

Naval Facilities Engineering Command Ergonomic Risk Assessment Fan Repair

Introduction

This report summarizes the ergonomic risk assessment conducted in April of 2004. The Fan Repair area was 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 Fan Repair operations were observed in order to determine sources of ergonomic 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 include new equipmentⁱ and administrative controlsⁱⁱ. Recommendations are included with as much vendor informationⁱⁱⁱ 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 and in OPNAVINST 5100.23F. Ch 12 Hazard Abatement.

Fan Repair

Purpose of the Operation: Responsible for craft fan maintenance and repair.

Population: 7 active duty personnel

Injury Data: There have been no reported injuries. Operation started 3 months prior.

Description of the Operation:

The workers maintain and repair fans used on the craft. Fans are removed from craft and arrive at the repair shop on a fixture in a crate. The crates are disassembled so that the fans remain on the wooden fixture which is interior to the crate, photo 1. The wooden fixture is intended for shipping only and tends to warp and degrade when used during the repair process to hold the fan, photo 2. The fans are moved by overhead hoist if necessary.

Each craft has four fans, each weighing approximately 1000 lbs. In the repair shop, the fans are disassembled and all of the blades removed. Each fan has two sides, each side contains 28 blades. Corrosion and anti-corrosive material are removed from the blade by hand scraping. Removal of material from a single blade takes about 30 minutes. In the past 3 months, 9 fans have arrived for repair. The shop supports the repair of 4 fans at a time. After the repairs are complete the fan blades are inspected and reassembled. After being repaired, the fans are re-crated and sent to another facility for balancing. The fans are transported to the balancing facility on the back of a flat bed truck.



Photo 1: Fan on wooden fixture

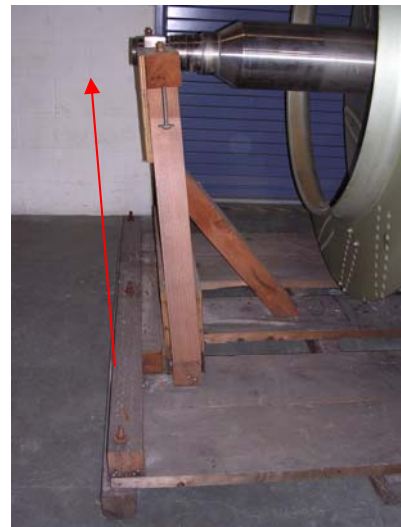


Photo 2: Warped Fixture supports

Ergonomic issue description:

Repair work requires sustained awkward postures of the back, neck, and shoulders as well as repetitive force associated with manual hand tool use.

Repetitive Motion, Awkward Postures and Force: Workers manually remove corrosion and anti-corrosive material from the fan blades with a scraper. As shown in photo 3, the worker is exerting high hand forces while assuming an awkward torso posture. Scraping also requires highly repetitive movements of the upper extremities. These risk factors are combined with a high duration because of the number of fan blades on each fan. While scraping, the workers are often in awkward and unsupported postures of the back, shoulders, and wrists. This task results in risk factors, such as force, duration and awkward posture, occurring in combination. When risk factors occur in combination the risk of injury is increased

Employees assume awkward postures of the back, neck and wrist during all phases of the repair operation, photos 3, 4, and 5, due in part to the position of the fans. The awkward postures found are frequently combined with highly repetitive motions, static postures or force. Workers use task chairs with limited adjustability to work on the fans from a seated posture which causes awkward postures and extended reaches. Figure 4 shows a worker assuming awkward and static neck and back postures while performing repairs. Workers use a hand held light to examine the fan blades during the inspection process, as shown in figure 5.

Exerting high forces with the hands can contract muscles to their maximum capability and strain tendons which leads to fatigue and possible damage to the muscles and other tissues. The likelihood of injury is increased when the force is combined with awkward postures. Repetitively exerting high forces or repeatedly assuming static postures can cause strain in the muscles and supporting ligaments and tendons which can lead to a WMSD. Static awkward postures such as these (called “static loading”) restrict blood flow and can cause muscle fatigue.



Photo 3: Scraping material from fan blades



Photo 4: Repairing blades

Photo 5: Quality check



Recommendations



- Design a fixture, similar to a vise, to hold the blades during repair in order to encourage neutral postures.
- Design and build 8 fixtures for the fans that can be used for transportation and repair. Ideally, this fixture would have casters which could be removed or retracted while the fans are being transported on the flat bed truck to the balancing facility. The fixture should have slots to enable a fork truck to transport the fan and a stop for holding the fan in place. The fixture could be covered with a tarp, rather than a wooden crate for transporting in trucks if the unit is secure. The fixture shown in photo 6 is used for transportation within the facility but can not be used for transportation on truck or repair work. A similar fixture with greater portability would help reduce ergonomic stressors associated with this operation. Anteon has delivered an estimate for these fixtures for \$8300 each including delivery.



Photo 6: Transportation fixture for facility

- Recommend lighting for fan inspection to reduce awkward postures caused by bending to see the blades and holding a light. Safety glasses with LED lights and a gooseneck lamp are listed in Table 1.
- Utilize tool stools, table 1, when working on the fan to reduce reaching and awkward back postures.

Table 1: Material Handling Equipment				
Description	Vendor	Product	Estimated Cost	Figure
Lighting	Sears www.sears.com	Craftsman lighted safety glasses	\$15	
	Lab Safety 1-800-356-0783	BAYCO Master Series Magnetic and Clamp-On Work Lights *can be purchased with a clamp or a magnetic attachment	\$40	

Tool Stool	C&H Dist 800 558 9966	Mechanics Seat	\$132.	
	Whiteside 740 363 1179	Mechanics Seat	\$84	
	Grainger 757-855-3153	Tool Stool	\$166.50	

Note: Information contained in this report that is specific to the command has been removed for distribution.

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

ⁱⁱ Administrative controls are management controls or procedures that are 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.

ⁱⁱⁱ 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.