THE CRANE CORNER

Navy Crane Center Technical Bulletin

http://ncc.navfac.navy.mil ***44th Edition - December 2004***

Editor: m_lstr_ncc_ccorn@navy.mil

A WORD FROM TOPSIDE

Sam Bevins

Fiscal year 2004 was another busy and productive year for the Navy Crane Center as we executed our primary mission of promoting safe weight handling operations at the global Navy shore activities. Despite the continued heavy weight handling workloads as a result of world events, Navy shore activities maintained the excellent safety record achieved in the past few years; reducing both the total number of shore activity weight handling equipment (WHE) accidents and the number of significant accidents (injuries, dropped loads, overloads, and two-blockings) from FY03.

Our emphasis on having activities report ALL accidents (no matter how minor) that meet our stringent definition of a WHE accident, our regular promulgation of accident lessons learned, our training initiatives, and our program of periodic audits of Navy shore activities support this continued positive trend and helps us identify and share lessons learned to prevent more serious accidents. Although the FY04 safety record is commendable, we continue to encourage our Navy shore activities to drive toward our ultimate goal of ZERO WHE accidents.

The positive trend in activity compliance with NAVFAC P-307 requirements continued in FY04 with 83 percent of the shore activities audited substantially compliant. When the audit program started in FY98, only 19 percent of the activities audited were in compliance. This metric is a positive indicator of the recognition by the activities — from the Commanding Officers down to the essential deckplate personnel who maintain and operate our cranes — of the importance of safe equipment and safe operations, and reflects the commitment of the claimants to provide the resources necessary for a successful weight handling program.

Navy shore activities maintained their high standard of equipment condition in FY04 with 76 percent of audit cranes found fully satisfactory. This metric is one of our indicators of the readiness of the equipment at Navy shore activities to meet Fleet weight handling requirements.

We made significant contributions to assist Navy shore activities in meeting mission requirements and maintaining Fleet readiness through the acquisition or reconstitution of WHE. Among several initiatives undertaken to improve our efficiency in meeting client needs, we expanded our contract toolbox by awarding a third multiple award contract. This vehicle provides more options to our clients covering various kinds of WHE including bridge cranes, jib cranes, monorails, hoists, wall cranes, and similar equipment for Navy, Marine Corps, and other Department of Defense agencies worldwide.

Inside This Issue

Training is a major contributor to the improvements that are being achieved by the Navy shore activities. Early this year, we distributed a training film on mobile crane operation safety. This film is used to enhance the crane operator safety training offered by the Navy Crane Center. Although mobile cranes

make up only 7 percent of the Navy's crane inventory, they are involved in 39 percent of Navy WHE accidents. This video provides an additional tool to reduce mobile crane accidents, which are frequently the most serious accidents reported.

With effective criteria management, training support, assistance in weight handling program management, engineering, inspection, and safety, and with the acquisition of new and reconstituted equipment, the Navy Crane Center stands ready to assist the Navy shore activities in their support of the Navy's ever increasing missions in today's challenging global environment. Safe and effective weight handling is an essential enabler of Fleet readiness.

HAVE YOU HEARD ABOUT?

A wide assortment of unique chain sling assemblies and chain fittings is available from a major chain manufacturer. The chain is made with round steel links of 4 to 22 mm diameter and load ratings of 0.6 to 20.0 tons. Four-leg sling assemblies are rated up to 56.0 tons. The material is tempered alloy steel with up to 30 percent higher tensile strength than the common quality chains, and minimum elongation of 20 percent. The chains and fittings are coated with a pink material that provides corrosion protection similar to galvanizing and serves as a heat indicator - it changes its color to various darker shades to record the maximum temperature to which the chain has been subjected, from 225 to 400 degrees Centigrade.

Some of the novel fittings include snag-proof hooks, overload indicating links, multi-functional identification tags, and chain-shortening hooks and claws. These fittings are designed for chains that comply with the DIN standard.

- Snag-proof hook. The hook is similar to the standard shape, but is equipped with a forged steel safety latch configured so that when it engages the hook tip, there is no hook tip protrusion to snag on any object it may contact.
- Overload indicating link. The link is in the form of a standard master link but includes two opposed prongs with a fixed gap between them. (See figure 1.) If the link - that is, the sling where the link is installed - is overloaded, the prongs close the gap and provide an immediate visual

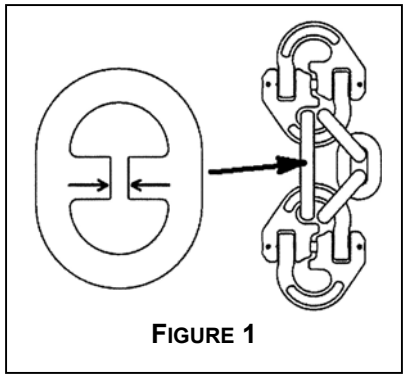

FIGURE 1

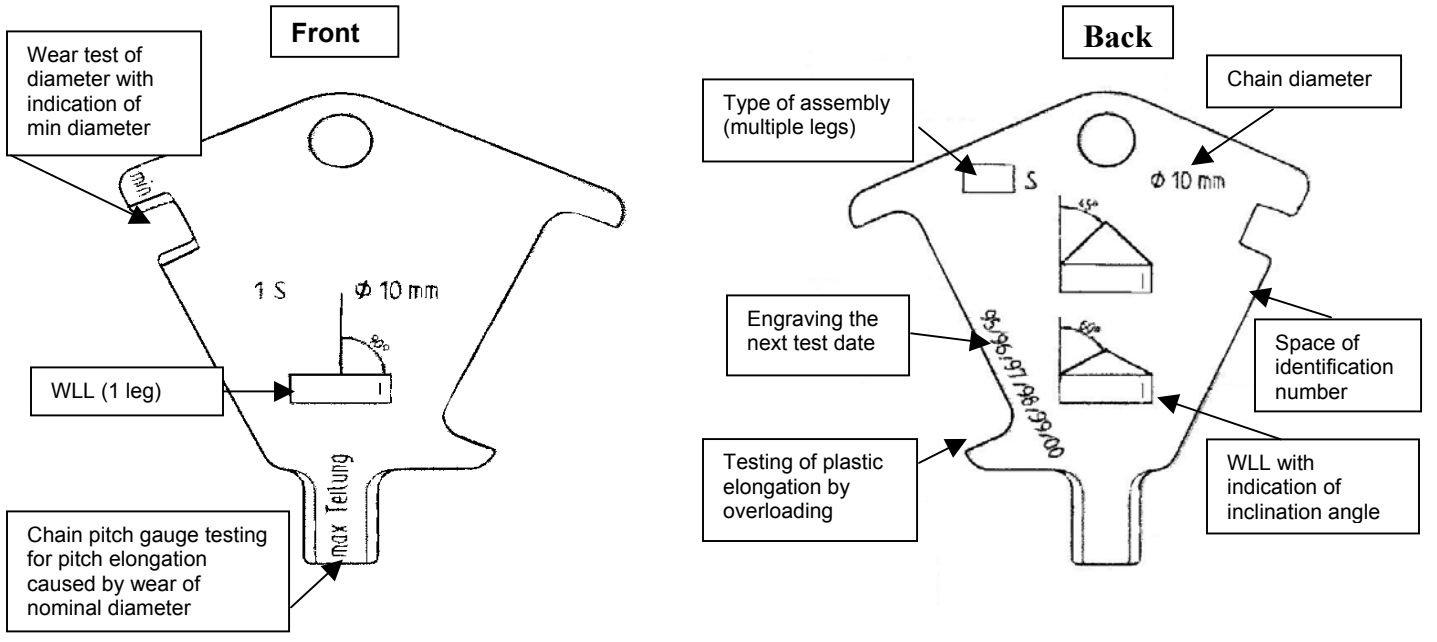

FIGURE 2

indication of the overload. The link is installed so that it spans three chain links, which provide a normal safe load path around a deformed link and the sling rating is not compromised.

- Multi-functional identification tag. The tag is a metal plate permanently attached to the master link of the sling assembly. It identifies the type of sling assembly; records the chain diameter, safe working loads for single-leg assembly and two-leg assembly at 45 and 60-degree inclination from the vertical, and provides space for engraving the sling identification number and the next test date. Additionally, the tag includes direct measuring gauges for wear and overload. (See figure 2.)

- Chain-shortening hook. The hook is configured to securely engage a chain link. It is attached to the sling by three chain links near the master link end of the sling assembly. To shorten the sling, the hook is inserted into any suitable chain link to obtain the desired shortened sling length or to form a choke hitch. The safe working load of the sling is not affected. (See figure 3.)

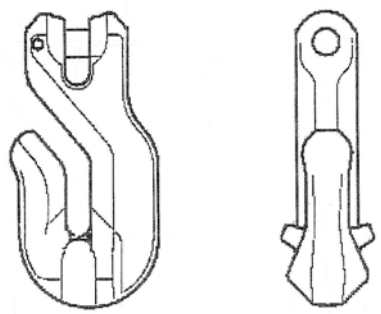

FIGURE 3

- Chain-shortening claw. This fitting is available in closed and open configurations. (See figures 4 and 5.) One end of the claw is permanently pinned to any chain link and the other (movable) end can engage any other link to shorten the sling. The closed configuration has a movable end that fully encloses the chain; the open configuration has a slotted movable end. The movable end of either configuration is locked in the engaged position by a spring pin. The engaged claw does not affect the safe working load of the sling.

FIGURE 4

Specialty fittings. These fittings are too numerous to describe in detail, but they include:

- Self-locking hook. Can be opened only when unloaded, has no protruding hook tip.
- Non-conductive (electrically isolating) latch up to 1000 volts. For welding on suspended loads.
- Balancing assembly. Allows the chain to roll over to equalize the load on both legs of the sling.
- Container hook. Similar to a container twist lock.
- Container hook. Wide-throat configuration to engage twist lock pockets of containers.
- Socket connector. For use when only the center bores can be used for lifting, custom machined to specifications.
- Balancing head. Short beam to equalize two legs of four-leg sling assemblies.
- Swivel connector for hooks. With sealed ball bearing.

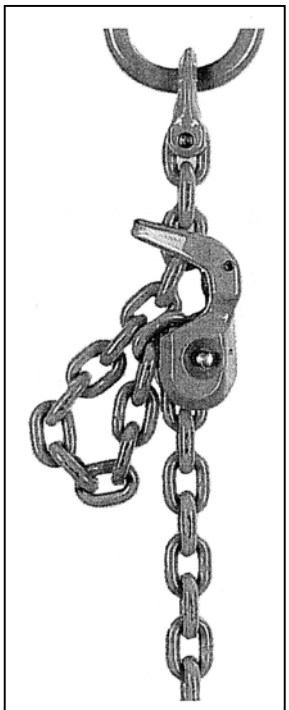

FIGURE 5

SHARE YOUR SUCCESS

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

CRANE SAFETY FOR THE NEW YEAR

Historically, January has been a bad month for Navy weight handling equipment accidents. Typically, crane operation tempos pick up after an extended holiday break. The combination of an increased lifting and handling tempo following extended leave very likely contributes to the high number of accidents in January. Your response to the 2004 safety reminder was outstanding. January 2004 was the best January on record. The number of reported accidents was slightly over half the number for the previous January. While commendable, we can do better.

With the coming of the new year, all weight handling managers must intensify emphasis on crane operation safety as crane teams return from leave and pick up the pace of lifting and handling operations. In FY04, 97 percent of the accidents were attributable to human error and more than one-third of the accidents occurred with no load on the hook. With a heightened safety awareness (even when operating unloaded cranes), an ingrained philosophy of operational risk management, and a commitment to safety by all, you will improve on the record you set this past January. Please share this message with all personnel involved in weight handling operations and encourage them to continue striving for our ultimate goal of zero accidents.

Weight Handling Program Films

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. The video is available at http://dodimagery.afis.osd.mil/ (DAVIS/DITIS) (PIN 806467) in VHS, CD-ROM, and DVD.

Load Testing Mobile Cranes at Naval Shore Activities provides load test personnel guidance on properly testing mobile cranes per NAVFAC P-307. The video is available at http://dodimagery.afis.osd.mil/ (DAVIS/DITIS) (PIN 806634) in VHS, CD-ROM, and DVD.

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. The video is available at http://dodimagery.afis.osd.mil/ (DAVIS/DITIS) (PIN 806721) in VHS, CD-ROM, and DVD.

As a reminder, crane accident prevention lessons learned videos were distributed to all activities. These videos provide stark reminders of the risks involved in every lifting and handling operation. Additional copies are available by emailing m_lstr_ncc_ccorn@navy.mil.

CATEGORY 3 CRANE SAFETY COURSE ON NAVY KNOWLEDGE ONLINE

NAVFAC P-307 requires operators of category 3 non-cab operated cranes to successfully complete the Category 3 (Non-Cab) Crane Safety course. As a cost-effective alternative to classroom training, the Navy Crane Center in cooperation with the Naval Education and Training Center has developed and posted this course on Navy Knowledge Online (NKO), www.nko.navy.mil.

Register and then log on with your user name and password. The log on takes you to the home page.

- Launch Navy E-Learning. (This link is in the left hand column under Get Started.)
- Go to Navy Crane Training, Category 3 (Non-Cab) Crane Safety, Enroll Now, Launch.
- From the course viewer, open the first icon to open the Welcome module.
- After completing a module and successfully completing the module quiz, close that module. You can then select the next module. If you close NKO and return, your course information will be bookmarked. To return, log on, launch Navy E-Learning, go to My Enrollments and Launch.
- After completion of all 12 modules and the final exam, return to the Navy E-Learning home page to print your certificate. Go to My Transcripts and Certificate. Verify your printer is set for landscape and print your certificate.

Other courses required by NAVFAC P-307 will be added to NKO as they are completed.

WEIGHT HANDLING PROGRAM AUDITS

SECNAVINST 11260.2 directs the Navy Crane Center to audit Navy shore activity weight handling (WH) programs annually or biennially, as appropriate, to ensure compliance with NAVFAC P-307. The audits will be conducted per procedures contained in NAVFACINST 11200.33D.

Approximately 45 days prior to the scheduled date, activity WH program managers will be contacted by an audit team leader to request pre-audit information and to establish the in and out-briefs with the commanding officer, certifying official and other key WH program personnel as appropriate. The audit will include a detailed review of all WH program elements including inspection, testing, certification, maintenance/repair, operations, licensing, safety, accident reporting, engineering support, rigging, crane records/documentation, and training. A random sample of cranes will be selected for condition inspection by the Navy Crane Center and load test by the activity crane team. Certifying officials should be prepared to discuss initiatives planned or taken to prevent crane accidents, effective weight handling equipment inventory utilization, actions taken upon receipt of Navy Crane Center messages, and receipt and utilization of Navy Crane Center safety videos. For activities using contractor-operated cranes, the audit will include contracting officer compliance with NAVFAC P-307, paragraph 1.7.2, and contractor reported crane accidents. In addition, certifying officials are requested to share any WH program cost saving initiatives implemented by the activity which could be exported to other naval activities, including improvements to efficiency and cost effectiveness realized through the reduction from active inventory of underutilized weight handling equipment.

Some activities whose WH programs are centrally managed by a regional command will be audited in two phases. The object of the initial phase will primarily be to globally assess the effectiveness of the regional command in those program elements for which WH services are provided (e.g., inspection, testing, certification, maintenance/repair, licensing, engineering support, crane records/documentation). The second phase will audit the activity's effectiveness in the remaining WH program elements for which the activity retains primary responsibility (e.g., crane operations, rigging/ rigging gear documentation, safety/accident reporting, training).

It is very important to the successful and efficient completion of the audit process that all key activity WH program personnel (including contractors) be available upon arrival and throughout the duration of the audit. It is essential that the activity provide the necessary logistical and administrative support since the duration of the audit is five days or less. This includes means of safe access to the cranes selected for inspection. A list of complete support requirements will be requested in the formal audit notification letter.

Activities will provide pre-audit information, in electronic format, as follows:

- Self-assessment questionnaire. (The self-assessment is available in the Download section of http://ncc.navfac.navy.mil. The self-assessment must be completed and returned approximately 30 days prior to the audit. Audit results continue to indicate that some self-assessments inaccurately reflect the activity's WH program status. Certifying officials are required to review and approve the self-assessment.)
- Detailed inventory of weight handling equipment.
- Crane data sheets.
- Rigging gear inventory.
- Activity points of contact.

In addition, information including the WH organization chart, all WH instructions, lockout/tagout procedures, internal audit reports, and activity training records must be available for audit team use upon their arrival on site.

To assist activities in improving their WH programs, a complete review of FY04 unsatisfactory crane results and other audit findings can be found in the audit report section of our website.

NAVY SHORE ACTIVITY WEIGHT HANDLING PROGRAM PROGRESS REPORT FY04

In FY04, 184 Navy shore activity crane accidents were reported to the Navy Crane Center. This represents a 40 percent reduction for crane accidents from our baseline year of FY99. Combined significant accidents of personnel injuries, dropped loads, and two-blockings continue to be a relatively small percentage of total accidents. With the recent change in mishap classifications, 12 crane accidents met the threshold for reporting to the Naval Safety Center. To maintain our focus on safety, we have a very rigorous crane accident definition that includes essentially any unplanned event in a weight handling evolution whether or not injury or damage occurs, using the basic strategy that all accidents (regardless of severity) must be reported to ensure we benefit from the lessons learned. A definition was added to NAVFAC P-307 for rigging gear accidents. These are accidents occurring during rigging operations when cranes are not used. In FY04, 28 rigging gear accidents were reported.

While this record is good, especially in light of the continued increased tempo of weight handling operations in FY04 due to world events, there remains room for significant improvement. Human error increased to 97 percent as the leading cause of accidents during FY04. Using operational risk management principles, as prescribed in the OPNAVINST 3500.39, should help drive these numbers down. Additionally, the Navy Crane Center provides quarterly summaries and important lessons learned for significant accidents. FY04 crane accident information is available at our web site, http://www.ncc.navfac.navy.mil/, under Crane Safety.

Contractor crane accidents are still a serious problem. As in previous years, most of the contractor crane accidents reported were serious and included three tipped cranes, four dropped loads, two overloads, three two-blockings, and three injuries (one very serious injury). We must have thorough reviews of contractor critical lift plans and effective surveillance of contractor crane operations by knowledgeable personnel. This is essential if we are going to reverse this trend.

As reported by our audits in FY04, 83 percent of the shore activity weight handling programs were substantially in compliance with NAVFAC P-307. For those few activities that have failed to improve or have slipped back to deficient programs, we recommend requesting weight handling equipment services from a capable regional service provider were feasible.

In FY04, 76 percent of audit sample cranes were satisfactory. Deficient brakes accounted for 27 percent of the unsatisfactory cranes. Increased emphasis on brakes, establishing safe brake setting ranges, and improved knowledge of brake adjustments should reduce these occurrences. Load test deficiencies accounted for 10 percent of the unsatisfactory cranes, due to problems relating to incomplete testing, insufficient test loads, or not retesting upon removal/replacement of load bearing parts.

While activity rigging programs continued to show overall improvement, the audit teams found deficiencies at 60 of the 153 activities audited. The most significant number of deficiencies involved rigging gear available for use with expired re-inspection due dates or gear not yet placed into the activity's controlled program. Although the percentage of defective rigging gear (4 percent) was low, its criticality for safe weight handling operations warrants more stringent inspection procedures to ensure that only defect-free rigging gear is available for use. A complete review of FY04 unsatisfactory crane results and other audit findings can be found under Audit Report at our web site, http://www.ncc.navfac.navy.mil/.

Although shore activities have made significant progress in reducing weight handling equipment accidents in the past six years, all activity commanding officers and weight handling managers must apply the initiatives outlined SECNAV message 151652ZJUL2003, Reducing Mishaps, and continue to pursue the goal of reducing weight handling equipment accidents by 50 percent by the end of FY05. With commitment from activity leadership, this goal can be achieved. In addition to working hard to achieve this near term 50 percent accident goal, all of us should continue to strive for our ultimate goal of zero crane accidents. Each accident diminishes support to the fleet. ■

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-112D: Failure of Westmont 100-Long Ton Floating Crane Hoist Motor Assembly and Mounting Capscrews.
CSA-138: Anti-Two-Block Devices On Auto Crane Category 4 Cranes.
CSA-139: Key Failure on a P&H Bridge Crane with KR-10 or K-10 Hoist Unit.
CSA-140: Failure of Foot-Operated Crane Control Interlock to Prevent Uncontrolled Lowering During Operator Incapacitation.

EQUIPMENT DEFICIENCY MEMORANDA

EDM-069: Transfer Bridge Conductor Bar Section Failure.
EDM-070: Failure of GE Heavy Duty DC Contactor Due to Improper Reasssembly During Maintenance.
EDM-071: Excessive Wear on Plate Clamp Gripping Surfaces.
EDM-072: Failed Shaft Due to Excessive Brake Torque.

FOURTH QUARTER FY04 ACCIDENT REPORT

The Navy Crane Center disseminates crane accident lessons learned to prevent repeat accidents and improve overall crane safety. NAVFAC P-307 requires commands to submit to the Navy Crane Center a final, complete accident report (including corrective/preventive actions) within 30 days of an accident involving Navy-owned weight handling equipment, regardless of severity or type. This reporting requirement includes rigging gear accidents, i.e., gear covered by section 14 of NAVFAC P-307 used by itself in a weight handling operation. In addition, contracting officers are required to forward to the Navy Crane Center and the host activity reports of all contractor caused accidents including contractor caused accidents with Navy-owned cranes.

For the fourth quarter of FY04, 51 Navy WHE accidents (48 crane accidents and 3 rigging accidents) and 4 contractor weight handling equipment accidents were reported. Significant Navy accidents this quarter included four personal injuries, three dropped loads, five overloads, and one two-blocking.

PERSONAL INJURIES

Accident: A rigger sustained a laceration to a finger while landing a pallet jack onto a trailer. A total of six pallet jacks were to be moved from a ship to the bed of a tractor trailer. Four of the pallet jacks were of rigid construction and were moved without incident. The remaining two were an articulating type in which the configuration of the pallet jack's body changed when the unit was lifted and lowered. The rigger aboard ship noticed this as the first of this type was lifted but did not communicate this to the rigger-in-charge or the rigger positioned at the trailer. The remaining crane team members did not become aware of the configuration difference until the first of that type was lowered onto the trailer. During the lowering of the last pallet jack, the rigger at the trailer was using both hands to steady the load as it was lowered. When the pallet jack's wheels touched down onto the bed of the trailer, it changed configuration as the weight came off. The rigger's finger became caught in a pinch point between the two structural parts of the pallet jack.
Lessons Learned: Riggers must be alert for potential pinch points. Situational changes that may affect the safe handling of a load must be communicated to all crane team members as soon as they become known.

Accident: While a vacuum hose was being lifted to a ship in dry dock, the hose parted at one of the joints and fell to the ship striking two contractor employees. Three 50-foot sections of 8-inch vacuum hose were joined together by duct tape and a safety line, which was intended to keep the sections connected. After checking the areas joined together, the rigger used a nylon sling in a choker configuration approximately 15 feet from one end of the assembled sections. Each section weighed approximately 450 pounds. The load was raised and moved into position over the ship. Before the load could be lowered, it separated at the upper hose joint.
Lessons Learned: The rigger-in-charge must ensure the load to be lifted is properly secured for lifting and will not dislodge during the lifting operation. Additionally, personnel working in the crane operating envelope must remain alert at all times during lifting and handling operations and ensure that they are not under a suspended load.

Accident: A rigger sustained a laceration to a finger while attempting to adjust a strongback lifting device. In preparation for lifting a storage tank, the crane team riggers ascertained that the strongback required a configuration adjustment. None of the riggers had experience with this type of strongback and there were no procedures available detailing how to perform the configuration adjustment. The riggers incorrectly assumed that the adjustment characteristics would be the same as those on the type of strongback they had experience with. The strongback was attached to the crane when the riggers started to change configuration by moving the cross bar from one position to another. As the cross bar was moved, the center of gravity changed, causing the strongback to tilt. Although the riggers had anticipated this, and thought they could control the movement, they did not realize the cross bar would slide toward the end of the main beam at a speed they could not control. While attempting to stop the crossbar, one of the riggers inadvertently placed a hand into a pinch point resulting in the laceration of a finger.
Lessons Learned: The characteristics of rigging gear must be known and not assumed based on past experience. The rigger-in-charge must be aware that although rigging gear may look similar to gear previously handled, adjustment characteristics may in fact be different and require different procedures.

Accident: A diver's finger was severed while installing a propeller on a submarine. As the propeller was positioned onto the shaft, the angle was incorrect and the decision was made to remove the propeller to reposition it. During this operation, a diver's neoprene work glove became entangled on a stud. While attempting to pull his hand free, the glove's elasticity pulled his hand back to where a finger was caught between the propeller and the shaft. At that time, a water swell caused the propeller to shift, severing the finger. Although procedures for this evolution require calm waters and the water was calm prior to starting work, it was not possible to control swell action created by large ships using shipping lanes adjacent to where the work was accomplished. Additionally, movement of the propeller during the swell may have been intensified because a floating crane was being used to support the installation.
Lessons Learned: Personnel working in the crane operating envelope must remain alert to situational changes at all times during lifting and handling operations. Activities must practice operational risk management by investigating additional safe guards for this type of evolution, i.e., performing propeller work in protected waters, use of a crane from pier side, additional observers topside to identify incoming swells, etc.

DROPPED LOADS

Accident: A high pressure air compressor (HPAC) was being loaded onto a shipping skid when it was dropped causing significant damage to the HPAC. Although the HPAC was configured with four padeyes, one on each corner, and the rigger and crane operator had performed lifts of HPACs before, the rigger decided to use two 14-foot nylon slings and a strongback for the lift. The rigger ran the slings through the shackles on the strongback to terminate the ends of the slings at the four padeyes on the HPAC. The rigger essentially created an inverted basket configuration by using two long slings vice four shorter slings hooked to the padeyes. When the crane stopped traveling, the load shifted and the nylon slings rendered through the shackles on the strong back dropping the HPAC.

Lessons Learned: It is very important for the rigger to select the proper rigging gear and to choose the optimal pick points and securing method. Use of other than designed lift points must be confirmed by the cognizant engineering activity prior to attempting the lift. Additionally, the entire crane team is responsible for recognizing potential problems while working together to ensure safe crane operations.

Accident: A life raft, being lifted by a barge mounted crane, slipped from one of the two nylon slings and fell to the deck of the barge. Prior to starting the job, the rigger-in-charge requested an additional rigger to assist due to minimal experience in this type of lifting evolution. The request was denied due to lack of resources at the time. The life raft was rigged using two nylon slings in a basket hitch, one on each side. While the life raft was being lifted out of its rack, the rigger noticed that one end was coming up before the other end. This caused the life raft to rotate 90 degrees outward, coming to rest on an outside empty rack. One of the assigned riggers gave the stop signal and the crane operator stopped operations. As the life raft pivoted, a wave surge under the barge caused the hook to move up and down, causing one nylon sling to become slack, which allowed the life raft to slip out of the other sling and fall to the deck of the barge. One of the riggers had noticed that movement of the barge was increasing from swells, but failed to get the rigger-in-charge's attention and failed to stop the lift until the concerns were resolved.
Lessons Learned: A choker hitch with an additional strap attached horizontally between the two nylon slings would have prevented the slings from sliding off the load. Crane team members must take action to stop operations immediately when a possible safety hazard arises such as increase wave action. Additionally, management must ensure that only qualified, experienced personnel are assigned to a lifting evolution.

Accident: A trim and drain valve was dropped while being lifted out of a lathe, when the nylon sling parted. The valve was attached to a steel plate to help mount the valve to the lathe. The machinist ran the sling through two bolt holes on opposite sides of the valve body in a basket hitch configuration without any chafing material. The valve was lifted approximately 1-2 inches above the lathe and stopped. As the valve hung suspended, the sling parted and dropped the valve back onto the lathe. The machinist borrowed another nylon sling from a second machinist and continued the lift in the same manner. When the machinist turned the parted sling in to the weight test shop, the rigger accepting the sling recognized it as an accident and contacted the supervisor. Inspection of the second sling also revealed damage and it was removed from service.
Lessons Learned: Management must ensure that all applicable personnel are trained in proper rigging techniques and the use of chafing material on sharp edges. Following an accident or suspected accident, NAVFAC P-307 requires activities to stop work and promptly initiate an investigation. Management must ensure that all applicable personnel are trained on these requirements.

OVERLOADS

Accident: A category 3 crane was overloaded while removing a cylinder liner from a diesel engine in a power plant. The cylinder liner was being removed by repeatedly placing a strain on it with the crane while monitoring with a dynamometer in the rigging. The crane operator forgot that the crane's capacity was 10,000 pounds and was placing a strain on the cylinder liner upwards of 15,000 pounds.
Lessons Learned: Crane operators must be aware of the crane's lifting capacity and the reason for having a dynamometer in the rigging. Written procedures with specific stop points may be required for close tolerance lifts where the crane can be overloaded if the lift is not properly monitored. Lifts exceeding 80 percent of the crane's capacity are considered critical lifts and require additional procedures and cautions in accordance with NAVFAC P-307.

Accident: During a recent Navy Crane Center audit, auditors found that a mobile crane's test load had exceeded the NAVFAC P-307 allowable load during testing. While calculating the test load, the test director used a poor quality copy of the load chart and misinterpreted the 9,000-pound capacity as 9,900 pounds. Neither the test director nor the certifying official, who was present at the time of testing, questioned the calculated test load weight when compared to previous certifications.

Lessons Learned: Management must ensure that personnel are qualified for their assigned duties and that cranes are inspected and tested in accordance with the requirements of NAVFAC P-307.

Accident: A sling was overloaded and an engine damaged while attempting to move the engine. The crane team attached the sling to the lifting points on the engine. Their supervisor instructed them not to proceed until he returned. Neither the operator nor the rigger had prior experience with this type of lift. While the supervisor was absent, the rigger and operator decided to take the next step required by the technical manual, which was to take tension on the engine sling prior to removal of the engine mounting bolts. Not knowing the amount of tension to apply, the crane operator with the concurrence of the rigger continued applying tension until the sling attachment bolts snapped damaging the sling and the attached engine parts.
Lessons Learned: It is imperative that all crane team members adhere to the pre-lift brief and instructions for the lift.

Accident: A weapons handling assembly, with a 10,000-pound load limit was overloaded while removing a test weight (shape) used to perform tests on a submarine weapons shipping system. The rigging gear and weapons handling assembly had a load indicating device (LID) incorporated, and a 9,600-pound lifting force had been established for removal. While attempting to remove the shape, the LID spiked from 6,600 pounds to 14,800 pounds, at which time the lift was stopped. Upon investigation, it was determined that during lowering of the shape, the nosepiece assembly came into contact with the rubber covering of the track. During movement of the shape, the contact had caused the rubber to tear and pile up under the shape causing it to roll to one side. With the shape no longer centered on the track, its clearance was significantly reduced for movement, causing it to jam against a positioning mount, stopping the movement of the shape. Although there were contractor and ship's personnel who had performed the testing positioned in the hull, there were no riggers in position to properly witness the lift.
Lessons Learned: Qualified personnel must be in proper position to observe all aspects of the lift looking for possible interference. The LID should be continuously monitored while lifting through tight clearances in a slow controlled manner (using a manual chainfall if needed to avoid an overload).

Accident: A crane's 30,000-pound capacity whip hoist and the rigging gear attached to the crane were overloaded while attempting to remove a hydrostatic test dome. The crane team was informed that the test dome was ready for removal from a missile tube. The rigger-in-charge had not performed this type of work before and relinquished control of the lift to the crane rigger who had previous experience. At one point in the lifting evolution, it was noted that the battery of a load indicating device (LID) that was hung on the crane was weakening. Since the test dome weight was verified to be 14,600 pounds, it was decided that the LID was not needed and the LID read out was removed. The crane rigger directed the crane operator to "come up easy" and the test dome appeared to raise approximately 1/8 inch and then stop. The operator inquired as to the LID reading and was informed the read out was removed for charging. At the operator's request a rigger apprentice retrieved the read out and turned it on briefly to see a reading of 57,050 pounds. The apprentice then gave the read out to the crane rigger who turned it on and saw the same reading but informed the operator, rigger-in-charge and the rigging supervisor that the read out showed 17,000 pounds. It was decided that the dome was not ready to lift since it did not lift at the expected 16,000 pounds (which included the weight of the rigging gear). The supervisor, not knowing of the overload, directed the crane team to other work planned for the day. Later in the day, upon learning the capacity of the whip hoist, the rigger apprentice informed the rigging supervisor that the read out had read 57,050 pounds. The rigging supervisor stopped work and reported a possible overload. During the investigation, a number of factors were attributed to this accident. The test dome had not been completely vented as required, approved procedures were not followed, there were no test dome removal instructions identified in the procedure, the rigger-in-charge did not actively take part in the evolution, and the crane rigger knowingly made false statements attempting to obscure the fact that an overload had occurred.
Lessons Learned: Complex and/or unique lifts increase the potential for problems and management must ensure that all required procedures are in place and understood during the pre-job brief before commencing a

lift. The rigger-in-charge must be actively engaged throughout the lifting evolution. Management must ensure that all applicable personnel are knowledgeable and responsible to stop all operations and notify the immediate supervisor upon having an accident.

TWO-BLOCKING

Accident: A category 3 bridge crane was two-blocked during its monthly documented pre-use check per NAVFAC P-307. The operator continued with the inspection and submitted the monthly checklist with all attributes marked satisfactory. The operator believed lifting light loads, less than 100 pounds, would be acceptable even if the crane had been damaged. During the following monthly pre-use inspection, the operator requested maintenance personnel inspect the crane for damage before lifting heavier loads. When maintenance personnel did not find any deficiencies, the operator explained that the previous month the wire rope had been spooling on top of itself and had two-blocked. An investigation revealed that the crane was being side loaded causing mis-spooling of the wire rope and the hoist block to be out of position of the geared limit switch.
Lessons Learned: Loads shall be lifted vertically only. Operators shall not allow side-loads to be applied to the hook. Following an accident or suspected accident, NAVFAC P-307 requires operators to stop operations and notify supervision. Management must ensure that all applicable personnel are trained on these requirements.

SIGNIFICANT RIGGING GEAR ACCIDENTS

Accident: A 2-ton hoist and wire rope pendants were overloaded, damaging the hoist lower hook and kinking the wire rope pendants during installation of a submarine fairwater crosshead assembly. When first identified, the damaged hoist was not reported. After the assembly was installed in the sail by a crane, 2 2-ton hoists and 2 wire rope pendants (capacities of 2,400 pounds and 3,950 pounds) were installed to support the installation. The weight of the assembly was thought to be approximately 3,800 pounds, however, the assembly weighed approximately 5,400 pounds. At one point in the installation, riggers made the decision to lower the angle of pull on the hoists to approximately 30 degrees to support the assembly. Although the rigging gear was not intended to support the full weight, the lower angle of the hoist and shifting of rigging gear may have allowed for tip loading of the hook, causing it to spread. The investigation revealed a number of factors contributed to the overload.

- No pre-job brief was conducted.
- Obstructions in the work area, which are normally removed, remained in place
- Locally developed installation procedures were used, which may have contributed to the overload by allowing the rigging gear to shift.
- During the pre-use inspection, it was noted that the safety latch on one of the 2-ton hoists was not working properly, but the hoist remained in service.
- When it was found that the hook on one of the hoists had spread, it was replaced with another hoist but the damage was not reported.

Lessons Learned: Management must ensure that formalized procedures are in place for complex rigging evolutions to include determining known weights of loads and conducting pre-job briefs. Additionally, riggers must be properly trained in the performance of pre-use inspection of rigging gear and the identification and reporting of an accident in accordance with NAVFAC P-307.

Accident: Part of a rigging gear assembly was overloaded during bolt removal. The removal of bolts from a component required 50 to 100 pounds of pull with 100 pounds set as the pull limit after the nuts were removed. The rigging gear assembly consisted of a chainfall, two load indicating devices (LIDs), shackles, wire rope slings, turnbuckle, and a fixture that attached to the bolts. The turnbuckle had a capacity of 200 pounds and the fixture had a capacity of 100 pounds. While removing one of the bolts, one LID reading increased to 240 pounds while the other increased to 296 pounds causing an overload to the turnbuckle and fixture. The apparent

cause was binding of the bolt, which was not discussed during the pre-brief or noted in the procedures for bolt removal.
Lessons Learned: Management must ensure that procedures address all aspects of the job and that they are discussed in the pre-brief.

CONTRACTOR SIGNIFICANT ACCIDENTS

Accident: During removal of sedimentation tanks, a category 4 crane was overloaded, sheared its mounting bolts, and toppled to the ground. Additionally, when the crane toppled, the operator fell from the operator's platform to the ground knocking the wind out of him. Previously, removal of sedimentation tanks had been accomplished by locating the crane on the side of the tank and backing a lowboy trailer under the tank after it was lifted. Because of an inoperable truck, the operator decided to load the tanks onto the stationary trailer. This required the crane to lift the load at a greater radius and then to rotate the load to the trailer. The maximum capacity of the crane at a 30-foot radius is 4,200 pounds. The operator believed the tank weighed less than this. However, after the accident, it was determined that the tank weighed approximately 7,950 pounds.
Lessons Learned: Operators must ensure that the weight of loads are known and not assumed. Additionally, when proven methods of performing a lift requires changing, the cognizant supervisor must give approval prior to executing the lift.

Accident: While lifting a high-reach manlift from a barge, the manlift rolled over due to improper rigging. A rigger attached the rigging gear to what was thought to be the manlift pick points. To do this, the manlift boom was rotated over the side. The manlift was lifted approximately one foot off the barge and held for ten minutes to check stability. Although the crane operator and another rigger on-site were unsure of the lift, they began to hoist again and the manlift rolled over to the boom side. During the investigation, it was learned that the rigger who connected the manlift had no experience in this type of lift. The operator's manual stored on the manlift showed the proper pick points and lift procedures, but was not reviewed by the personnel on-site.
Lessons Learned: Management must ensure that only qualified personnel are assigned to a lifting evolution. The rigger must have the knowledge to select the proper rigging gear and pick points for lifting the intended load. Established lifting procedures must be reviewed and followed. Most important, when any member of the crane team has doubts concerning the safety of a lift, all work must stop and the process reviewed before continuing the evolution.

Accident: While lifting scaffolding to a ship, a mobile crane was overloaded and tipped over. The crane received extensive damage. Damage also occurred to the scaffolding, the pier, and ship-to-shore utility cables. The operator planned the lift based on a previous lift of similar scaffolding weighing approximately 1,260 pounds. The lift required a boom length of 80 feet at a 65-foot radius. In this configuration, the capacity of the crane is 3,060 pounds minus appropriate deductions. During the investigation, the owner of the scaffolding provided an estimated weight of 4,700 pounds.
Lessons Learned: Operators must ensure that the weight of the load is known and not assumed.

Accident: While attempting to upright the mobile crane noted above, a sling parted dropping the mobile crane boom back onto the pier. A synthetic roundsling was placed around the boom of the tipped mobile crane in a choker configuration without any chaffing material. As the crane was being uprighted, the sling parted due to the sharp edges of the boom.
Lessons Learned: Management must ensure that all applicable personnel are trained in proper rigging techniques, the selection of proper rigging gear, and the use of chafing material on sharp edges.

Weight handling program managers and safety officials are encouraged to consider the potential risk of accidents occurring at your activity similar to those highlighted above and apply the lessons learned to prevent similar accidents. OPNAVINST 3500.39, Operational Risk Management, prescribes methods for assessing hazardous operations, which should be used in the planning and preparation of all WHE lifts.

E-mail submission (m_lstr_ncc_safty@navy.mil) of reports of accidents, unplanned occurrences, and near misses is encouraged. The reports must include a complete and concise situation description, corrective and preventive actions, probable cause and contributing factors, and an assessment of damage. For equipment malfunction or failure, include specific description of the component and the resulting effect or problem caused by malfunction or failure.

NAVY CRANE CENTER

OFFICE HOURS: MON-FRI 0630-1730

PHONE: DSN 443-0505
COMMERCIAL (610) 595-0505

FAX: CONTRACTS/PROJECT MGMT 0747
DIRECTOR 0748
ENGINEERING 0749
FIELD SUPPORT 0812