THE CRANE CORNER

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A WORD FROM TOPSIDE

Sam Bevins

As fiscal year (FY) 2011 draws to a close, I want to review our Navy shore activity weight handling safety record. Although we saw an increase in the total number of crane accidents, and an increase in the number of accidents (overloads, dropped loads, two-blockings, and personal injuries) that we classify as significant because they have a greater potential for serious consequences, we still had an excellent year in terms of accident severity, with only three of the accidents reaching the reporting threshold of OPNAV Instruction 5100.02, and all three were Class C accidents.

With our "wide aperture" definitions for crane and rigging accidents, i.e., virtually any unplanned event regardless of degree of injury or whether damage occurred, our philosophy of reporting, analyzing, and learning from the small events has proven effective in keeping the number of truly serious accidents at a very low level. As I reflect back over the past several years, I am encouraged that we are now seeing incremental progress in raising the sensitivity on the part of activity personnel to report lower level events (near misses and other unplanned events) in addition to those events that meet our comprehensive accident definition. I am convinced that this strategy will significantly and continuously improve the safety of weight handling operations over the long term.

This is not to say we should be satisfied with our record. There is still significant room for improvement. We saw an unsatisfactory increase in overload accidents, with most of them being rigging gear overloads. Some of this can be attributed to the increased use of portable load indicating devices (LIDs) in lifts of constrained loads. In many of these cases, the use of LIDs merely confirmed that overloads had been occurring in the past but were not recognized. We strongly encourage the use of portable LIDs, in conjunction with appropriate stopping points, to prevent overloads. It is low-cost insurance to prevent a serious accident. On the other hand, a number of rigging gear overloads occurred due to poor rigging practices, indicating in many cases a lack of understanding of rigging fundamentals. Additional training, re-training, and increased surveillance of crane rigging may be required.

Although our definitions of crane and rigging accidents are broad, there are events that fall outside the definition but where lessons can be learned and shared. There are also close calls and near misses where luck played a significant part. I strongly encourage activities to investigate these near misses and other unplanned events for potentially valuable lessons and to report them so that we can share the lessons with our Navy shore weight handling community. I am very encouraged in the increase in these reports in FY 2011; however, we want to see more of these reports. This is certainly a low-cost way of learning to improve crane and rigging safety.

Our goal is to evolve a culture wherein people instinctively

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focus on the value of gaining lessons learned from the reporting of all unusual events in a weight handling operation to prevent more serious events from occurring. Such a culture achieves a continuous improvement in safety over the long term. We also want to encourage leadership to maintain an appropriate level of concern, focused on the severity level of events, without potentially stifling the reporting of events by unintentionally sending the wrong message to deckplate personnel by focusing solely, and negatively, on just the total number of events reported.

As we know, a safe and effective weight handling program is an essential enabler for Fleet Readiness. Please continue to raise the level of safety awareness in our journey toward our mutual goal of ZERO accidents.

CRANE SAFETY ADVISORIES AND EQUIPMENT DEFICIENCY MEMORANDA

We receive reports of equipment deficiencies, component failures, crane accidents, and other potentially unsafe conditions and practices. When applicable to other activities, we issue a Crane Safety Advisory (CSA) or an Equipment Deficiency Memorandum (EDM). A CSA is a directive and often requires feedback from the activities receiving the advisory. An EDM is provided for information and can include deficiencies to non-load bearing or non-load controlling parts.

CRANE SAFETY ADVISORIES (CSA)

CSA 144B, Check For Proper Assembly for Johnson Industries Caliper Disc Brake

Background:

A. This revision supersedes and cancels CSA 144A.

B. The purpose of this CSA is to revise the fastening instructions for the piston to the spring guide to reflect the revised OEM procedure.

C. CSA 144A detailed where an activity reported finding two out of four end cover cap screws broken on a Johnson Industries Model BAH1018 caliper disc brake actuator utilized on a Johnson Industries 3018 caliper disc brake. The screws are not load bearing or load controlling components and are used to store the actuator caging ring and secure the end cover plate to the actuator housing. Failure of these screws did not affect the safe operation of the actuator. It was concluded that the actuator piston, used to release the brake, was not fully threaded and seated on the spring guide (approximately 2 turns short of 20 turns or 0.159 inches short of full thread engagement). When hydraulic pressure was applied to the actuator, to release the brake, the piston contacted the caging ring and over time two of the four end cover cap screws broke. CSA 144A corrective action was to fully thread/seat the piston to the spring guide and have Loctite 242 applied to the first 10 threads of the spring guide.

D. Since issuance of CSA 144A, an activity has reported a recurrence of broken end cover cap screws due to similar unthreading of the actuator piston on the spring guide. Disassembly of the actuator found the Loctite applied to the spring guide threads had become contaminated with grease from the Belleville spring washers. Contact with the OEM revealed that their procedure for assembling the actuator piston on the spring guide had been revised to eliminate the use of applying a threadlocker. The new OEM procedure is to apply a nickel based anti-seize lubricant to the spring guide threads along with applying 600 ft-lbs of torque when seating the actuator piston on the spring guide.

Johnson industries drawing DSAS-01.5, titled "DS" Series Brake Actuator Instructions, provides a pocket depth dimension "a" to verify that the piston is fully threaded and seated on the spring guide for all model "DS" caliper disc brake actuators. The pocket depth dimension "a" varies between the model numbers.

Direction:

A. At the next type "B" maintenance inspection, activities equipped with Johnson Industries series "DS" caliper disc brakes (Westmont, Craft, Amclyde, and Samsung portal cranes) shall check all actuators for proper "a" dimension pocket depth indicating the piston is properly threaded/seated on the spring guide. Actuators that are found with pocket depth dimensions greater than allowable may remain in-service provided the brake air gap and actuator spindle have not been adjusted since the last load test and certification. This ensures that the actuator force (and brake torque) has not been reduced since the previous load test. These dimensions shall be recorded and available for comparisons upon future inspections.

B. Actuators that require servicing to fully thread/seat the piston to the spring guide shall have a nickel based anti-seize lubricant applied to the spring guide threads and the piston/spring guide assembly torque to 600 ft-lbs for all Johnson Industries series "DS" caliper disc brake actuators. As a minimum, all actuators shall be serviced to fully thread/seat the piston using a nickel based anti-seize lubricant and shall be torqued to the specified 600 ft-lbs no later than the next type "C" maintenance inspection.

C. Due to variation in Johnson Industries pocket depth dimension tolerances and machining practices on the spindle retainer recess, some actuators may have pocket depth dimensions outside of the specification even though the piston is fully threaded/seated on the spring guide. These actuators may be used provided the spring guide to piston threaded connection is confirmed to be fully seated and the actual pocket depth is recorded and traceable to that actuator assembly and assembled components for comparison upon future inspections.

CSA 199A, Securing of Weight Handling Equipment (WHE) During High Wind Events

Background:

A. CSA 199, issued 29 July 2011, directed activities to send a list of all outdoor rail mounted WHE's, the method used to secure the WHE at shutdown and during high wind events, wind conditions that trigger securing WHE, and the wind force analysis (including calculations) to NAVCRANECEN no later than 16 September 2011. Negative responses were also required. To date, NAVCRANECEN has received responses from less than 15 percent of activities.

Direction:

A. All activities identified by NAVFAC P-307, paragraph 1.1, shall provide NAVCRANECEN the information required by CSA 199 or provide a negative response indicating that your activity does not have any outdoor rail mounted WHE . CSA 199, with the outdoor crane report form may be found on the NCC website at https://portal.navfac.navy.mil/. Negative responses (activities without outdoor rail mounted WHE) may be e−mailed to the POC identified on the CSA.

CSA 200, Metal Tack that Detached From 3-Ton Budgit Model USA Chain Hoist

Background:

A. The purpose of this CSA is to alert Navy activities of a metal tack that detached from the inside of a hoist frame on a 3-ton Budgit model USA chain hoist. The metal tack (Budgit Operation, Service and Parts Manual ref #23 for 3-ton hoist) positions the spring retainer plate for the brake pawl spring. Although the metal tack became detached, the operation of the brake pawl was not affected. This metal tack is used on 1-1/2 ton through 6-ton Budgit Model USA chain hoists (excluding the two load chain 2-ton model). The Budgit parts manual calls for a self-tapping screw to be used when replacing the metal tack. The parts manual reference numbers for the metal tack and replacement screw may vary with the size of the chain hoist.

B. As discussed with the OEM, the metal tack aids in positioning the spring plate during assembly and use, however there is also a stop integral to the hoist frame that restrains movement of the spring plate should the metal tack become dislodged. The spring plate is also captivated on the pawl pin by the brake pawl, washer, and retaining ring.

Direction:

A. Activities shall replace the metal tack on 1-1/2 ton through 6 Ton Budgit Model USA chain hoists (excluding the two load chain 2-ton model) with the appropriate size self-tapping screw (refer to the Budgit Operation, Maintenance, and Parts Manual for proper screw size and installation) prior to or during the next annual inspection. NAVCRANECEN recommends the use of a thread locking compound upon installation of the self-tapping screw.

EQUIPMENT DEFICIENCY MEMORANDUM (EDM)

EDM 099, Excessive Disc Wear on a Dings 80 Series Brake Used in a High Cycle Shock Application

Background:

The purpose of this EDM is to inform activities of a problem with rotating friction disc wear when used in a high cycle/shock application and available heavy-duty brake package options for Dings 60 through 90 series normal duty brakes.

An activity reported excessive wear of brake rotating friction discs within a Dings 80 series normal duty brake utilized on a 6-ton Yale cable king hoist. Excessive brake dust and material was discovered in the brake housing during the annual maintenance inspection prompting the activity to further disassemble the brake. The rotating friction discs have a fiber core splined connection to the brake shaft. The splines on the brake discs had worn severely, to the point that the disc splined core was not fully seated on the splines on the brake shaft. The hoist did not have any reported issues with load slippage or operating problems during use.

Recommendation:

Discussions with Dings and Yale revealed this condition has been reported in a few cases where the end user was repeatedly jogging the hoist controls for fine positioning. Both OEMs recommended utilizing available heavy duty brake package options, which include metal disk center rotating friction discs, hardened hubs, high tensile studs, and ductile iron stationary discs for use in high cycle/shock applications. Not all of these heavy-duty brake options are available on all Dings series brakes.

Activities are advised of heavy-duty brake package options for Dings 60 through 90 series brakes. The heavy-duty brake package options are recommended for use in high cycle/shock applications (e.g., where frequent jogging of the controls is required). Activities will need to contact dings to determine which heavy-duty brake options are available for the series brake installed on the hoist. A crane alteration request for NAVCRANECEN approval will be required where dings brakes are to be retrofitted with heavy-duty brake package options. Also, activities are reminded that where problems are found during inspections, P-307, appendices C and D require further disassembly of components for inspection and evaluation.

ACQUISITION NEWS

The Navy Crane Center accepted four 7-1/2 ton rated capacity, top running single girder bridge, underhung trolley/hoist, electric traveling, ordnance handling bridge cranes and three 3-ton rated capacity, underrunning bridge, underhung trolley/hoist, electric traveling, ordnance handling bridge cranes between June and September, 2011. The 3-ton capacity bridge cranes included free-standing runways. The contract acceptance test was used in each case by the activity as the load test for crane certification. The CMAA 74 and MH27.1, Class D, top running 7-1/2 ton capacity cranes have a 28-foot span with 15-foot hook height. The MH27.1, Class D, 3-ton capacity cranes have a 30-foot span with 14-foot hook height. Features of the cranes included ASME HST-4, duty service classification H4, packaged wire rope hoists, patented track bridge girders, dual hoist brakes, infinitely variable speed electronic drives on all functions, and pendant mounted crane controls. The 7-1/2 ton capacity crane project included runway conductors for each 57-foot, 11-inch long runway. One of the 3-ton capacity cranes includes design features that allow it to operate in an NFPA 70 Class I, Division I, explosion proof environment, including stainless steel wire rope, bronze hook, totally enclosed brakes, NEMA Type 7 electrical enclosures, and bronze trolley and travel wheels. For more information regarding this crane project, contact the POC identified on the CSA.

3-ton Ordnance Handling OET Crane on Free-Standing Runway

The Navy Crane Center accepted replacement trolleys for one 5-ton rated capacity and one 10-ton rated capacity, double girder overhead electric traveling, ordnance handling bridge cranes on June 30, 2011. The trolley replacements were requested by the user activity to provide quieter hoist operation.

The replacements included the trolley frame, trolley wheels and shafts, trolley motors and gearboxes, and all hoist machinery. The original electrification, control systems, wire rope and hook block were retained. The contract acceptance test was used by the activity as the load test for crane certification.

For more information regarding these cranes and project, contact the POC identified on the CSA.

CHANGE 2 TO NAVFAC P-307 DECEMBER 2009 REVISION ISSUED

Change 2 to NAVFAC P-307 December 2009 Revision was issued on 11 August, 2011. This change was issued to provide additional requirements that apply to cranes utilized by Navy activities that may be owned by other military services or government agencies. Other clarifications to Navy WHE policy have been included in this change. The full text of Change 2 can be downloaded from the Navy Crane Center's web site.

The clarifications and corrections in this change are in effect immediately. For those cranes not currently maintained and certified in accordance with NAVFAC P-307, Navy activities shall achieve full compliance within one year.

A CAUSAL APPROACH TO PROBLEM SOLVING

Weight handling program self-assessments, responses to audit findings, and crane accident investigations all rely on internal or external reporting of the problem, cause, and corrective action. In many cases, activities are "missing the mark" and not identifying the true causes or causes that may be program wide and which, if corrected, can lead to safer and more efficient weight handling. Typical responses to problems frequently add complexity and difficulty to future tasks and end up repeating past performance. Prudent causal analysis should be conducted before determining actions to resolve a given problem.

One common trap managers will fall into is restating a given problem as a cause of the problem. This approach may mitigate the symptom or problem at hand; however will usually not prevent problem recurrence long term or allow managers to make smart business decisions of precious manpower time that could add overall program value for your activity in the long term. Each individual problem is rarely the result of only one event (or condition or process). Typically, many events in a causal chain occurred before the event and if one event in the chain is broken the event would not occur.

Current Navy and Civilian managers are trying to place workplace safety as a top priority more than ever before. Evidence of this in accident statistics and severity has been mentioned before. However, work schedules, work environment, and complex processes make it more difficult than ever before to efficiently conduct the work in a safe manner. Rarely does a worker come to work and decide to overtly not follow a procedure or a rule or conduct business in an unsafe manner. Management and supervisory response to "personnel error" needs to include a critical review of internal and external environmental issues, processes, and procedures that do not tend to foster an efficient and safe work environment. These issues are typically more insidious and difficult to find. The simple, least number of steps, that utilizes a highly visible process will also improve safety and allow us to better meet the Navy's mission. These responses are critical to improving work culture and human factors involved in reducing crane accidents. For example, one typical management approach following an identified personnel error is to discipline the employee by various different approaches such as time off without pay. This approach again is not incorrect but if not used rarely for outright negligence can degrade command culture and cause personnel to not report problems. Many other approaches by understanding all of the factors involved will reduce human error by correcting the error itself. Or if done right cause better focus by operators and supervisors at critical work steps.

Some examples are provided to illustrate the point:

1. The first case is an example of simple quick problem resolution where a detailed analysis is not required. Only the overarching philosophy, recognition of the environment, conditions, and current processes in place, are needed.

A crane operator is directed to move the load in the west direction. However, the operator presses the east push button. This is not a crane accident but if done at the wrong moment could have drastic consequences. The human factors may include long work hours, numerous repetitive tasks moving the crane with other riggers, mechanics, and supervisors involved in the work. The work processes are very complex and hands-on training is conducted to perform the work. A typical approach to this problem would be to brief the individual on the error and continue operations. This approach can be simply stated as the "do better" approach, can refocus a person for a short period of time but is prone to recurrence. A better approach recognizes the human factors involved and would have the operator point to the switch prior to operation (to allow for teammate backup) or swap the operator at a more frequent interval. If an approach like this is taken when the problem occurs during routine less critical times, problem severity is kept low.

2. In the second case, the activity responded to an audit finding. If a more detailed causal approach was used, the follow on crane accident could have likely been avoided.

An audit finding identifies a crane operator had allowed the load to strike some objects during a qualification practical (the certifying official qualified the operator) then the same practice was observed including similar errors during an audit load test . The finding cause was determined to be "the operator did not perform as trained." The operator qualification was removed and he was then requalified. Sometime later at the same activity a crane operator and rigger in charge (RIC) overloaded and tipped over a mobile crane. In this instance, the activity attributed the cause to "the operator and rigger-in-charge did not follow procedures to determine capacity." The operator and the RIC were disqualified and requalified. Although the causes identified by the activity in both of these events are correct, a more detailed, causal analysis of the fundamental errors from the audit finding would likely have identified contributing causes in supervision, training and answer why procedural compliance did not occur. This approach could have prevented the accident that occurred later in time.

3. This case involves a rigging accident. A rigger knows he should consult his procedure which shows a drawing detailing where to install a safety hoist ring on a load but threads a slightly undersized safety hoist ring into the load and forgets to use torque wrench. When the load is initially lifted the safety hoist ring comes out and causes the load to fall and injure a coworker. The human factors in this case involve schedule pressure, work inside a dark tank, and difficulty obtaining tools and drawings. The activity did not fire the rigger but disqualified him and directed time off without pay. Consider a better approach to accountability by having the worker determine why he made the error, then having him personally train his coworkers on how to perform the correct approach. Include the worker in investigating better methods to get tools and drawings to the work place. Given the opportunity this rigger will likely never make the mistake again and his peers will appreciate the first hand specificity he could provide for the whole program to benefit.

4. In the last case, an activity performs a self-assessment for many consecutive years identifying the fact that contractor crane accidents and contractor crane oversight is a problem. Audit findings for the activity also identify many contractor crane performance problems but responses to these problems do not go far enough into the causal chain and are isolated to the issues. The actions are well intentioned but causes are not identified in the self-assessment or the audit responses simply restate the problem. So the underlying causes, which are likely external to the activity, (such as the scope and breadth of oversight or contract language) continue. An improved causal analysis of this problem in the self-assessment (in this case may have many causes) would greatly benefit the external audit team and the activity, especially if other commands, regulations or contracts are driving the underlying cause.

In summary, activities are encouraged to use a causal approach to problem solving and treat each problem whether in an audit self-assessment or crane accident as a "golden nugget of opportunity". This approach will reduce the number and severity of problems and improve task efficiency to take our weight handling programs to the next level of improvement.

CRANE ACCIDENT PREVENTION IMPROVEMENT CHALLENGES

As we approach the close of fiscal year (FY) 2011, I encourage each of you to take the time to reflect on the safety and health of your weight handling program and intensify your focus on safety as we enter the new fiscal year. After experiencing a significant reduction in crane accidents in FY2010, we have seen an upswing in FY2011. More disturbing, the number of accidents we classify as significant (i.e., dropped loads, overloads, two-blockings, and any other accident that involves an injury) has nearly doubled from last year's total for the same period. We trend these events because they occur all too commonly and have the potential for serious consequences. The good news is that nearly all of the reported accidents classified as significant were minor in nature, but it is obvious that in many cases, we were fortunate that something more serious did not occur.

Although the Navy shore weight handling safety record is very good, we can all make it better through better recognition and reporting of minor accidents, near misses, and other unsafe events. Auditors have found minor scrapes and dents during inspections that were not recognized by the activity as potential crane accidents; damaged rigging gear that was disposed of without asking how it was damaged; and unsafe acts during operations that were not recognized and documented as near misses.

A healthy weight handling program is one where these minor events are recognized, documented, and reported so that valuable lessons are learned and shared. If your Command is not reporting near misses and other unplanned occurrences, as defined in paragraph 12.5 of NAVFAC P-307, even though they may not rise to our definition of an accident, your program may not be as healthy as it could be. The number of near misses reported to NAVCRANECEN was up significantly this year. This is encouraging. However, the number reported, as well as the number of activities that reported them, is still far fewer than what we should be seeing for the size of the global Navy shore weight handling program.

Awareness is the first step. To that end, NAVCRANECEN incorporates crane accident/near miss lessons learned and provides a summary of the trends via quarterly naval messages. We also select specific identified trends and issue weight handling safety briefs (WHSBs) to inform weight handling personnel of recent problems in the trade and methods to avoid recurrence. The WHSB is a concise and informative, data driven, one page snapshot of a trend, concern, or requirement related to recent real time issues that have the potential to affect our performance and efficiency. The WHSB can be used by your activity to increase awareness of potential issues that could result in problems for your weight handling program. WHSB's are available online at https://portal.navfac.navy.mil/private/ncc/extranet_pages/whapi/whs_brief

Other information, such as the quarterly NAVCRANECEN "Crane Corner" technical publication, informative videos on weight handling safety and accident prevention, prior safety messages, crane safety advisories, and crane accident data is also available at our NCC web site, https://portal.navfac.navy.mil/ncc. This website provides weight handling managers useful information to foster continuous improvement in their weight handling safety programs.

Additionally, we have developed and posted on Navy Knowledge Online (NKO) a comprehensive Rigging 101 training course. This course is one of seventeen weight handling courses that are Available on NKO. The other courses that are available on NKO are:

General Crane Safety (NCC-GCS-02)
General Crane Safety Refresher (NCC-GCSR-03)
Category 2 and Cab-Operated Category 3 Crane Safety (NCC-C2CS-01)
Category 2 crane safety refresher (ncc-c2csr-02)
Category 3 (Non Cab) Crane Safety (NCC-C3CS-01)
Category 4 crane safety (ncc-c4cs-01)
Crane Rigger (NCC-CR-03)
Rigging Gear Inspection (NCC-RGI-02)
Load Test Director (NCC-LTD-01)
Certifying Official (NCC-CO-01)
Electrical Crane Inspector (NCC-ECI-01)
Contractor Crane Awareness (NCC-CCA-02)
Crane Mechanic (NCC-CM-01)
Mobile Crane Mechanic (NCC-MCM-01)
Mechanical Crane Inspector (NCC-MCI-01)
Crane Electrician (NCC-CE-01)

We have also posted on our website a Contractor Crane Awareness Workshop presentation that is designed to communicate and improve weaknesses identified as a result of lessons learned in our contractor crane oversight program. I highly recommend that you take advantage of this tool for use at your activity if you have contractor cranes coming aboard.

With the new fiscal year on the horizon, I ask you to gauge the health of your weight handling program. Human error continues to be a major challenge. Our immediate goal is to ensure that when mistakes do occur, they are minor in nature and without injury. Paying attention and learning from the minor mistakes and understanding the value of capturing these issues ultimately ensures the continuous improvement of our weight handling program. I challenge all weight handling personnel to keep up the hard work in performing weight handling operations with the utmost safety in mind and in practice.

No job is worth doing if it cannot be performed safely. My team and I stand by to assist as needed to help ensure a safe weight handling work environment.

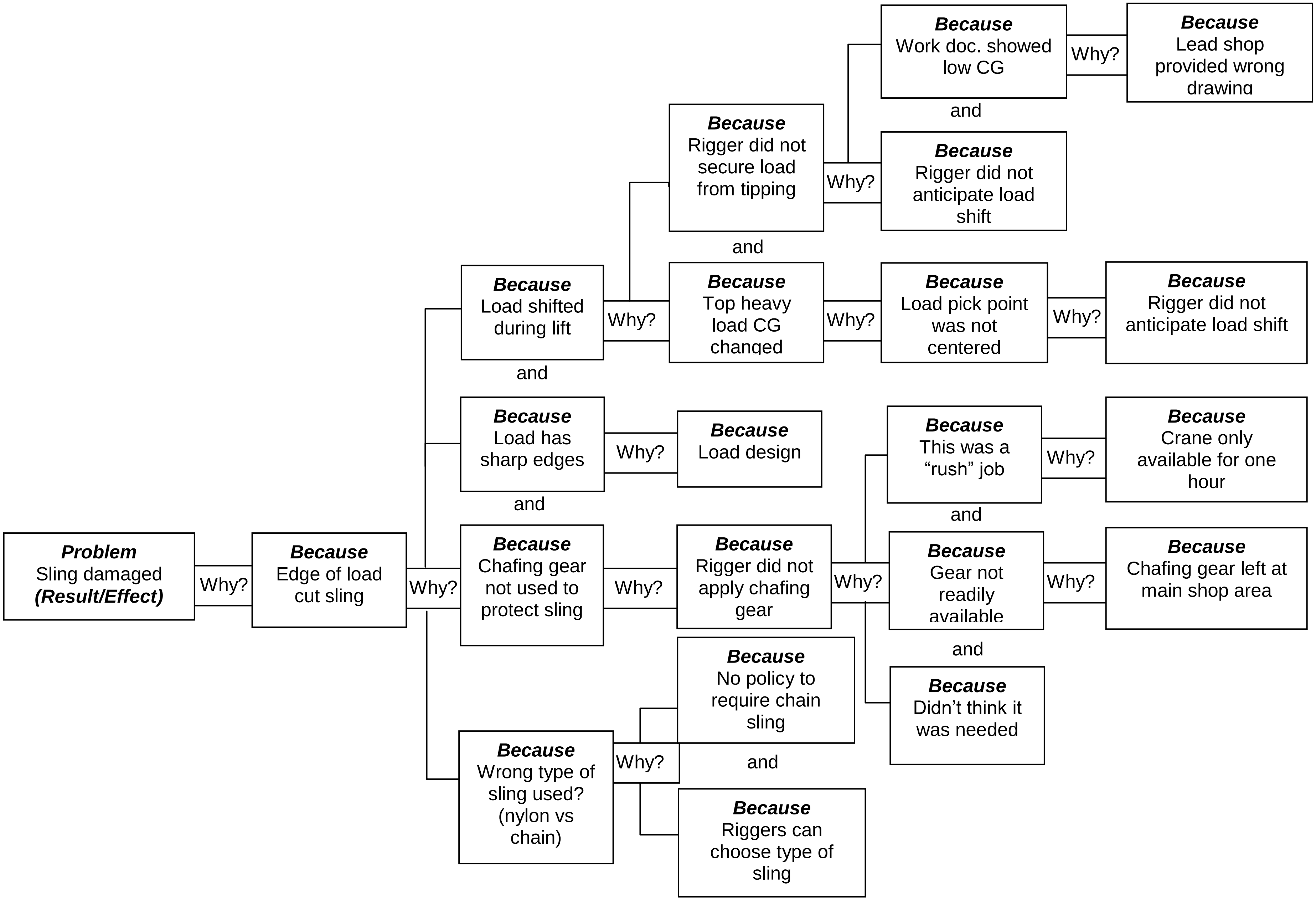
Each weight handling accident diminishes support to the fleet. A safe and reliable Navy weight handling program is an essential enabler for fleet readiness. Commanding officers of Navy shore activities are strongly encouraged to intensify their efforts to raise the level of safety awareness in their weight handling operations and continue to strive for the goal of zero weight handling mishaps.

LEARN BY ASKING "WHY"
(CRANE & RIGGING ACCIDENT PREVENTION)

Crane and rigging accidents at shore-based activities take a toll each year in injuries and property damage. The vast majority of crane and rigging accidents are avoidable. In most accidents, a team member either performs an unsafe action or fails to perform a required action safely. Well conducted and properly documented accident investigation and reporting are extremely important in helping to prevent future weight handling accidents. Root cause analysis, using cause mapping, is an effective method for identifying the underlying causes of why an accident occurred so that effective solutions can be identified and implemented. Although it can be used when something goes well, cause mapping is more commonly used when something goes badly, like a crane or rigging accident. Accident investigation, root cause analysis, and problem solving are all fundamentally connected by three basic questions: What is the problem? Why did it happen? What can be done to prevent it in the future?

To briefly show how cause mapping can help improve WHE accident reporting (which then results in more effective methods to prevent future accidents) we can use an all too common accident scenario as an example.

Accident #1. During a crane lift, the synthetic sling used to rig the load is damaged beyond allowable limits. This, I am sure you would agree, is a problem. Typically, an accident report put together by an activity contains all of the basic facts associated with the accident such as time, location, crane number, weather conditions, weight of the load, etc. along with a few fundamental facts gathered during the investigation. Many times, the facts gathered during the investigation are then used to make general statements regarding the "root cause" of the accident. In this type of accident (rigging gear damage) it is not uncommon to see **"the"** root cause stated as something like "rigger in charge failed to perform as trained." But is having the rigger perform as trained really the only thing that could have prevented this accident? What we often find when we analyze reports for accidents like this is that the investigators stopped asking the "why" questions far too early in the investigation process. Using a cause map type of investigation process will, in most cases, benefit the investigating/reporting team as they will likely find more than one root cause for the accident, any one of which, had it been identified and mitigated beforehand, could have prevented the accident from happening. A cause map is a tool that provides a visual explanation of why an incident occurred. It connects individual cause-and-effect relationships to reveal the system of causes within an issue. A cause map can be very basic or it can be extremely detailed depending on the issue. Investigating a problem begins with the problem and then backs into the causes by asking "why." Once the key "why" questions are answered, effective short and long term corrective actions can be applied using this synthetic sling accident as an example, a basic cause map could look something like this:


Problem
Sling damaged
(Result/Effect)
Why?
Because
Edge of load cut sling
Why?
Because
Load shifted during lift
Why?
Because
Rigger did not secure load from tipping
Why?
Because
Work doc. showed low CG
Why?
Because
Lead shop provided wrong drawing
and
Because
Rigger did not anticipate load shift
and
Because
Top heavy load CG changed
Why?
Because
Load pick point was not centered
Why?
Because
Rigger did not anticipate load shift
and
Because
Load has sharp edges
Why?
Because
Load design
and
Because
Chafing gear not used to protect sling
Why?
Because
Rigger did not apply chafing gear
Why?
Because
This was a "rush" job
Why?
Because
Crane only available for one hour
and
Because
Gear not readily available
Why?
Because
Chafing gear left at main shop area
and
Because
Didn't think it was needed
Because
Wrong type of sling used? (nylon vs chain)
Why?
Because
No policy to require chain sling
and
Because
Riggers can choose type of sling

As you can see from the sample cause map, there were several key events, actions, or decisions that directly contributed to this accident. These are the causes of the accident, or the "why it happened" answers. Some contributing elements may not even be identified in this sample cause map; can you think of other questions that needed to be asked? The bottom line is, had any of the key events, actions, or decisions identified on this cause map been done differently, it is highly likely that the accident would not have happened. Each one was an opportunity to prevent an accident!

Having identified the key events, actions, and decisions that lead to this accident, an activity can then apply specific, targeted, and effective methods and measures to prevent similar accidents in the future. Commonly, a change in process or procedure is a good place to start looking for solutions. We will discuss work process as it relates to crane and rigging accident prevention in a future article.

P-307 QUESTIONS & INTERPRETATIONS

The questions and interpretations listed below are based on crane program issues that arose and were submitted on Requests for Clarification, Deviation, or Revision (RCDR), NAVFAC P-307, Figure 1-1. For the official RCDR, please visit the Navy Crane Center website https://portal.navfac.navy.mil/ncc and navigate to the P-307 Questions and Interpretations section of interest. Please note, NAVFAC P-307, paragraph 1-12 contains specific guidance on the use of previously approved RCDRs.

P-307 Reference Section 3

Question: Paragraph 3.4.2.1 of NAVFAC P-307 addresses the requirement for load testing a component when it is replaced. It states a load test is required if holding strength is affected by the work performed (i.e., failure to make the proper adjustment, repair, etc., could result in dropping or uncontrolled lowering of the load). If the work to replace the drive, and the drive replacement itself, were performed incorrectly (e.g., if a motor power lead is not sufficiently tightened or if the new drive is defective) then the drive will immediately trip, shutdown, and brakes set securing the load in a safe manner. Does the replacement of a microprocessor controlled hoist drive require a load test?

Answer: The replacement of a microprocessor controlled hoist drive requires a load test and recertification in accordance with NAVFAC P-307, paragraph 3.4.2.1. This paragraph states in part, "When the adjustment, repair, disassembly, alteration, or replacement of a load bearing part, load controlling part, or operational safety device requires a load test for verification of satisfactory work performed, recertification is required. To determine if a load test is required, the component's impact on holding strength shall be assessed. If holding strength could be affected by the work performed (i.e., failure to make the proper adjustment require, etc., could result in dropping or uncontrolled lowering of the load), then a selective inspection, load test, and recertification shall be performed." The drive is a load-controlling replacement part that has never been load tested, failure of which could result in uncontrolled lowering of the load and therefore a load test is required.

SUMMARY OF WEIGHT HANDLING EQUIPMENT ACCIDENTS THIRD QUARTER FY11

For the third quarter of FY11, there were 63 reported crane accidents (20 significant); 12 rigging accidents (4 significant); 12 crane accident near misses; and 4 rigging accident near misses. Additionally there were 4 reported contractor crane accidents (2 significant). Significant accidents are those involving overload, dropped load, two blocking, or personal injury. Some of the more significant accidents and trends are discussed herein.

Crane collisions continue to account for a large percentage of crane accidents that are reported. Over 44 percent of crane accidents reported this quarter involved collisions of either the crane or load. 22 collisions involved the crane contacting an object within the crane envelope and 6 involved the load making unplanned contact with an object. 15 of the 22 crane collisions occurred while there was no load on the hook. 50 percent of the crane collisions involved bridge cranes.

Lessons Learned: Maintaining and ensuring a clear crane operating envelope must be stressed to all personnel. Prior to any movement of the crane, loaded or unloaded, personnel must check to ensure the travel path is clear and monitor crane and load movement at all times to ensure adequate clearance is maintained. Additional personnel should be posted as necessary to monitor clearances, even when traveling without a load on the hook. Operators must be aware of crane rail end stops or other cranes located on the same crane rail. Look for unexpected objects within the crane operating envelope and find them before they find you.

DROPPED LOAD ACCIDENTS

Accidents: 6 dropped load accidents occurred during rigging and crane operations. A 500-pound component was dropped five decks while being hoisted from a machinery space during an in-hull rigging evolution. The rigging team improperly installed a safety hoist ring in a location that was not designed for lifting the component. In another event, while lifting a cylindrical object that was 30 feet in length, the object separated in the middle where the rigging gear was choked around the load. Part of the load fell in the water and the other half fell to the pier.

Lessons Learned: Although no personnel were injured during the two accidents discussed above, the results could have been disastrous. Rigging personnel must ensure safe rigging practices are followed and proper rigging attachment is made prior to lifting loads. Not only must rigging personnel install and attach rigging gear properly to support the load, they must also ensure the load and attachment points are structurally sound and capable of supporting the weight of the load. If structural capacity is questionable, or assistance is needed to determine appropriate rigging attachment points, the activity engineering department should be contacted for assistance. These accidents also serve as reminders as to why personnel should never work beneath a suspended load.

OVERLOADING OF THE CRANE OR RIGGING GEAR

Accidents: 7 of the 20 significant crane accidents involved overloading of the crane or rigging gear. During lifting of a mobile crane, the rigging gear was overloaded and a spreader bar was bent due to an incorrect rigging configuration used for the lift. An investigation determined that the spreader bar had also been overloaded during previous use.

Lessons Learned: Ensure personnel are properly trained to use the equipment as required, and validate that all equipment is being utilized in accordance with NAVFAC P-307 and OEM requirements. Know the weight of the load and ensure the crane has adequate capacity to perform the lift. Where the weight of the load is in question, a load indicating device with readout readily visible to the signal person or rigger-in-charge (RIC) should be used. An appropriate stopping point should be established to minimize the risk of overload. Ensure the proper rigging configuration and attachment is used for the object or component being lifted. Crane and rigging personnel must ensure that rigging gear being used has adequate capacity for the work to be performed in the configuration in which it is being used.

We are encouraged by the increased reporting of crane and rigging near misses. Identifying and analyzing potentially unsafe acts and conditions can minimize the occurrence of weight handling accidents. Activities should take advantage of the NAVFAC P-307, Section 12.5 near misses and other unplanned occurrences reporting requirement so that additional lessons learned can be shared with our Navy weight handling community. Near miss and unplanned occurrence reporting is an indicator of a maturing weight handling program. A reported near miss can be a life saver.

Weight handling program managers and safety officials should review the above lessons learned with personnel performing weight handling functions and consider the potential risk of accidents occurring at your activity. Contracting officers should share this information with representatives who oversee contractor weight handling operations. This is also a good time to reinforce the principles of operational risk management. Our goal remains zero weight handling accidents.

For information on any WHE accidents, contact The POC identified on the CSU.

DO YOU KNOW about …?
POLYALKYLENE GLYCOL's

Polyalkyline Glycol's (PAG's) are environmentally friendly fluids being used as lubricants and oils in a growing number of applications. While not suitable for all crane applications, consider the pros and cons below:

Pros

- Environmentally Friendly: Non-sheening (per 40CFR 435, Static Sheen Test), "Relatively Harmless" and "Practically Non-toxic" to fish and other aquatic wildlife (US Fish and Wildlife Service), "Readily Biodegradable" (per OECD 301F)
- Good Performance: Rated as "Anti-Wear" per ASTM D-7043. PAG's may offer substantially improved results as a lubricant in some applications in durability and reduced friction coefficients over mineral oils.
- Stability: Does not break down in the presence of water or form sludge over time. PAG's do not form a varnish. Degradation components are soluble in the fluid. PAG's resist thermal breakdown and maintain their viscosity over a range of temperatures.
- Fire Resistance: PAG's have a higher ignition temperature and much lower heat output than mineral and vegetable oils.

Cons

- Viscosity: Not available in higher viscosity formulations, such as grease.
- Material Compatibility: PAG's are incompatible with hydraulic fluids, non-epoxy paints and some seal materials, including polyurethane.

- Cost: PAGs cost about four times the price of hydraulic fluids (~$30/gal), plus replacing incompatible components.
- Closed Systems: Not for use in systems open to the environment – PAG's will wash away.

Work with a PAG vendor when specifying or converting oil based systems to ensure you take full advantage of the benefits PAG's have to offer. ■

Operational Risk Management
5-Step Process

- Identify hazards
- Assess Hazards
- Make Risk Decisions
- Implement Controls
- Supervise (Watch for Changes)

Navy Shore

Weight Handling Safety Brief!

Title: Synthetic Sling Use/Protection of Gear

Target Audience: All personnel who use synthetic slings

Thus far In FY11, ***10 damaged synthetic sling accidents have been reported where improper, inadequate, or no chafing material was used.*** ***Two*** **accidents resulted in dropped loads.** **Synthetic slings provide a much greater ease of handling when compared to wire rope or chain slings, but they are also very susceptible to damage and can be easily cut if used improperly.** **If synthetic slings are used improperly, or inadequate/improper chafing material is used, the consequences can be disastrous!** **Listed to the right are several synthetic sling use requirements and considerations:**

- **Use synthetic slings per the OEM and ASME B30.9 requirements.**
- **Chafing protection must be used where there is a possibility of slings being cut or otherwise damaged due to sharp edges, or configurations that could cause damage. Chafing protection material shall be of sufficient thickness and strength to prevent sling damage.**
- **Ensure the rigging configuration is stable and SLINGS CANNOT SLIDE OFF THE CHAFING protection material.**
- **Ensure sling capacities are adequate in the configuration used and consider the effects of sling angle stress when slings are used at angles other than vertical.**
- **Recognize that the edge need not be "razor" sharp to damage and cut the slings. Compression and tension, combined with a "moderate" edge and the sling skipping across the load edge, can result in sling damage.**

- **Remember, SYNTHETIC SLINGS ARE UNFORGIVING IF USED IMPROPERLY! Follow OEM requirements, and always use adequate chafing material to protect the rigging and load when rigging gear is subjected to hazards. Wear protection devices should be selected for the specific conditions of the lift!**

SAFETY

25 July 2011

Navy Crane Center 11-S-06

SHARE YOUR SUCCESS

We are always in need of articles from the field. Please share your sea stories with our editor nfsh_ncc_crane_corner@navy.mil.

WEIGHT HANDLING PROGRAM SAFETY VIDEOS

Accident Prevention, seven crane accident prevention lessons learned videos are available to assist activities in raising the level of safety awareness among their personnel involved in weight handling operations. The target audience for these videos is crane operations and rigging personnel and their supervisors. These videos provide a very useful mechanism for emphasizing the impact that the human element can have on safe weight handling operations.

Weight Handling Program for Commanding Officers provides an executive summary of the salient program requirements and critical command responsibilities associated with shore activity weight handling programs. The video covers NAVFAC P-307 requirements and activity responsibilities.

Mobile Crane Safety covers seven topics: laying a foundation for safety, teamwork, crane setup, understanding crane capacities, rigging considerations, safe operating procedures, and traveling and securing mobile cranes.

"Take Two" Briefing Video provides an overview on how to conduct effective pre-job briefings that ensures interactive involvement of the crane team in addressing responsibilities, procedures, precautions and operational risk management associated with a planned crane operation.

"*Safe Rigging and Operation of Category 3 Cranes*" provides an overview of safe operating principles and rigging practices associated with category 3 crane operations. New and experienced operators may view this video to augment their training, improve their techniques, and to refresh themselves on the practices and principles for safely lifting equipment and materials with category 3 cranes. Topics include: accident statistics, definitions and reporting procedures, pre-use inspections, load weight, center of gravity, selection and inspection of rigging gear, sling angle stress, chafing, D/d ratio, capacities and configurations, elements of safe operations, hand signals, and operational risk management (ORM). This video is also available in a stand alone, topic driven, DVD format upon request.

Note: ***"Load Testing Mobile Cranes at Naval Shore Activities"*** is currently being updated to address the new load test procedures in the December 2009 edition of NAVFAC P-307.

All of the videos can be viewed on the Navy Crane Center website: https://portal.navfac.navy.mil/ncc.

HOW ARE WE DOING?

We want your feedback on the Crane Corner.
Is it Informative?
Is it readily accessible?
Which types of articles do you prefer seeing?
What can we do to better meet your expectations?

Please email your comments and suggestions to ***nfsh_ncc_crane_corner@navy.mil***