion, it will likely take AAO/M&H several days to clear the Safety Evaluation Screening and authorize resumption of operations. The potential safety concern at issue was ultimately determined to be whether or not the uranium present in a limited number of unit parts could have hydrided (not aluminum hydride, as originally reported). M&H and the Design Agencies have agreed that unit 2 likely represents the worst case unit in the W79 family, given its storage history. Although the detailed material examinations are still in progress, initial examinations yielded no indication of hydriding. It should be noted that the triggering event for this shutdown -- the observation of separation of the aluminum coating from the mid-plate and aft-plate -- cannot be categorized as an unexpected occurrence. It has been documented before, for example in the *Report of Test Results from the W79 Mod 1 AAU* [Report # AAU 79-01-85] published January 18th, 1985.

W88 Tooling Failure: Supplemental information related to Occurrence Report ALO-AO-MHSM-PANTEX-1998-048 is enclosed as Attachment 1.

Attachment 1
Occurrence Report ALO-AO-MHSM-PANTEX-1998-048:
Information Supplement

Occurrence Category: Unusual

Brief Description of Event (per AAO Daily Operations & Event Report): At approximately 1400 CDT Thursday June 25th, 1998, M&H reported that during rotation of the W88 Moment of Inertia (MOI) tooling fixture from a horizontal to a vertical position while it was suspended from the Building 12-60 Bay 1 hoist, the trunnion bolt broke and the tooling dropped to the ground, narrowly missing a technician. No weapons were involved. A critique was held Friday, June 25th, 1998, at 1000 CDT. Mechanical and metallurgical investigation continued throughout the day.



Detail: Al Trunnion for Lifting & Rotating W88 MOI Fixture

Description of Part: A rough drawing of the point of failure is provided, facing the fixture end-on (looking lengthwise down a unit). The trunnion bolt flares from a threaded 1-inch diameter shaft to a mounting flange. The trunnion bolt/flange is a single piece of 6061 aluminum. Four fasteners penetrate the flange in 2 rows of 2, securing the trunnion bolt to the fixture. A hardened steel liner (wear ring) is press-fit over the trunnion bolt. A hardened steel lifting eye then slides over the liner with several mils clearance. This allows the fixture and the eye to rotate relative to each other. Note that rotation is limited by [1] two metal stops (not shown) that preclude rotation beyond a 90° arc; and [2] a hand-operated quick release pin (also not shown) that passes through the lifting eye to mate with one of two holes located in the flange at the 0° and the 90° positions.

Operations Associated with Event: At the time of the event, 3 PTs were completing the procedure for performing mass properties measurements on a W88. The unit had been hoisted from its transportation platform and placed on the Miller Moment of Inertia/Center of Gravity (MICG) table using the W88 MOI tooling fixture. Required measurements were then obtained. The unit was then hoisted again using the fixture, rotated to a horizontal position, and placed on the MICG table a 2nd time. Additional required measurements were obtained. The unit was hoisted a 3rd time using the fixture, rotated back to the vertical position, and returned to its transportation platform. [The unit was then moved to one side, awaiting transportation out of the Bay.] In order to complete the procedure, TARE measurements on the W88 MOI tooling fixture are also required, following unit measurement. Therefore, the (now empty) fixture was hoisted, rotated to a horizontal position, and placed on the MICG table. Required measurements were obtained. The fixture was then hoisted again, preparatory to rotation to a vertical position for the last set of measurements. At this point, while the fixture was suspended in the horizontal position and a PT was attempting to pull the quick release pin to allow rotation, the fixture drop occurred.

Additional Data: The empty W88 MOI tooling fixture weighs somewhat less than 300 lbs. The height of fall was approximately 6 feet. The lifting operation for this fixture involves the Bay hoist, and a strongback nearly 2 feet wide with 2 steel cables depending from opposite ends, each terminating in an industry standard safety hook. Each hook is attached to a lifting eye on the W88 MOI tooling fixture. The fixture has a valid load test stamp (June 1997); M&H Tooling & Machine Design (T&MD) indicated that the empty fixture had a calculated safety factor of ~100 per this load test.

Probable Cause(s) of the Event: Initial reports from the eyewitnesses present indicated that the trunnion bolt nearest the PT trying to pull the quick release pin suddenly failed, separating from its lifting eye, which remained on the safety hook. The fixture fell as far as the now unbalanced strongback and single steel cable would allow, then rebounded upward, forced the other lifting eye past the remaining (attached) safety hook, and completed the drop to the ground. However, it was subsequently revealed that one PT was in fact facing away from the lift, being involved with unbolting a piece of tooling from the Miller table. A second PT, responsible for handling the hoist controls, was specifically moving and then watching the various hoist controls/cables to prevent them from becoming entangled in the W88 MOI tooling fixture when it was rotated. The third PT was making his third attempt to adjust the fixture to a perfectly horizontal position so that the quick release pin could be removed. [Note that the empty fixture is slightly unbalanced and does not naturally hang horizontally.] This adjustment is performed at a height of 6 feet -- above the head of the PT. Thus, at the time of the event, two of the eyewitnesses were in fact not directly observing the fixture, while the third was so close to the fixture, as well as physically threatened by its immediate trajectory as it fell, that his recollections of the event are probably of limited value. These eyewitness' observations are disputed by subsequently developed investigative data.

Initial microscopic analysis (performed by A. Duncan, M&H) of the failed trunnion bolt face indicates that it failed in tension, not in shear or in torsion. This conclusion is supported by several independent indicators, including the following.

- [1] There is an indentation driven into the trunnion flange on the side away from the hook attachment point in the lifting eye, matching the outline of the edge of the steel liner.
- [2] Paint from the edge of the Miller table and scratches from the floor grating on the W88 MOI tooling fixture appear to indicate the fixture was spinning in the opposite direction from that initially reported by the PTs when it struck the table and then the floor as it fell.
- [3] The quick release pin was not pulled by the PT, but dragged out with its ball stops engaged, as indicated by markings gouged in both sides of its hole in the trunnion flange. [It remained in the broken lifting eye, hanging on the hoist, after the event.] If the trunnion bolt had failed in shear, as reported, this quick release pin has a calculated shear capacity of 4600 lbs, quite sufficient to maintain the fixture on the hoist. The calculated load necessary to pull the pin out with the ball stops engaged is 575 lbs.
- [4] If one side of the fixture had failed in shear, the fall of the fixture until the unbalanced strongback and remaining cable brought it up short would introduce enough energy into the system to fail the remaining trunnion bolt in tension. Instead, this trunnion bolt survived the event, apparently undamaged.

Based on this initial analysis, M&H is focusing on improper hoisting and lifting as the root cause for this event. It appears that the (unfailed) lifting eye came off its hook first, the fixture began to fall, failed the remaining trunnion bolt in tension, pulled away from the quick release pin, and landed on the ground. The cause of the unfailed eye detaching is presumed to be improper or incomplete initial attachment.

Corrective Actions to Date: Given this root cause, M&H management ordered a safety stand-down to review proper hoisting and lifting procedures with every shift of PTs (completed Friday, swing shift). Until further notice, NDE Department (to whom the PTs involved report) has

suspended similar operations involving the W62 and W84. Once operations resume, the presence of a supervisor will be required for any NDE lifting operation.

In addition, although they no longer believed the root cause of this event was attributable to the specific equipment/materials in use, M&H began a review to determine if any other lifting fixtures containing aluminum shaft trunnions exist at Pantex. This trunnion bolt configuration, involving aluminum, is not common. While this review is in progress, all PTs and Operations Supervisors have been instructed to contact M&H T&MD if they observe a possible aluminum trunnion in their tooling while preparing for any hoisting and lifting operations. At least two such observations were reported. T&MD inspected the fixtures in question prior to hoisting and approved their subsequent use.

Attachment 2 Upcoming Pantex Events:

Now thru July 3 -- Building 12-116 DOE ORR [ongoing]
June 30 -- Building 12-104A Paint Bay Milestone 2/NESS Planning Meeting
July 1 -- ARGUS demonstration for NESSG
??July?? -- Building 12-116 startup
July 7 -- W62 NESS Revalidation SNL Briefing (@ DOE-AL)
July 7 -- Quarterly NMO Program Meeting
July 8 -- Quarterly Production Meeting
??July?? -- Building 12-94 AAU MSA
??July?? -- B61-7 Limited Readiness Assessment**
July 21-24 W62 NESS Revalidation resumption (@ Pantex)
July 23 -- W78 SEP
July 27-31 -- B53 Aft Cap Assy Cover NESS
??July?? -- W56 SIRR**
July 30-August 26 -- NES Electrical Tester Master Study
August 3-5 -- DP-3 review of BIO Upgrade status
August 11 -- Public Meeting: Draft Surplus Pu PEIS
August 28 -- Building 12-104A Paint Bay MSA commences

NOTES: ** highlights events which are new listings or for which schedule has changed