

DoD Ergonomics Working Group NEWS



Issue 113, February 2011

www.ergoworkinggroup.org

BEST PRACTICE AWARD WINNER

Navy Southwest Regional Maintenance Center: Ergonomics + NAVFAC = A Tight Ship

Southwest Regional Maintenance Center (SWRMC) is the Navy's largest Shore Intermediate Maintenance Activity and the second largest ship repair facility in the Southwestern United States. SWRMC employs some 2,200 military and civilian personnel across 70 industrial work centers.

One group of SWRMC personnel is charged solely with the maintenance and repair of accommodation (ACCOM) ladders (also known as anchored ladders) and watertight fixtures (i.e. doors, scuttles, hatches) for ships home-ported in San Diego. Ladders and fixtures are serviced when a ship returns to port; the time between services varies based on the mission.

Repair technicians have the potential to be exposed to a number of hazards when repairing and maintaining the ACCOM ladders, including the intense light created by arc welding and very hot materials. Until recently, they were exposed to high forces when lifting ACCOM ladder components and turning the ladders and non-neutral postures during repair and maintenance tasks.

Personnel previously placed the ACCOM ladders on sawhorses to perform maintenance work and repairs. SWRMC personnel identified this arrangement as unsuitable and unstable with the potential to fall over. After an initial ergonomics site visit, SWRMC personnel practiced participatory ergonomics by designing a ladder turning fixture. The worker-based design was used as a foundation for the final holding device.



Fully assembled accommodation ladder staged after repair.



Watertight fitting

Continued on page 2

The ladder assembly as a whole was difficult to work on. It had to be manually turned to allow personnel to work on its underside. Workers exerted unacceptably high forces when performing this heavy lifting task.

Personnel were required to bend, stoop, twist, and kneel during the preventive maintenance (PM) process to access all sides of the ACCOM ladder. Short, infrequent exposure to non-neutral postures are typically tolerated by the workforce where long exposures can cause injury.

The combination of heavy lifting and sustained non-neutral postures placed those working on ACCOM ladders at an increased risk of developing work-related musculoskeletal disorders (WMSDs) of the spine or shoulder. These disorders can be caused by exerting high forces that can contract muscles to their maximum capability, leading to fatigue and possible damage to the muscles and other soft tissues. Lifting outside of one's power zone (e.g., from knees to shoulders) increases stress on the spine. SWRMC personnel noted these postures when turning the heavy ACCOM ladders.



Before: Non-neutral working posture was quite common during welding tasks on the ACCOM ladders.

SWRMC's safety department contacted the Naval Facilities Engineering Command (NAVFAC) after a safety inspection revealed their potential ergonomics hazards. NAVFAC manages the Chief of Naval Operations' (CNO's) Mishap Prevention and Hazard Abatement (MP/HA) program, which provides assistance in improving the work process in order to reduce the risk of injury.



After: Rotating ladder fixture orients easily into the position that best suits the worker and the task whether it be welding or bolt removal, continually fitting the task to the person.



After: Rotating ladder fixture allows one worker to safely turn the ladder and lock it into place. The ladder system saves time and effort, and reduces the risk of injury and equipment damage.

The NAVFAC MP/HA Team assessed the ACCOM operation, discussed potential resolutions with SWRMC personnel, and generated a detailed report. An MP/HA project was subsequently developed, submitted, and funded in April of 2009. The funding was used to design and fabricate a rotating ladder fixture, which eliminated the need to man-handle the ACCOM ladders, and greatly reduced the requirement for sustained non-neutral postures.

Although heavy lifting and somewhat non-neutral postures are inherent to ACCOM ladder repair, the use of the ladder fixture has greatly reduced the severity and frequency of the exposure to these ergonomic stressors.

The ladder fixture was provided to the shop along with additional tooling to assist personnel with the removal of seized parts on the ACCOM ladders and watertight fixtures. Designing the tooling was no small task due to the numerous positions and sizes of these parts which included a variety of bolts, bushings, and pins, many of which were one-of-a-kind.

Successful completion of this project has saved a considerable amount of time and effort during the PM of ACCOM ladders and watertight fixtures.

From 2005 through September of 2010, there were seven reported mishaps:

- Five mishaps related to sprains/strains (multiple body parts)
- One mishap related to cuts/lacerations
- One mishap related to contusion/bruises (both while using tools)



Previously seized bolts/bushings/pins were removed with an impact hammer or by manually hammering them out. Blunt impact, both first aid and lost workday injuries, occurred from the manual method.



After: The stanchion removal tool effortlessly pushes the bolts free and eliminates the manual method.



Examples of brass bushing (left) and hinge (right) on a watertight fitting reworked during repair process.

Using the average total cost per claim by nature of the injury data as published in the National Safety Council's "Injury Facts" 2010 edition (page 58), the table below summarizes the assumed direct costs incurred due to injuries.

Nature of Injury	Cost Per Claim	# of Injuries	Direct Cost
Sprain/Strain	\$19,507.00	5	\$97,535.00
Cut/Laceration	\$17,239.00	1	\$17,239.00
Contusion/Bruise	\$17,870.00	1	\$17,870.00
Total Direct Cost			\$132,644.00

Indirect costs are calculated using the index from Liberty Mutual* that estimates businesses are faced with between \$2 and \$5 of indirect costs for each \$1 of direct costs. Three dollars of indirect to every direct dollar was used for this project.

- Direct cost: \$132,644.00
- Indirect cost: \$397,932.00
- Total injury costs: \$530,576.00

Injury cost averaged over 6 years = $\$530,576.16 \div 6 = \$88,429.00$ per year.

Return on Investment Calculation

- Pre-intervention annual injury cost = \$88,429.00
- Post-intervention annual injury cost = \$0
- Annual cost difference (savings if injuries are avoided) = \$88,429.00
- Expected tool service life = 10 years
- Improvement investment = \$377,000.00

10-Year Cost Savings: \$507,290.00

10 (annual cost of pre-intervention) – [improvement cost + {10 (annual cost of post-intervention)}] =
 10 (\$88,429.) – [\$377,000. + {10 (\$0.)}] = \$507,290.00

The improvement breaks even in 4.3 years.

Improvement cost / annual cost savings = $\$377,000 \div \$88,429 = 4.26$ years

The calculations do not take into account the time savings and product quality improvement from using the solutions provided to the shop through MP/HA.

*Liberty Mutual Work Place Injury Data, April 2002 (<http://www.ergoweb.com/news/detail.cfm?id=569>).



More information on ergonomics and the technical support available through the MP/HA Program can be found on the NAVFAC Ergonomics website at www.navfac.navy.mil/safety (select "Ergonomics").