

## Naval Facilities Engineering Command Ergonomic Risk Assessment

### Introduction

This report summarizes the ergonomic risk assessment conducted in September and November of 2003. The Wire Rope, Diesel Engine, and Motor Rewind Shops were observed in order to determine sources of ergonomic stress and recommend improvements. This assessment is based upon interviews with supervisor, safety specialist, and employees as well as an evaluation by the Naval Facilities Engineering Command (NAVFACENGCOM) Hazard Abatement Ergonomist.

The Job Requirements Physical Demands Survey (JR/PD), an ergonomic survey, was also administered to the employees. The results of the JR/PD indicate the Wire Rope Net Shop as an ergonomic problem area with a score of **8** on a scale of 1 to 9 where 9 is a maximum value. The JR/PD assesses five distinct body regions: shoulder/neck, hand/wrist/arm, back/torso, legs/feet, and head/eyes based upon identified ergonomic risk factors and employee reported discomfort. For the Wire Rope Net Shop, the shoulder/neck, hand/wrist/arm, back/leg, and head/eye regions were found to have significant ergonomic risk. Ergonomic risk is based upon ergonomic stressors associated with the task and employee discomfort. A significant number of employees reported experiencing work-related pain or discomfort that does not improve when away from work overnight or over the weekend and interferes with normal activities. Over half of the employees have seen a health care provider in the past 12 months for pain or discomfort that he/she feels is related to the job. A significant number of employees also reported pre-existing MSDs which places them at a higher risk of additional or more severe WMSDs.

According to the JR/PD results, the Diesel Engine Shop, Motor Rewind Shop are not Ergonomic Problem Areas, with scores of **2** and **1** respectively. These areas will not be addressed in this ergonomic assessment but employee suggestions covered new, durable, electric and pneumatic tools appropriate for the task.

The shops were observed in order to determine sources of ergonomics stress and make recommendations to reduce the risk of work-related musculoskeletal disorders (WMSDs) and improve safety, health and productivity. Musculoskeletal Disorders (MSDs) are injuries and illnesses that affect muscles, nerves, tendons, ligaments, joints, spinal discs, skin, subcutaneous tissues, blood vessels, and bones. Work-Related Musculoskeletal Disorders (WMSDs) are:

- Musculoskeletal disorders to which the work environment and the performance of work contribute significantly or
- Musculoskeletal disorders that are aggravated or prolonged by work conditions.

Recommendations to the command to further reduce the probability of injury for workers in the Wire Rope Shop include new equipment<sup>i</sup> and administrative controls<sup>ii</sup>.

Recommendations are included with as much vendor information<sup>iii</sup> as possible to assist in the evaluation of products and services. Input gathered from the workers, safety specialists, and other personnel to evaluate equipment before purchasing is recommended. This process will increase product acceptance, test product usability and durability, and take advantage of employee experience.

The command may request additional funds from the Chief of Naval Operations (CNO) Hazard Abatement (HA) Program to abate the risk of injury. Naval Facilities Engineering Command (NAVFACENGCOM) manages the CNO Hazard Abatement Program, which is a centrally managed fund to correct safety and health deficiencies beyond the funding capabilities of the activity. Information about the HA program can be found on the Naval Facilities Engineering Command web site [www.navfac.navy.mil/safety](http://www.navfac.navy.mil/safety) and in OPNAVINST 5100.23F. Ch 12 Hazard Abatement. The deadline for submission is March 15, 2004.

## Wire Rope Shop

Purpose of the Operation: Fabricate wire rope nets

Population: 12 active duty personnel

Injury Data: According to the Job Requirements and Physical Demands Survey results, 8 of the 12 employees have visited a health care provider for pain/discomfort that he/she feels is related to the job in the last 12 months.

### Description of the Operation:

Employees fabricate and weight test wire rope nets used on flight decks. Employees fabricate about 15 wire rope nets per week. The employees sit on the floor and wrap wire ropes around bolts on forms to lay out the net pattern, as shown in figure 1. The nets are then picked up and placed on a table 27" in height. The wire ropes are secured at each intersection with a two piece star-shaped fastener. The bottom of the star fastener is placed into a 50 lb. die block. Two wire ropes are laid across the bottom fastener and the top fastener is placed over the intersection. A metal insert is placed on top of the die block. The employee uses a 3 lb. sledge hammer to contact the insert; thereby, securing the star fastener around the crossing of the two wire ropes and creating a secure junction, as shown in figure 3. The die block is then picked up and placed under the next wire crossing. The edges of the wire rope nets are secured with cylindrical fasteners which are crimped with a 30 lb. crimping tool. An 8' x 8' net weighs about 60 lbs and is lifted off the table and stored prior to transportation to the flight deck.



Figure 1: Laying out wire rope on the floor



Figure 2: Using a sledge hammer to create a wire junction



Figure 3: Star and Cylindrical Fasteners

Ergonomic issue description:

**Repetitive Motions and Static, Awkward Postures:**

Laying out the wire rope net pattern on the floor requires the employees to assume awkward postures while repetitively weaving rope. Awkward postures combined with high repetition can fatigue muscles and cause the employee to exert more force than is necessary. Sitting and kneeling on the floor creates biomechanical stress on the knees and requires the workers to bend over to lay out the nets. Maintaining an awkward posture such as sitting cross legged or kneeling can create static loading on the leg muscles. Static postures increase loads or forces on the muscles and tendons needed to maintain those postures, which contributes to fatigue. Fatigue is a pre-cursor to WMSDs. Muscles require movement in order to allow blood flow. Blood flow brings nutrients to the muscles and carries away the waste products of muscle metabolism. Employees were found bending their torso while weaving nets and attaching fasteners which can place strain on the lower back, especially when combined with high force exertions such as swinging a sledge hammer from an awkward posture.

**High Force Exertion:**

Employees exert heavy forces in awkward postures while picking up nets, moving around 50 lb. die blocks, swinging a sledge hammer to attach fasteners, and using a 30 lb. crimping tool. Lifting heavy loads and repetitively exerting high forces can cause fatigue and strain in the upper extremities and back which can lead to a WMSD.

**Recommendations**

- Provide a worktable for assembling and fastening wire rope nets. A local Naval Shipyard performs the same operation upon a table with a metal frame and wooden top that has built in die blocks to eliminate laying the net pattern on the floor and then picking it up and placing it on the table. A table will eliminate awkward postures during pattern layout, lifting nets and moving the 50 lb die blocks. In addition, a table that is positioned at the proper height will reduce some of the forward bending.

- A new tool that automatically delivers the blow for attaching the star fasteners would eliminate use of the 3 lb. sledge hammer. Refer to Table 1.
- A short term solution would be tool stools, knee pads and foam wedges to reduce the biomechanical stress to the knees and ankles from kneeling and sitting on the floor during the layout process. Refer to Table 1.
- Anteon manufacturing is going to build a table with built in template for the wire rope nets and attach a pneumatic tool for fastening.

<b>Table 1: Knee protectors</b>				
<b>Description</b>	<b>Vendor</b>	<b>Product</b>	<b>Estimated Cost</b>	<b>Figure</b>
Fastener	Jarvis 860-347-7271	USSS-1 - pneumatically operated high speed captive bolt stunner for cattle	\$6000	
Knee protectors	Alimed <a href="http://www.alimed.com">www.alimed.com</a> 1-800-225-2610	Knee pad JA70039 JA70041	\$19-\$23/pair	
		Knee Saver JA62161	\$40/pair	
	Lab Safety 1-800-356-0783	Bevco Repair Stool	\$149	
	C&H Distributors 1-800-558-9966	Bevco Repair Stool	\$153	
	Grainger <a href="http://www.grainger.com">www.grainger.com</a>	Tool Trolley Stool	\$166	

\*Some information has been removed from this report that is specific to the activity.

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<sup>i</sup> Equipment purchase without proper and repeated training will not mitigate risk and may in fact increase hazards.

<sup>ii</sup> Administrative controls are management-controlled work practices and policies designed to reduce exposures to work-related musculoskeletal disorders (WMSDs) hazards by changing the way work is assigned or scheduled. Administrative controls reduce the exposure to ergonomic stressors and thus reduce the cumulative dose to any one worker. Examples of administrative controls that are used in the ergonomics context are employee rotation, employer-authorized changes in the pace of work, and team lifting.

<sup>iii</sup> This report does not constitute an endorsement of any particular product. Rather, it is a recitation of how Navy personnel have addressed a particular work place safety issue. Neither the Navy nor its employees and agents warrant any product described in this report for any use, either general or particular.