Naval Facilities Engineering Command
Ergonomic Risk Assessment

Security, Weapons, and Public Works Detachment

Introduction

This report summarizes the ergonomic risk assessment conducted in October of 2004. The Security, Weapons, and Public Works Detachment were observed. This assessment is based upon interviews with supervisor, safety personnel, and employees as well as an evaluation by the Naval Facilities Engineering Command (NAVFACENGCOM) Hazard Abatement Ergonomist.

Security, Weapons, and Public Works Detachment operations 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.

The ergonomic survey was requested based upon a discomfort questionnaire distributed by the Safety Office and analyzed by the Jacksonville based Industrial Hygiene Office in 2002. Security, Weapons, and Public Works Detachment were identified as potential ergonomic problem areas. These three areas were again surveyed with the Job Requirements and Physical Demands Survey (JR/PD) in 2003. The JR/PD is an ergonomic assessment tool endorsed by the Department of Defense Ergonomic Working Group and used by the tri-services to collect occupational health data. Refer to Appendix I for specific survey results and analysis.

JR/PD Summary Results

Security

The results of the JR/PD indicate the Security area is an Ergonomic Problem Area (EPRA). The activity scored an Overall or Survey Priority Rank of **seven** (on a scale of 1 to 9), where nine has the highest priority for intervention. A score of five or greater indicates an Ergonomic Problem Area. Ergonomic risk is based upon ergonomic stressors associated with the task and employee discomfort. The JR/PD assesses five distinct body regions: shoulder/neck, hand/wrist/arm, back/torso, leg/foot, and head/eye. The leg/foot region received the highest priority scores. 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. Lingering pain may indicate a discrepancy between the capabilities of the workers and the jobs being performed. A significant number of employees also reported pre-existing MSDs as well as conditions

recognized as contributing factors for the development of MSDs, which places them at a greater risk of developing additional or more severe MSDs.

Public Works Detachment

JR/PD results indicate the Public Works Detachment area is an Ergonomic Problem Area (EPRA). The activity scored an Overall or Survey Priority Rank of **five** (on a scale of 1 to 9), where nine has the highest priority for intervention. The survey indicates the presence of both ergonomic risk factors and discomfort for a majority of the workers. The back/torso, and shoulder/neck regions received the highest priority scores. A significant number of employees also reported conditions recognized as contributing factors for MSDs, which places them at a higher risk of additional or more severe WMSDs.

Weapons

The JR/PD results for the Weapons area did not indicate an ergonomic problem area. Ergonomic risk factors were associated with the back/torso and leg/foot regions but the reported discomfort was low. The good health and relative young age of the active duty work force may reduce their likelihood of experiencing or reporting discomfort on the job while ergonomic risk factors are still present. Forty-four percent of the survey respondents reported seeing a health care provider for pain or discomfort associated with his/her job. A significant number of employees also reported pre-existing MSDs as well as conditions recognized as contributing factors for MSDs, which places them at a higher risk of additional or more severe WMSDs.

Recommendations for the command to further reduce the probability of injury include new equipment[i] and administrative controls[ii]. Recommendations are included with as much vendor information[iii] 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.

Hazard Abatement and Mishap Prevention projects can be submitted for fiscal year 2006 funding consideration if received by February 28 2005. Naval Facilities Engineering Command (NAVFACENGCOM) manages the Hazard Abatement and Mishap Prevention Program (HAMP), which is a centrally managed fund to correct safety and health deficiencies beyond the funding capabilities of the activity. Information about the HAMP 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.

Security

Purpose of the Operation: Responsible for providing security for the Naval Station which includes multiple locations.

Population: 160 active duty and civilian personnel.

Injury Data: No recorded injuries. Two employees (15%) who completed the Job Requirements and Physical Demands Surveys have seen a health care provider for pain or discomfort that he/she feels is related to the job.

Description of the Operation:
The Naval Station has four entry gates currently in use. At least two employees secure a gatepost at one time, while up to five may be required. One employee usually stands outside of the gate house and checks driver identification while another employee sits in the gate house to answer phones and monitor surrounding traffic, figure 1. Other employees patrol the grounds in a vehicle answering calls and monitoring activity.

Employees work 13.5 hour days. Active duty personnel work 5 days one week and two days the following week. Civilian personnel work 6 days over a two week period. Employees are given one hour three times a week for physical fitness.

Since the JR/PD survey was administered a lot of changes have been made to the security task to reduce ergonomic risk factors. Exposure times have been reduced by limiting working hours. Employees no longer have to stand and hold a shotgun since chairs have been provided. Anti-fatigue matting has also been procured although workers commented that it is heavy and difficult to clean. Employees still noted fatigue associated with prolonged driving and standing which is compounded by the Florida heat. Lower back pain was associated with wearing gun belts that weigh almost 20 lbs and reside on the hips.

Figure 1: Monitoring gate

Ergonomic issue description: Driving during patrol and gate monitoring can require prolonged sitting and standing which has been reported to cause fatigue. Temperature can contribute to the risk of developing a MDS.

Static Postures: The employees stand at the gate and sit in their cars for extended periods of time. Constrained static postures can cause lactic acid to accumulate in the muscles which can lead to muscle fatigue and discomfort. Exercise and movement allows blood to reach the muscles to provide nutrients and remove waste products such as lactic acid. Sitting and standing can both contribute to lower back pain which is exacerbated by a heavy gun belt. Standing for long periods can be a strenuous activity that promotes blood pooling in the legs and feet and can result in discomfort and fatigue. Leg/Foot discomfort indicated in the JR/PD may be a result of prolonged standing.

Temperature: Heat does not cause MSDs but it can be a contributing risk factor which increases the likelihood of developing an injury. Working in a hot climate can increase the physical demands on a worker. Employees also work more slowly in a hot environment. As we age it is harder to regulate our internal temperature, so older workers are at a greater risk of developing heat stress.

Recommendations

- A sit/stand stool for the gate house would allow the worker to maintain at standing eye height, while seated, which allows for monitoring but also permits the worker to easily get up from the chair to assist fellow workers. The guard checking identification can also use a sit/stand chair if traffic is intermittent. A sit/stand stool supports 2/3 of the user's body weight to reduce stress associated with prolonged standing. Refer to Table 1 for vendor information.

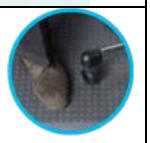
- Light-weight anti-fatigue matting for inside the gate house and surrounding walk-ways will improve comfort levels. Refer to Table 1 for vendor information.

- Promote stretch breaks and continue to educate workers on the importance of drinking fluids to reduce the risk of heat stress.

- Provide all workers with gun belts with suspenders to transfer the load across the torso and reduce the exposure to the low back.

Table 1: Security Equipment

Description	Vendor	Product	Estimated Cost	Figure
Sit/Stand Chairs	Lab Safety 1-800-356-0783	Bevco Sit/Stand	$152	

	Grainger	Sit-Stand Stool	$231	
	Grainger	Bevco Sit/Stand	$150	
	Alimed 1-800-225-2610	Portable Sit/stand	$299	
Anti-fatigue Matting	PeakLogix 703-819-6061	Matting prices depend on size. Most vendors will send you a sample. Matting is very subjective and it is a good idea to let your employees try it. Grid matting is easy to clean. Look for a vendor with a warranty.		 
	Alimed 1-800-225-2610			
	Ergomat 1-800-357-2111			

Public Works Detachment- Tire Shop

Purpose of the Operation: Change and repair tires for Navy vehicles

Population: 1 civilian worker

Injury Data: Two recorded injuries, three previous employees on workmen's compensation.

Description of the Operation:
The tire shop in the Public Works Detachment (PWD) was observed. One worker is responsible for changing and repairing tires on the PWD fleet of 350 vehicles. The worker changes approximately 16 to 25 tires a day. Each tire weighs between 35 and 70 lbs. The worker lifts the tire from the floor onto the bead breaker which has a load height of 42", figure 2. According to the Military Standard 1472F, the maximum weight that can be safely lifted by a male worker from the floor to 5 feet is 56 lbs (from the floor to no more than 3 ft is 87 lbs). Some of the tires exceed this guideline placing the worker at an increased risk of injury. It should be noted that a tire is an awkward shape and size which makes lifting more difficult.

Figure 2: Lifting a tire onto the bead breaker

Ergonomic issue description: Breaking the tire bead to remove the tire from the rim requires forceful exertions. Manually handling tires in excess of 56 lbs. is considered heavy lifting.

Forceful Exertions and Heavy Lifting: Lifting the tires onto the bead breaker requires an awkward heavy lift as well as forceful exertions. Exerting high forces can contract muscles to their maximum capability which leads to muscle fatigue and possible damage to the muscles and other supporting tissues. Heavy lifting can strain the back and place the worker at risk of injury.

Recommendations

- An automatic bead breaker which can lift tires from the floor will reduce heavy lifting and the force required to break the bead.

- A height adjustable cart can transport tires from the storage racks to the bead breaker and lift to the machine load height to reduce heavy lifting. Refer to table 2 for vendor information.

Table 2: Public Works Detachment Equipment

Description	Vendor	Product	Estimated Cost	Figure
Height Adjustable Carts *price depends on size	Lab Safety 1-800-356-0783	Bishamon Mobile Scissor Lift Tables 330 lb. Capacity #18771	$560	
	Grainger 757-855-3153	Manual Hydraulic Elevating Scissor Cart 400 lb. Capacity #3KR46	$378	
	Global Equipment 1-800-645-1232	Scissor Lift Table 660 lb. Capacity #GK954850	$367	
	C&H 1-800-558-9966	Mobile Scissor Lift Truck 330 lb. Capacity 71-525A	$568	

Weapons

Purpose of the Operation: Store and distribute ammunition and assist groups with qualifications.

Population: 24 active duty personnel

Injury Data: No recorded injuries. Eight employees (44%) who completed the Job Requirements and Physical Demands Surveys have seen a health care provider for pain or discomfort that he/she feels is related to the job.

Description of the Operation:
The Weapons area is responsible for storing and distributing ammunition and other related items. They currently load most ordinance manually and transport them on carts, figure 3. Missiles weighing 132 lbs. are lifted by three workers from pallets on the ground into missile fixtures on the carts. For a mixed male and female population Military Standard 1472F recommends a maximum of 121 lbs be lifted from the ground to a height less than 36". Three male lifters can safely lift 239 lbs., but this operation places female workers at risk of injury.

The employees noted the hardest task is lifting cans of ammunition. The cans can weigh up to 55 lbs. but have narrow metal handles that are difficult to hold. When lifting items with handles, the shape of the handle can actually limit the amount a person can safely lift when it compresses the palm of the hand. Cans are stored on pallets at floor level and on pallet racking systems, figures 4 and 5. Retrieving cans from pallet racking can require a lift over shoulder height. Lifting from above shoulder height transfers the weight of the load to the shoulder and places the worker at risk of injury. The can shown in figure 5 has a handle height of 76"; therefore, handling the cans at this height places the workers at an unacceptable risk of injury. The cans are frequently carried through the facility. The MIL STD 1472F recommended carrying weight limit for a mixed population up to 33 feet is only 42 lbs; 82 lbs. for a male population. A full can of ammunition exceeds these limits for a mixed male and female population.

Bags of concrete weighing 80lbs are also stored on pallet racking and are frequently retrieved by pulling them down. According to the Military Standard 1472F, a mixed male and female population should not lift an object weighing more than 44 lbs. from the floor to a height of 3 feet; 87 lbs. is permissible for an entirely male population. The recommended weight limit is reduced to 37lbs if the destination of the lift is up to 5 feet; 56lbs. for a male population. Lifting a bag of concrete is only within the lifting guidelines for a male population when it is stored below three feet off the ground. A female population is at risk of injury for this task.

Figure 3: Carts used for transportation

Figure 4: Cans of ammunition

Figure 5: Cans stored on pallet racks

The weapons group also uses and stores drums of discarded materials and emergency water. The discarded materials include metal and wood and weigh up to 200 lbs. The drums are moved for storage and dumping by hand. A worker rolls the drum on edge to move it and then pushes it for dumping. A drum being rolled on its edge can cause a serious injury to the foot or body if it gets away from the worker.

Figure 6: Rolling a can of waste

Four workers are responsible for repair of the carts used for transporting ordinance. The weapons group has 40 carts. These workers noted that their knees hurt at the end of the day from kneeling to repair the carts, figure 7. These same workers also repair 30 lb. weapons adaptors used on the carts. The workers tend to work on the adapters while they're still in the pallet racking, figure 8. Standing at the pallet racking is less stressful on the knees than kneeling, but the workers have to exert awkward postures and extended reaches to access the adaptors, which places stress on the back and upper extremities.

Figure 7: Repairing carts

Figure 8: Repairing adaptors

Ergonomic issue description: The ordinance workers perform a lot of repetitive heavy lifting in the storage of ordinance. The repair workers spend extended periods in sustained awkward postures.

Forceful Exertions and Heavy Lifting: Lifting bags of concrete and ordinance items requires repetitive heavy lifting which exceeds the guidelines for safe lifting. Exceeding the guidelines for lifting places workers at an unnecessary risk of injury. Moving cans of discarded material can require forceful exertions. Exerting high forces can contract muscles to their maximum capability which can lead to fatigue and possible damage to the muscles and other tissues. Heavy lifting can strain the back and place the worker at risk of injury.

Awkward Postures: Repair workers spend a large percentage of their time in kneeling or stooping postures while working on carts. Kneeling or squatting on a hard surface can restrict blood flow and also cause mechanical stress on the knees. Sustained awkward postures restrict blood flow and can cause muscle fatigue as well as place the employee at risk of developing WMSDs. Awkward postures may also put additional strain on the tendons, which can cause inflammation, swelling, restricted movement, and pressure on nearby nerves and if occurring often can lead to WMSDs.

Recommendations

- ∞ Height adjustable carts are recommended to provide moveable work heights and promote neutral postures. Carts can also be used to reduce carrying of equipment through the facility. Refer to table 2 for vendor information.

- ∞ A pallet lifter will allow for ordinance stored on pallets to be lifted to the height of the carts for an easy transfer that will reduce heavy lifting. Refer to Table 3 for vendor pricing.

- ∞ Rolling ladders or order pickers will allow the workers to retrieve items from the pallet racking without having to climb or perform heavy lifting and carrying. Refer to table 3.

- ∞ Material handling equipment designed for the transportation and dumping of drums will reduce the risk of injury. Refer to Table 3 for vendor information on drum dollies and dumpers.

- ∞ Tool stools will allow the repair workers to work on the transportation carts without having to kneel or squat on the floor. Refer to Table 3 for vendor information.

Table 23: Weapons Area Equipment

Description	Vendor	Product	Estimated Cost	Figure
Scissor lift pallet Jack	Lab Safety 1-800-356-0783	High Lift Pallet Truck	$706	
	Grainger	Electric Portable Scissor Lift	$2640	
	Global Industrial 1-800-645-1232	Heavy duty- High Lift Skid Truck	$539	
	Peaklogix 703-819-6061	Electric Portable Scissor Lift	$2259	

Rolling ladders	Grainger	Warehouse ladder	$671	
	Lab Safety 1-800-356-0783	Narrow Aisle order picker	$4547	
	Ballymore (610)696-3250	Orderpicker Model OP-11 Capacity 300 lbs. Platform Ht. 10’6”	$3354	
Tool Stool	Grainger 757-855-3153	Tool Trolley Stool	$166.50	
	Lab Safety 1-800-356-0783	Repair Maintenance Stool	$149	

	Global Industrial 1-800-645-1232	Stool with Steal Tray	$136	
	Peaklogix 703-819-6061	Tool Trolley Stool	$159	
Drum Dolley	Peaklogix 703-819-6061	Drum dolly with leash	$73	
	Grainger	Drum dolly with leash	$80	
	Lab Safety 1-800-356-0783	Drum caddy	$93	
Drum dumper	Lab Safety 1-800-356-0783	Hydraulic drum dumper	$2329	
	Grainger	Drum dumper	$2577	
	Global Industrial 1-800-645-1232	Forklift attachment drum dumper	$648	

Appendix I
Job Requirements and Physical Demands Survey

Introduction

The Job Requirements and Physical Demands Survey (JR/PD) was administered. Three areas were evaluated: Security, Weapons, and Public Works.

The JR/PD results indicate that the Security and Public Works sections are Ergonomic Problem Areas. Information regarding the development, instruction, and validation of the JR/PD can be found on the US Air Force web site at http://www.brooks.af.mil/afioh/Health%20Programs/ergonomics_jrpd.htm
The JR/PD is an ergonomic assessment tool endorsed by the Department of Defense Ergonomic Working Group and used by the tri-services to collection occupational health data.

Security

Overall Priority Score

The results of the JR/PD indicate the Security area is an ergonomic problem area with an overall score of **seven**. An Overall Job Priority score of five or greater establishes a task/job as an ergonomic problem area. The Overall Job Priority score is determined by selecting the highest Body Region Score for the job which in this case is the leg/foot region. The workers are exposed to significant levels of risk factors associated with WMSDs for the leg/foot region.

The Overall Priority Rating Score is used to determine which jobs or areas are associated with the most significant ergonomic risk. It is important to note that a high Overall Priority Score (i.e. ergonomic problem area) does not necessarily mean that the risk of illness associated with a job or area is high. Rather a high rating indicates that the tasks expose workers to a considerable level of risk factors associated with WMSDs in comparison to jobs/tasks or areas that receive lower scores.

Demographics

13 (workers/respondents) completed the JR/PD survey resulting in a **response rate of 52%**. The population is **92% male and 8% female, 77% civilian and 8% contractors**. **15%** of the workers are between the ages of **20 and 30**, **23%** are between **31 and 40, 38%** are between **41 and 50, 15%** are between **51 and 60, and 8%** are **over 60.** Age is a contributing factor for the development of WMSDs.

Priority Score

The JR/PD prioritizes five distinct body regions based upon a combination of ergonomic risk factors and discomfort. Workers indicate their duration of exposure to different ergonomic risk factors. Ergonomic risk factors include posture, force, frequency, repetition, vibration, contact stress, and restrictive personal protective equipment. The frequency and severity factors are combined to evaluate discomfort in each of the five body regions. Table 1 demonstrates the relationship between body region, discomfort, and risk. The leg/feet region has a significant score.

Table 1 Body Region, Discomfort and Risk

		BODY REGIONS				
		Shoulder/ Neck	Hand/Wrist /Arm	Back/ Torso	Leg/ Foot	Head/ Eye
Priority Score		3	1	3	7	3
Risk	**Prevalence**	0%	8%	15%	62%	15%
	Rating	Low	Low	Low	High	Low
Discomfort	**Prevalence**	31%	15%	31%	46%	31%
	Rating	Medium	Low	Medium	Medium	Medium

Risk Prevalence and Rating

The percentage of respondents exposed to specific ergonomic risk factors for a given body region, for longer than two hours per day, assesses the prevalence of risk. A low rating represent less than 30% prevalence, medium 31% to 60% and high is greater than 61% of the respondents have exposure greater than 2 hours per day. The leg/foot body region has high risk prevalence.

Discomfort Prevalence and Rating

The terms fatigue, numbness, and pain categorize discomfort. The percentage of respondents and their discomfort ratings determine whether discomfort is prevalent among the workers. Combinations of frequency and severity that indicate significant discomfort prevalence are shown with asterisks in Table 2. Low ratings represent less than 30% prevalence, medium 31% to 60% and high is greater 61%. All of the body regions except hand/arm/wrist have medium levels of discomfort.

Table 2: Discomfort Matrix

		SEVERITY	
FREQUENCY	Mild	Moderate	Severe
Daily	*	*	*
Weekly		*	*
Monthly			*

The Priority matrix in Table 3 determines the overall prioritization of specific body regions. The relationship between discomfort and risk factors determines priority rating from 1 to 9 for each body region. A priority greater than four, indicated by an asterisk, is significant. The Overall Priority ranking for Security is equal to the highest body region priority value, which is **seven**.

Table 3 Priority Matrix

RISK FACTOR	DISCOMFORT		
	High	Medium	Low
High	9*	7*	4
Medium	8*	5*	2
Low	6*	3	1

Organizational Information

Organizational factors contribute to ergonomic stressors. The organizational score for this area was **low**, which indicates job stress factors are not likely present. Survey respondents were asked if they understood their job responsibilities, if their workload was too heavy, if they are able to get pertinent information, if they received comments on performance, etc. Suggestions to improve stress associated with organizational factors include providing workers with more autonomy and improving discussion and feedback between workers and supervisors.

Physical Effort

The survey resulted in a perceived physical exertion score of **8.31**. Respondents were asked to describe the physical effort required of their job on a scale of 1 to 15 where one is no exertion at all and fifteen is maximal exertion. The higher the score, the greater the level of perceived physiological exertion. A value of 8 is somewhat hard.

Health Care Provider Score

According to the health care provider score, **2 (15%)** of the employees reported visiting a health care provider in the last 12 months for pain or discomfort that he/she thinks is related to his job.

Recovery Time Score

38.46% of the respondents reported experiencing work-related pain or discomfort that does not improve when away from work overnight or over the weekend. A score above 30% is of high importance. Lasting pain/discomfort is an indicator of inadequate recovery time for the muscles, tendons, and ligaments. Muscles, tendons, and ligaments that do not recover are more likely to be injured. The physically demanding

nature of the job is apparent in the workers' inability to recover after the cessation of work.

Activity Interruption Score

38.46% of the respondents indicated that in the past 12 months, work-related pain or discomfort has caused difficulty in carrying out normal activities (e.g. job, hobby, leisure, etc.). A score above 50% is of high importance. The physically demanding nature of the job is apparent in the workers' inability to recover after the cessation of work and its interruption of normal after-work activities.

Previous Diagnosis Score

The survey asks if "a health care provider ever told you that you have any of the following conditions which you think might be related to your work?

Tendonitis/Tenosynovitis	Ganglion Cyst
Trigger Finger	Epicondylitis (Tennis Elbow)
Bursitis	Carpal Tunnel Syndrome
Thoracic Outlet Syndrome	Back Strain, Knee or Ankle Strain
Overuse Syndrome"	

30.77% of respondents indicated affirmatively. Pre-existing WMSDs can contribute to an employee's pain and discomfort levels; thereby affecting the overall priority score. Working conditions may exacerbate a pre-existing disorder. Workers with pre-existing WMSDs are likely to experience additional or more severe WMSDs if the environment is unchanged.

Contributing Factors

Respondents were asked if they had ever had one or more of the following conditions:

Wrist Fracture	Hypertension	Kidney Disorders
Thyroid Disorders	Diabetes	Gout
Rheumatoid Arthritis		

23.08% of the respondents indicated positively. These health conditions are contributing factors and may increase one's risk of developing a musculoskeletal disorder; thereby affecting overall priority.

Process Improvement Opportunities

This section of the survey allows employees to write in responses to questions. All statements are included exactly as written by the employees with the exception of spelling errors and expletives. Responses were also taken from a discomfort survey, which was distributed to the population.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
   - ∞ Long hours of standing, cramped up in vehicles
   - ∞ Standing for 12 hours checking ID cards

2. Which tasks take the most effort
   - ∞ Going to work

3. Are there any tools or pieces of equipment that are notoriously hard to work with?
   - ∞ STARS Program- Its always kicking you out. So you end up wasting a lot of time

4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest.
   - ∞ Better lighting in work space
   - ∞ Need to train management and supervisors in people skills. Employee's need to learn to work together and do away with office politics and backstabbing fellow officers.
   - ∞ Less hours a day and more people
   - ∞ Ability to exercise at the gym during your shift

Public Works

Overall Priority Score

The results of the JR/PD indicate the Public Works Detachment is an ergonomic problem area with an overall score of **five**. An Overall Job Priority score of five or greater establishes a task/job as an ergonomic problem area. The Overall Job Priority score is determined by selecting the highest Body Region Score for the job. The back/torso and shoulder/neck regions have significant priority scores, which contribute to the overall priority score. The workers are exposed to significant levels of risk factors associated with WMSDs for those body regions.

The Overall Priority Rating Score is used to determine which jobs or areas are associated with the most significant ergonomic risk. It is important to note that a high Overall Priority Score (i.e. ergonomic problem area) does not necessarily mean that the risk of illness associated with a job or area is high. Rather a high rating indicates that the tasks expose workers to a considerable level of risk factors associated with WMSDs in comparison to jobs/tasks or areas that receive lower scores.

Demographics

Twenty-five (workers/respondents) completed the JR/PD survey resulting in a **response rate of 93%**. The population is **100% male, 96% civilians and 4% contractors**. **4%** of the workers are **under the age of 20, 8%** between the ages of **20 and 30**, **12%** are between **31 and 40**, **32%** are between the ages of **41 and 50, 36%** are between the ages of **51 and 60**, and **8%** are **over the age of 65.** Age is a contributing factor for the development of WMSDs.

Priority Score

The JR/PD prioritizes five distinct body regions based upon a combination of ergonomic risk factors and discomfort. Workers indicate their duration of exposure for different ergonomic risk factors. Ergonomic risk factors include posture, force, frequency, repetition, vibration, contact stress, and restrictive personal protective equipment. The frequency and severity factors are combined to evaluate discomfort in each of the five body regions. Table 1 demonstrates the relationship between body region, discomfort, and risk. The back/torso and shoulder/neck regions have significant scores.

Table 1 Body Region, Discomfort and Risk

		BODY REGIONS				
		Shoulder/ Neck	Hand/Wrist /Arm	Back/ Torso	Leg/ Foot	Head/ Eye
Priority Score		5	2	5	2	1
Risk	**Prevalence**	44%	44%	48%	56%	8%
	Rating	Medium	Medium	Medium	Medium	Low
Discomfort	**Prevalence**	32%	16%	32%	12%	12%
	Rating	Medium	Low	Medium	Low	Low

Risk Prevalence and Rating

The percentage of respondents exposed to specific ergonomic risk factors for a given body region, for longer than two hours per day, assesses the prevalence of risk. A low rating represent less than 30% prevalence, medium 31% to 60% and high is greater than 61% of the respondents have exposure greater than 2 hours per day. All of the body regions except for head/eye were associated with medium levels of risk.

Discomfort Prevalence and Rating

The terms fatigue, numbness, and pain categorize discomfort. The percentage of respondents and their discomfort ratings determine whether discomfort is prevalent among the workers. Combinations of frequency and severity that indicate significant discomfort prevalence are shown with asterisks in Table 2. Low ratings represent less than 30% prevalence, medium 31% to 60% and high is greater 61%. The shoulder/neck and back/torso regions are associated with medium levels of risk.

Table 2: Discomfort Matrix

		SEVERITY	
FREQUENCY	Mild	Moderate	Severe
Daily	*	*	*
Weekly		*	*
Monthly			*

The Priority matrix in Table 3 determines the overall prioritization of specific body regions. The relationship between discomfort and risk factors determines priority rating from 1 to 9 for each body region. A priority greater than four, indicated by an asterisk, is significant. The Overall Priority ranking for the Public Works area is equal to the highest body region priority value, which is a 5.

Table 3 Priority Matrix

	DISCOMFORT		
RISK FACTOR	High	Medium	Low
High	9*	7*	4
Medium	8*	5*	2
Low	6*	3	1

Organizational Information

Organizational factors contribute to ergonomic stressors. The organizational score for this area was **low**, which indicates job stress factors are not likely present. Survey respondents were asked if they understood their job responsibilities, if their workload was too heavy, if they are able to get pertinent information, if they received comments on performance, etc. Suggestions to improve stress associated with organizational

factors include providing workers with more autonomy and improving discussion and feedback between workers and supervisors.

Physical Effort

The survey resulted in a perceived physical exertion score of **8.84**. Respondents were asked to describe the physical effort required of their job on a scale of 1 to 15 where one is no exertion at all and fifteen is maximal exertion. The higher the score the greater the level of perceived physiological exertion. A value of 8 is considered to be somewhat hard.

Health Care Provider Score

According to the health care provider score, **8 (32%)** of the employees reported having been to a health care provider in the last 12 months for pain or discomfort that he thinks is related to his job.

Recovery Time Score

28% of the respondents reported experiencing work-related pain or discomfort that does not improve when away from work overnight or over the weekend. A score above 30% is of high importance. Lasting pain/discomfort is an indicator of inadequate recovery time for the muscles, tendons, and ligaments. Muscles, tendons, and ligaments that do not recover are more likely to be injured.

Activity Interruption Score

24% of the respondents indicated that in the past 12 months, work-related pain or discomfort has caused difficulty in carrying out normal activities (e.g. job, hobby, leisure, etc.). A score above 50% is of high importance.

Previous Diagnosis Score

The survey asks if “a health care provider ever told you that you have any of the following conditions which you think might be related to your work?

Tendonitis/Tenosynovitis
Trigger Finger,
Bursitis
Thoracic Outlet Syndrome
Overuse Syndrome”
Ganglion Cyst
Epicondylitis (Tennis Elbow)
Carpal Tunnel Syndrome
Back Strain, Knee or Ankle Strain

16% of respondents indicated affirmatively. Pre-existing WMSDs can contribute to an employee’s pain and discomfort levels; thereby affecting the overall priority score. Working conditions may exacerbate a pre-existing disorder. Workers with pre-existing

WMSDs are likely to experience additional or more severe WMSDs if the environment is unchanged.

Contributing Factors

Respondents were asked if they had ever had one or more of the following conditions:

Wrist Fracture	Hypertension	Kidney Disorders
Thyroid Disorders	Diabetes	Gout
Rheumatoid Arthritis		

40% of the respondents indicated positively. These health conditions are contributing factors and may increase one's risk of developing a musculoskeletal disorder; thereby affecting overall priority.

Process Improvement Opportunities

This section of the survey allows employees to write in responses to questions. All statements are included exactly as written by the employees with the exception of spelling errors and expletives. Responses were also taken from a discomfort survey, which was distributed to the population.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
   - ∞ Change/remove/repair fan, remove/repair/install dishwasher motor, change lights in stairwell
   - ∞ Working above my head
   - ∞ Working on ceiling fans, changing stairwell lites, post lites
   - ∞ Building and installing a roof on a building. At this level you are working in height, staging and off of ladders to get the job done.
   - ∞ Jack hammering concrete
   - ∞ Bending to pull weeds
   - ∞ Any type of roofing
   - ∞ Sitting in the morning meetings
   - ∞ Making repairs to jet at start consoles requires you to bend over, or on your knees on hot concrete or flight line
   - ∞ Working on panels and electrical boxes high on walls
   - ∞ Changing airfield lighting transformers and fixtures
   - ∞ Low mounted equipment e.g. generators
   - ∞ Working inside tanks; working under counters, sinks, around commodes; working overhead
   - ∞ Ditch work
   - ∞ Under countertops

- ∞ Repairing broken utility lines underground
- ∞ Climbing on top of some of the diesel fuel tanks to refuel them up
- ∞ Duct work, digging holes, jack hammering concrete drilling

2. Which tasks take the most effort
   - ∞ Service calls requiring a escort, roof access, work on water heaters
   - ∞ About ½ or ¾ of my task, getting escorts for jobs
   - ∞ Getting out of bed
   - ∞ Planning, setting up, designing to build houses. Frame to finish and getting the rest of the trades to do their jobs in a timely matter in order to keep the project ton schedule
   - ∞ Loading pieces of rock or concrete
   - ∞ Bending down
   - ∞ Bending over or looking up
   - ∞ lunch
   - ∞ Carrying/cutting large size of sheet metal
   - ∞ Pulling out 30 ft jet air start hose to test jet start console for air flow
   - ∞ Use of ladder for long periods of time
   - ∞ Moving safes to/from storage to/from customers spaces
   - ∞ Pulling in new service wiring through underground ducts
   - ∞ Picking up material over head to pass up to bucket person
   - ∞ Trenching and jackhammering
   - ∞ Under ground piping
   - ∞ Trenching
   - ∞ Loading or unloading steel by hand
   - ∞ Changing oil and oil filters /fuel filters
   - ∞ Jack hammering, duct work

3. Are there any tools or pieces of equipment that are notoriously hard to work with?
   - ∞ Need tools, water heater
   - ∞ The drill I have works good
   - ∞ Jack hammers and hammer drills
   - ∞ Jackhammers, trenching machines, concrete cutting machine, and chainsaws
   - ∞ Oil strap wrench
   - ∞ Jack hammer, chain-saws

4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest.
   - ∞ Truck that is safe, i.e. no rust holes in roof, bed, storage compartments, frame. Better communications i.e. radio's for all, less paperwork.
   - ∞ Have power tools available for certain tasks
   - ∞ Yes, I would update and re-fit the hand tools for the tradesmen
   - ∞ Better tools
   - ∞ Schooling on job practices
   - ∞ Need more coworkers of same wage grade and job code
   - ∞ More personnel that are properly trained
   - ∞ Tools made for the job

- New or equipment that works and more training
- More material
- Put some shelves in my truck so I don’t have to hunt for a particular item and climb all over stuff

Weapons

Overall Priority Score

The results of the JR/PD indicate the Weapons section is not an ergonomic problem area. An Overall Job Priority score of five or greater establishes a task/job as an ergonomic problem area. The Overall Job Priority score is a two (a five is required for an ergonomic problem area). The employee population is 89% active duty and their good health and relative young age may reduce their likelihood of experiencing discomfort on the job while ergonomic risk factors are still present.

The Overall Priority Rating Score is used to determine which jobs or areas are associated with the most significant ergonomic risk. It is important to note that a high Overall Priority Score (i.e. ergonomic problem area) does not necessarily mean that the risk of illness associated with a job or area is high. Rather a high rating indicates that the tasks expose workers to a considerable level of risk factors associated with WMSDs in comparison to jobs/tasks or areas that receive lower scores.

Demographics

Eighteen (workers/respondents) completed the JR/PD survey resulting in a **response rate of 72%**. The population is 94% male and 6% female; 89% active duty and 11% civilian. 61% of the population is between 20 and 30 years old, 23% between 31 and 40, and 12% between 41 and 50. Note, totals may not sum to 100% due to non-responses. The relative young age of the population may have contributed to an under-reporting of discomfort.

Priority Score

The JR/PD prioritizes five distinct body regions based upon a combination of ergonomic risk factors and discomfort. Workers indicate their duration of exposure for different ergonomic risk factors. Ergonomic risk factors include posture, force, frequency, repetition, vibration, contact stress, and restrictive personal protective equipment. The frequency and severity factors are combined to evaluate discomfort in each of the five body regions. Table 1 demonstrates the relationship between body region, discomfort, and risk.

Table 1 Body Region, Discomfort and Risk

		BODY REGIONS				
		Shoulder/ Neck	Hand/Wrist /Arm	Back/ Torso	Leg/ Foot	Head/ Eye
Priority Score		1	1	2	2	1
Risk	**Prevalence**	28%	22%	39%	33%	17%
	Rating	Low	Low	Medium	Medium	Low
Discomfort	**Prevalence**	28%	11%	22%	28%	17%
	Rating	Low	Low	Low	Low	Low

Risk Prevalence and Rating

The percentage of respondents exposed to specific ergonomic risk factors for a given body region, for longer than two hours per day, assesses the prevalence of risk. A low rating represent less than 30% prevalence, medium 31% to 60% and high is greater than 61% of the respondents have exposure greater than 2 hours per day. The back/torso and leg/foot regions have medium risk.

Discomfort Prevalence and Rating

The terms fatigue, numbness, and pain categorize discomfort. The percentage of respondents and their discomfort ratings determine whether discomfort is prevalent among the workers. Combinations of frequency and severity that indicate significant discomfort prevalence are shown with asterisks in Table 2. Low ratings represent less than 30% prevalence, medium 31% to 60% and high is greater 61%. All of the body regions have low risk.

Table 2: Discomfort Matrix

		SEVERITY	
FREQUENCY	Mild	Moderate	Severe
Daily	*	*	*
Weekly		*	*
Monthly			*

The Priority matrix in Table 3 determines the overall prioritization of specific body regions. The relationship between discomfort and risk factors determines priority rating from 1 to 9 for each body region. A priority greater than four, indicated by an asterisk, is significant. The Overall Priority ranking for the Weapons Area is equal to the highest body region priority value, which is a 2.

Table 3 Priority Matrix

	DISCOMFORT		
RISK FACTOR	High	Medium	Low
High	9*	7*	4
Medium	8*	5*	2
Low	6*	3	1

Organizational Information

Organizational factors contribute to ergonomic stressors. The organizational score for this area was **low**, which indicates job stress factors are not likely present. Survey respondents were asked if they understood their job responsibilities, if their workload was too heavy, if they are able to get pertinent information, if they received comments on performance, etc. Suggestions to improve stress associated with organizational

factors include providing workers with more autonomy and improving discussion and feedback between workers and supervisors.

Physical Effort

The survey resulted in a perceived physical exertion score of **8.06**. Respondents were asked to describe the physical effort required of their job on a scale of 1 to 15 where one is no exertion at all and fifteen is maximal exertion. The higher the score the greater the level of perceived physiological exertion. A value of 8 is considered to be somewhat hard.

Health Care Provider Score

According to the health care provider score, **8 (44%)** of the employees reported having been to a health care provider in the last 12 months for pain or discomfort that he or she thinks is related to his job.

Recovery Time Score

22% of the respondents reported experiencing work-related pain or discomfort that does not improve when away from work overnight or over the weekend. A score above 30% is of high importance. Lasting pain/discomfort is an indicator of inadequate recovery time for the muscles, tendons, and ligaments. Muscles, tendons, and ligaments that do not recover are more likely to be injured.

Activity Interruption Score

28% of the respondents indicated that in the past 12 months, work-related pain or discomfort has caused difficulty in carrying out normal activities (e.g. job, hobby, leisure, etc.). A score above 50% is of high importance.

Previous Diagnosis Score

The survey asks if “a health care provider ever told you that you have any of the following conditions which you think might be related to your work?

Tendonitis/Tenosynovitis
Trigger Finger,
Bursitis
Thoracic Outlet Syndrome
Overuse Syndrome”
Ganglion Cyst
Epicondylitis (Tennis Elbow)
Carpal Tunnel Syndrome
Back Strain, Knee or Ankle Strain

39% of respondents indicated affirmatively. Pre-existing WMSDs can contribute to an employee’s pain and discomfort levels; thereby affecting the overall priority score. Working conditions may exacerbate a pre-existing disorder. Workers with pre-existing

WMSDs are likely to experience additional or more severe WMSDs if the environment is unchanged.

Contributing Factors

Respondents were asked if they had ever had one or more of the following conditions:

Wrist Fracture	Hypertension	Kidney Disorders
Thyroid Disorders	Diabetes	Gout
Rheumatoid Arthritis		

28% of the respondents indicated positively. These health conditions are contributing factors and may increase one's risk of developing a musculoskeletal disorder; thereby affecting overall priority.

Process Improvement Opportunities

This section of the survey allows employees to write in responses to questions. All statements are included exactly as written by the employees with the exception of spelling errors and expletives. Responses were also taken from a discomfort survey, which was distributed to the population.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
   - ∞ Cutting grass on magazine mounds
   - ∞ Coming to work
   - ∞ Squatting while using the bar code scanner
   - ∞ Cut magazines
   - ∞ Cutting grass
   - ∞ Bonding pallets
   - ∞ Cutting grass on top of magazine mounds, many injuries
   - ∞ Working on equipment low to floor
   - ∞ Greasing the fittings
   - ∞ Typing

2. Which tasks take the most effort
   - ∞ Cutting grass on magazine mounds
   - ∞ Coming to work
   - ∞ Moving heavy pallets
   - ∞ Open and close heavy magazine doors
   - ∞ Cut magazines, squadron turn-ins, truck onloads/offloads
   - ∞ Cutting grass
   - ∞ Taking off tires
   - ∞ lifting

- ∞ Waking up in the morning

3. Are there any tools or pieces of equipment that are notoriously hard to work with?
   - ∞ Screwdrivers (wrist problems and thumbs)
   - ∞ 51 trailors

4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest.
   - ∞ Stay home
   - ∞ Provide us with electric forklifts
   - ∞ Spray grass on mounds and fence lines
   - ∞ Get a contract to cut/spray grass on magazine rounds
   - ∞ Having AZ in the workcenter ASAP. Should have been long time ago. Is more body's in the workcenter for corrosion prevention, periodic maintenance requirements and administrative duties we perform on a daily basis.
   - ∞ Hire a contractor to cut all of our grass areas and fence lines
   - ∞ Put in a PD680 machine
   - ∞ Airforce equipment
   - ∞ Less work

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

[ii] 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.

[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.