

Heavy Mobile Equipment Service, Mobile Equipment Metal Mechanic, Industrial Equipment Maintenance & Industrial Equipment Repair, & Materials Support Areas

Naval Facilities Engineering Command Ergonomic Risk Assessment

Introduction

This report summarizes the ergonomics risk assessment conducted in July of 2005. The Heavy Mobile Equipment Repair, Mobile Equipment Service, Mobile Equipment Metal Mechanic, Industrial Equipment Maintenance Mechanic and Industrial Equipment Repair, and Materials Support areas were observed in order to determine sources of ergonomics stress and recommend improvements. The Naval Facilities Engineering Command (NAVFACENGCOM) Hazard Abatement and Mishap Prevention (HAMP) occupational ergonomist based this assessment upon interviews with employees, supervisors, and safety personnel as well as an on-site evaluation.

The risk assessment was conducted in conjunction with the Job Requirements and Physical Demands Survey (JR/PD). The JR/PD is an ergonomics survey designed to assess ergonomics risk in the workplace. Appendices I through V contain the specific survey results for each job area as well as the survey methodology. Appendix VI contains survey results for areas not included in the evaluation. Scores are based upon a combination of physical risk factors associated with the job and employee reported discomfort. An Overall Job Priority score of five or greater establishes a task/job as an ergonomic problem area on a scale from one to nine (where nine is considered the highest priority for intervention). The Heavy Mobile Equipment Repair, Mobile Equipment Service, Mobile Equipment Metal Mechanic, Industrial Equipment Maintenance Mechanic and Industrial Equipment Repair, and Materials Support areas were ergonomics problem areas. The Overall Job Priority score is determined by selecting the highest body region score for the job.

- ∞ The Heavy Mobile Equipment Repair shop had an overall priority score of **9**, on a scale of 1-9 where 9 is the greatest risk. The shoulder/neck, hand/wrist/arm, back/torso, and leg/foot regions all had significant scores (greater than 4).
- ∞ The Mobile Equipment Service shop in the tire area had an overall priority score of **7**. The shoulder/neck, hand/wrist/arm, back/torso, and head/eye regions all had significant scores.
- ∞ The Mobile Equipment Metal Mechanic shop in the paint and body area had an overall priority score of **9**. The shoulder/neck, hand/wrist/arm, back/torso, and leg/foot regions all had significant scores.
- ∞ The Industrial Equipment Maintenance Mechanics and Industrial Equipment Repairers in Emergency Services had an overall priority score of **9**. All of the body regions all had significant scores.

- ∞ The Materials Support area had an overall priority score of **9**. The shoulder/neck, hand/wrist/arm, back/torso, and head/eye regions all had significant scores.

The command would benefit from an ergonomics program dedicated to the identification and mediation of ergonomics related hazards in the workplace. The benefits of a successful ergonomics program include reduced injuries, improved health and safety as well as productivity and employee satisfaction. 115 workers attended an ergonomics awareness seminar, which was offered in conjunction with the site visit. All employees would benefit from regular ergonomics training. Training materials and assistance are available from the Navy Ergonomics Program.

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 operations reviewed present opportunities to reduce the risk of WMSDs. Recommendations to the command to reduce the probability of injury include considering equipment purchaseⁱ, process redesign, and implementation of administrative controlsⁱⁱ. Representative vendor information is included in the recommendations to assist in the evaluation of products and servicesⁱⁱⁱ. Recommendations to the command include gathering input from the workers, safety specialists, and other personnel to evaluate equipment before purchasing. This process will increase product acceptance, test product usability, and durability, and takes advantage of employee experience.

HEAVY MOBILE EQUIPMENT REPAIR

Purpose of the Operation: Employees diagnose and repair forklifts and trucks

Population: Five civilian workers

Injury Data: No recorded injuries. Workers noted lower back pain.

Description of the Operation:

Workers repair large equipment including 15,000 pound capacity forklifts, garbage trucks, cranes, bucket trucks, and tractor trailers. When the vehicles arrive, the workers diagnose the problem and determine the extent of the repair work. Workers use an onboard diagnostics system (OBDII), battery tester, and antifreeze/cooling system and hydraulics testing devices to evaluate the extent of the repairs. Depending on the problem, each vehicle takes about one to five days for disassembly, repair, and reassembly.

Workers spend about 10 to 15% of their time under vehicles performing repairs and maintenance as shown in figure 1. Workers also perform work overhead when vehicles are on the lift, figure 2. The employees are not able to raise the lift high enough to allow them to stand upright, so they have to work with legs spread and knees bent. Working height is about 5'7" from the ground.



Figure 1: Working under a vehicle

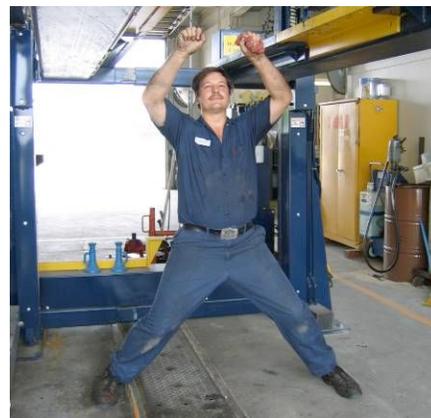


Figure 2: Working with the overhead lift

Working on engines requires the employee to bend over the vehicle while leaning against the front of the vehicle, figure 3. Engine repair can be a lengthy process. Workers repair small vehicle and forklifts while standing on the floor but larger vehicles requires the employee to stand on a work stand during the repair process, figure 4. The work stand tends to slide so the employee has to try to keep it in place while he's working.



Figures 3 and 4: Performing engine repairs

Workers noted the hardest task is repairing the P19 fire trucks. In order to access the engine, the worker has to climb a ladder and work over the engine on his knees, figure 5. Workers have to frequently lift a 50 lb. starter from this position and pull it out of the truck for repairs. Employees sometimes kneel on 1" rubber pads on the top of the platform near the engine.



Figure 5: P19 fire truck repairs

Workers also mentioned that changing forklift tires is a demanding task that places strain on the lower back. A forklift tire with rim weighs up to 150 lbs. Workers roll the tire across the shop and lift it onto a press to separate the tire from the rim and attach a new tire, figure 6. Lifting the tires requires two workers.



Figure 6: Changing a forklift tire

Workers frequently use pneumatic and manual tools for repair operations. The shop requires the workers to supply their own tools.

JR/PD Summary: The JR/PD survey results indicate that the heavy mobile equipment repair is an ergonomics problem area with an overall priority score of **9** on a scale from 1 to 9. A score of 5 or higher is considered significant. A significant number of employees reported pain and discomfort that does not abate away from their job and has caused them difficulty in carrying out normal activities. Eighty percent of the survey respondents have seen a health care provider within the last twelve months for pain or discomfort that he feels is related to the job. A significant number of employees also report pre-existing MSDs, and other contributing factors, which places them at increased risk of developing additional or more severe MSDs. The shoulder/neck, hand/wrist/arm, back/torso, and leg/foot regions all had significant scores. The results are contained in Table 1.

Table 1		Body Regions				
		Shoulder/ Neck	Hand/Wrist/Arm	Back/ Torso	Leg/ Foot	Head/ Eye
Priority Score		8	5	8	9	1
Risk	Prevalence	60%	60%	60%	80%	20%
	Rating	Medium	Medium	Medium	High	Low
Discomfort	Prevalence	80%	60%	100%	80%	20%
	Rating	High	Medium	High	High	Low

Ergonomics Issue Description and Recommendations

Heavy mobile equipment repair work requires sustained awkward postures of the back, neck, and shoulders as well as repetitive force associated with hand tool use. Working with heavy tires and vehicle parts requires heavy lifting. Workers also spend a great deal of time standing on the concrete floor.

Sustained Awkward Posture: Employees working overhead or bent over an engine commonly perform extended reaches. Extended reaches are examples of awkward postures that require the body to deviate from the neutral in the arms, shoulders, and back. Repeatedly performing tasks in such positions imposes increased stress on the joints and/or spinal discs. Injuries can occur when stressed muscles do not have adequate time to rest and recover. Although the repair tasks are varied, they utilize the same muscle groups, which reduce the opportunity for muscle recovery.

Employees performing standing work are commonly found holding (or sustaining) postures with significant back flexion. This awkward back posture is combined with holding the hands above shoulder height and bearing the weight of the manual or pneumatic tooling. The neck quickly fatigues in this type of posture, as do the shoulders. Working under the vehicle lift with legs splayed places extreme stress on the lower back, hips and neck. Employees were also seen kneeling or squatting, which places a high level of biomechanical stress on the musculature of the knee joint. Working in awkward, static postures increases the amount of force needed to accomplish an exertion, complete a task or sustain that posture, over time muscles tend to tire placing greater strain on tendons and ligaments. Sustained awkward postures also restrict blood flow and can cause muscle fatigue as well as place the employee at risk of developing Work-Related Musculoskeletal Disorders.

Employees typically have to bend their upper extremities (arms, hands, wrists) around objects to reach the component in need of repair; these awkward or deviated postures are combined with high hand forces when using manual tools or vibration when using impact tools. The muscles of the arm and hand are least effective (cannot exert as much force) when in an awkward posture because the ligaments and tendons are bending around corners and exerting internal force to simply hold the posture.

Excessive Lifting: The workers risk injury from forceful exertions caused by lifting heavy tires and parts. Forceful exertions can place high loads on the muscles, tendons, ligaments, and joints being used. Increasing the force required to lift a load also means increasing body demands (i.e. greater muscle exertion is necessary to sustain the increased effort) and imposing greater compressive forces on the spine. As force increases, muscles fatigue more quickly. Prolonged or frequent exertions of this type can lead to WMSDs when there is not adequate time for rest or recovery.

Prolonged Standing: Workers stand on the concrete shop floor for much of the day. 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.

Recommendations:

- ∞ Work areas should have oil-resistant anti-fatigue matting. In areas where carts or rolling equipment is used, anti-fatigue matting should be smooth with beveled edges. Cushioned inner soles can be provided as an alternative to anti-fatigue

matting when employees frequently move throughout the facility. Refer to vendor table 1.

- ∞ The workers currently use flat creepers, which still require the worker to support their upper body while reaching to perform repairs. An angle-adjustable creeper will support the upper torso and bring the worker closer to the repair area. The more natural posture will reduce the occurrence of awkward postures and diminish the risk of injury. If repair work can be performed from a seated position, an elevating creeper will help the employee work on vehicles on the lift in a more neutral position if the lift can not be raised further. Refer to vendor table 1.
- ∞ Topside creepers also allow the employees to obtain neutral positions and get closer to the task. Tool trays can also increase productivity because workers will have everything they need to complete the task. Refer to vendor table 1.
- ∞ Portable scissors lift tables will allow the worker to move forklift tires across the shop easily and safely. The scissor lift table can be lowered almost to floor level for loading and brought up to the height of the press for unloading to reduce heavy lifting. Refer to vendor table 1.
- ∞ The vehicle lift should be located so that it can be raised to a proper work height so the workers can work in a standing position.
- ∞ A sit/stand chair may be beneficial for employees working overhead. Refer to vendor table 1.
- ∞ Providing the workers with swivel attachments for their pneumatic tools and tool balancers will reduce the effort required to use them. Tool balancers relieve some of the weight of the tool. Swivel attachments allow the tool to swivel independently from the hose which aides maneuverability. Refer to vendor table 1.
- ∞ Kneepads will reduce the stress on the knees while employees are working on the P19 fire trucks. Refer to vendor table 1.

Vendor Table 1 – Heavy Mobile Equipment Repair			
Product	Vendor	Estimated Cost	Figure
Anti-Fatigue Matting	Lab Safety 1-800-356-0783	Price varies by size.	

Vendor Table 1 – Heavy Mobile Equipment Repair			
Product	Vendor	Estimated Cost	Figure
	Matting World 1-800-254-8557		
	Safeworker* recommended by NADEP Jax 1-888-456-3372	18" X 36 " Extreme Standing Mat with Beveled strips \$43.46 3'X5' Extreme standing mat with bevel strips \$156	
Inner-soles	Guard Industries *Recommended by NADEP Jax 1-314-534-6952	Body Cushion #3059 Hiker/casual insoles \$5.21	
	Alimed 1-800-225-2610	\$19 a pair	
	Polymer Dynamics 1-800-287-4466	\$10 a pair	
Angle adjustable creepers	Eidos Corp 1-800-210-9666	Price depends on features	
	Northern Tool & Equipment Co 800-221-0516	\$60	
	Whiteside 470 363 1179	\$147	
	Lab Safety 1-800-356-0783	\$114	

Vendor Table 1 – Heavy Mobile Equipment Repair			
Product	Vendor	Estimated Cost	Figure
High Lift Elevating Creeper	Eidos 1-800-210-9666	\$600	
Top-side creeper	Northern Tool & Equipment Co 800-221-0516	\$219	
	Whiteside 470 363 1179	\$200	
Topside tool tray	Northern Tool & Equipment Co 800-221-0516	\$79	
	Whiteside 470 363 1179	\$70	
Scissors Lift Table Price depends on weight capacity, construction material and table top size.	Grainger	\$401-\$1831	
	C&H 1-800-558-9966	\$386-\$1629	
	Lab Safety	\$916- \$1214	

Vendor Table 1 – Heavy Mobile Equipment Repair			
Product	Vendor	Estimated Cost	Figure
Sit/stand chair	Alimed 1-800-225-2610	\$475	
	Global Industrial 1-800-645-1233	\$223	
	C&H 1-800-336-1331	\$219	
Swivel attachment	Lab Safety 1-800-356-0783	\$12	
	Grainger	\$33	
Knee pads	Lab Safety 1-800-356-0783	\$16	
	Grainger	\$10-\$36	

TIRE SHOP (MOBILE EQUIPMENT SERVICER)

Purpose of the Operation: Tire maintenance

Population: Three civilian workers

Injury Data: Two back injuries

Description of the Operation:

Workers remove and replace vehicle tires. Workers bring tires into the shop after removing them from vehicles, which requires kneeling on concrete. Workers then separate the tire from the rim with a bead breaker. Repair tasks require the workers to lift the tires onto the bead breaker and the tire balancer, figure 7. The tire balancer requires the worker to hold the tire in place until the die is tightened, figure 8. Each tire has about 10 to 12 lug nuts. Workers maintain about 50 tires a week and use an impact wrench for the lug nut removal.



Figures 7: Lifting tire onto machine



Figure 8: Holding tire at balancer

The workers mentioned that the hardest task involves changing tires on the P19 fire trucks. Each tire weighs about 300 pounds with a 50" diameter and 15" width. Approximately 12 P19 tires are changed each year, requiring two workers and a forklift to perform repairs, figure 9.



Figure 9: Lifting a P19 tire

JR/PD Summary: The JR/PD survey results indicate that the tire shop is an ergonomics problem area with an overall priority score of **7** on a scale from 1 to 9. A score of 5 or higher is considered significant. The shoulder/neck, hand/wrist/arm, back/torso, and head/eye regions all had significant scores. The results are contained in Table 2.

Table 2		Body Regions				
		Shoulder/ Neck	Hand/Wrist/Arm	Back/ Torso	Leg/ Foot	Head/ Eye
Priority Score		7	7	7	4	5
Risk	Prevalence	67%	67%	100%	100%	33%
	Rating	High	High	High	High	Medium
Discomfort	Prevalence	33%	33%	33%	0%	33%
	Rating	Medium	Medium	Medium	Low	Medium

Ergonomics Issue Description and Recommendations

Workers in the tire shop are exposed to awkward postures and heavy lifting as well as vibration from hand tools.

Awkward Postures: Workers remove tires while kneeling on concrete, which places biomechanical stress on the knees that can lead to fatigue and discomfort. Hyper flexing the knees in a squatting or kneeling position can result in pressure on the back of the knees which may reduce circulation in the lower extremities.

Heavy Lifting: Workers lift, carry, and hold heavy tires repeatedly during the tire changing operation. Heavy lifting can place undue stress on the spine, which puts workers at risk of injury. Tires can be heavy and awkward because of their size and shape. Larger tires can be harder to grasp and carry.

Vibration: Changing tires requires the use of hand tools, which expose the worker to vibration. The National Institute of Occupational Safety and Health conducted a critical

review of epidemiological evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back. The review found strong evidence of a positive association between high level exposure to hand-arm vibration and vascular symptoms of hand-arm vibration syndrome (HAVS). For example, vibration can result from bad design, poor maintenance, and age of the powered hand tool. New powered hand tools even expose employees to excessive vibration if they do not include devices to dampen the vibration or shield the operator from it. There is substantial scientific evidence that as intensity and duration of exposure to vibrating tools increases so does the risk of developing HAVS.

Recommendations:

- ∞ Replace the current tire changing equipment with a version that picks up the tire in order to reduce heavy lifting for the worker. Refer to vendor table 2.
- ∞ Utilize kneepads or low stools when removing lug nuts on a concrete surface. Refer to vendor table 1.
- ∞ A torque reaction bar will reduce the impact associated with using the pneumatic impact gun and a swivel attachment on the end of the air hose will help the hose move more easily. See vendor tables 1 and 2.
- ∞ Vibration reducing gloves will help lower the vibration exposure of the workers while using hand tools. Only full-fingered gloves that conform to ISO 10819 Standard should be considered. Refer to vendor table 2.

Vendor Table 2- Tire Shop			
Product	Vendor	Estimated Cost	Figure
Tire Changing Equipment	Sander 1-800-227-6965	Corgi Equipment is available. Price depends on model.	
	Automotive Equipment Sales and Service (800) 749-5990		

Vendor Table 2- Tire Shop			
Product	Vendor	Estimated Cost	Figure
Torque Reaction Bar Contact vendor to make sure it is compatible with current tooling.	Atlas copco http://www.atlas-copco.com/getonboard/nasa/us_onboard.nsf/framebuilder Doug Eidem 253 437 3938	\$25	
	Snap-on; Mac tool; Ingersoll-rand, Chicago make similar products		
Vibration Reducing Gloves	Impacto 1-888-232-0031	Air Glove	
	Ergodyne 1-800-225-8238	Proflex	
	Chase Ergonomics Decase 1-800-621-5436		

PAINT AND BODY SHOP (MOBILE EQUIPMENT METAL MECHANIC)

Purpose of the Operation: Paint and repair damage to vehicles

Population: One civilian workers

Injury Data: Worker has trigger finger, carpal tunnel syndrome, bursitis and knee problems. Two recorded back injuries.

Description of the Operation:

The worker repairs damage to vehicles in the motor pool. When a vehicle arrives, it is first disassembled. The repair operation takes place on a concrete floor. Disassembly of a forklift can take a day and the entire process about four days. Approximately two forklifts are repaired each month. After the vehicle is disassembled, it is steam cleaned and sanded to remove rust and damaged areas. Minor bodywork may be performed on the vehicles. The vehicle is then wiped clean, taped off, primed, and painted. Painting, which can take up to two hours, is used to prevent corrosion and rusting. According to the worker, the most difficult part of the task is kneeling on the floor during repair work, figure 10. The worker also attaches decking to trailers using an impact gun to bolt boards in place.



Figure 10: Forklift Repair

JR/PD Summary: The JR/PD survey results indicate that the paint and body shop is an ergonomic problem area with an overall priority score of **9** on a scale from 1 to 9. A score of 5 or higher is considered significant. The employees reported pain and discomfort that has caused him difficulty in carrying out normal activities and pre-existing MSDs, and other contributing factors, which places him at increased risk of developing additional or more severe MSDs. The shoulder/neck, hand/wrist/arm, back/torso, and leg/foot regions all had significant scores. Both workers who completed

the survey have seen a health care provider in the past 12 months for pain or discomfort that he feels is related to the job. JR/PD results with less than three survey participants have limited applicability. The results are contained in Table 3.

Table 3		Body Regions				
		Shoulder/ Neck	Hand/Wrist/Arm	Back/ Torso	Leg/ Foot	Head/ Eye
Priority Score		9	9	9	9	4
Risk	Prevalence	100%	100%	100%	100%	100%
	Rating	High	High	High	High	High
Discomfort	Prevalence	100%	100%	100%	100%	0%
	Rating	High	High	High	High	Low

Ergonomics Issue Description and Recommendations

The worker in the tire shop is exposed to sustained awkward postures, compression and vibration from hand tools.

Awkward Postures and Compression: Workers repair forklifts while kneeling on concrete, which places biomechanical stress / compression on the knees that can lead to fatigue and discomfort. Hyper-flexing the knees in a squatting or kneeling position can result in pressure on the back of the knees which may reduce circulation in the lower extremities.

Vibration: Sanding and attaching decking require the use of hand tools, which expose the worker to vibration. The National Institute of Occupational Safety and Health conducted a critical review of epidemiological evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back. The review found strong evidence of a positive association between high-level exposure to hand-arm vibration and vascular symptoms of hand-arm vibration syndrome (HAVS). For example, vibration can result from bad design, poor maintenance, and age of the powered hand tool. New powered hand tools even expose employees to excessive vibration if they do not include devices to dampen the vibration or shield the operator from it. There is substantial scientific evidence that as intensity and duration of exposure to vibrating tools increases so does the risk of developing HAVS.

Recommendations:

- ∞ Utilize kneepads or wedges instead of kneeling on the concrete floor. Refer to vendor tables 1 and 3.
- ∞ Tools stools will also reduce the need to kneel on the concrete. Refer to vendor table 3.
- ∞ Low vibration tooling and vibration lowering gloves may reduce vibration exposure. Only full-fingered gloves that conform to ISO 10819 Standard should be considered. Refer to vendor tables 2 and 3.

- ∞ A lift or ramp for forklifts would allow the workers to assume neutral postures while performing repair work.

Vendor Table 3 – Mobile Equipment Metal Mechanic Shop			
Product	Vendor	Estimated Cost	Figure
Tool Stools	Lab Safety 1-800-356-0783	\$199	
	C&H 1-800-558-9966	\$156	
	Grainger	\$203	
	Alimed 1-800-225-2610	\$19-\$40	
Knee pads	Lab Safety 1-800-356-0783	\$16	
	Grainger	\$10-\$36	
	Alimed 1-800-225-2610	Industrial Knee Saver	
Low vibration tools	Atlas Copco 800 654 5965	Price depends on tool	
	Dynabrade 716 631 0110		

EMERGENCY SERVICES (INDUSTRIAL EQUIPMENT MAINTENANCE MECHANICS AND INDUSTRIAL EQUIPMENT REPAIRER)

Purpose of the Operation: Perform emergency services on base

Population: Six civilian workers

Injury Data: An injury occurred while a worker was retrieving a ladder. Workers mentioned back pain.

Description of the Operation:

The main purpose of this department is to perform emergency services on base for requests that will require less than 16 hours of work and \$1,000 in materials. About 60% of the time is spent on emergency services such as broken water pipes, electricity outage, and Heating, Ventilation, and Air Conditioning (HVAC) repairs. The workers also perform preventative maintenance on items such as sprinklers, attic exhaust fans, generators, and roll-up doors.

Workers spend 75% of their time out in the field although they also work in a machine and welding shop. Workers mentioned the hardest tasks are kneeling all day, pulling ladders off their trucks (figure 11), and retrieving equipment out of vehicles. Workers take starters, air compressors, engine parts, and repair parts to the jobsite and have to carry them from the vehicle to the problem area. Work is frequently performed on rooftops and many buildings do not have permanent ladders. Workers have to carry work items up ladders that they set up. Workers also noted that lifting 75 pound 40D battery is difficult, figure 12.



Figure 11: Retrieving ladder



Figure 12: Picking up 40D battery

JR/PD Summary: The JR/PD survey results indicate that emergency services is an ergonomics problem area with an overall priority score of **9** on a scale from 1 to 9. A significant number of employees reported pain and discomfort that does

not abate away from work. Eighty-three percent of the survey respondents have seen a health care provider within the last twelve months for pain or discomfort that he feels is related to the job. A significant number of employees also report pre-existing MSDs, and other contributing factors that places them at increased risk of developing additional or more severe MSDs. A score of 5 or higher is considered significant. All of the body regions all had significant scores. The results are contained in Table 4.

Table 4		Body Regions				
		Shoulder/ Neck	Hand/Wrist/Arm	Back/ Torso	Leg/ Foot	Head/ Eye
Priority Score		8	8	8	9	5
Risk	Prevalence	33%	33%	50%	67%	33%
	Rating	Medium	Medium	Medium	High	Medium
Discomfort	Prevalence	67%	67%	67%	83%	33%
	Rating	High	High	High	High	Medium

Ergonomics Issue Description and Recommendations

Workers in the emergency services shop are exposed to sustained awkward postures, compression and heavy lifting.

Awkward Posture and Compression: Workers assume sustained awkward postures during welding and repair operations. Squatting on the floor places biomechanical stress/compression on the knees, which can lead to fatigue and discomfort. Hyper-flexing the knees in a squatting or kneeling position can result in pressure on the back of the knees which may reduce circulation in the lower extremities. Retrieving ladders from vehicles requires awkward postures of the back and upper extremities combined with extended reaching and force exertions. Lifting from an awkward posture increases stress on the spine.

Workers who use traditional welding hoods have a tendency to lower the shield with a jerking motion of the neck to snap it shut. Frequent, abrupt neck motions can put stress on the neck and spine.

Excessive Lifting: The workers risk injury from forceful exertions caused by handling items for repair. Lifting materials from the vehicle and climbing up a ladder can place stress on the spine and upper extremities. Forceful exertions can place high loads on the muscles, tendons, ligaments, and joints being used. Increasing the force required to lift a load also means increasing body demands (i.e. greater muscle exertion is necessary to sustain the increased effort) and imposing greater compressive forces on the spine. As force increases, muscles fatigue more quickly. Prolonged or frequent exertions of this type can lead to WMSDs when there is not adequate time for rest or recovery.

Recommendations:

- ∞ Utilize kneepads or wedges instead of kneeling on the concrete floor. Refer to vendor table 3.
- ∞ A bucket organizer will make it easier to retrieve and carry tools. A seat attachment turns the bucket into a place to sit during the repair operation to reduce kneeling and squatting.
- ∞ When the lease expires on the current vehicles, replacements with ladder loaders and/or bumper hoists should be investigated. A ladder loader brings the ladders from the top of the vehicle down to the user automatically; thereby reducing heavy lifting. A bumper hoist can be used to retrieve materials from inside the vehicle. Refer to vendor table 4 and the following success story.
<http://www.safetycenter.navy.mil/success/stories/0042.pdf>
- ∞ Auto-darkening welding helmets will reduce awkward neck motions associated with lowering traditional hoods. The auto-darkening feature also reduces the likelihood of welding without proper eye protection. Refer to vendor table 4.
- ∞ Tool stools or a welding creeper will allow workers to weld at or near floor level in a more neutral posture. Refer to vendor tables 3 and 4.
- ∞ The 40D batteries should be stored off the ground if possible to reduce back bending when they are picked up. Carts should be utilized instead of carrying the batteries. If possible, the welders could fashion a two person handle for the batteries or better handles. Refer to this success story from SWERMC of an example of a two-person handle used for power-cons.

<http://safetycenter.navy.mil/success/stories/0100.pdf>

Vendor Table 4- Emergency Services			
Product	Vendor	Estimated Cost	Figure
Easy Ladder Loader	Knaac Manufacturing, 800-456-7865	\$800 + installation	
	Team TEMCO 1-800-322-7997	\$964	

Vendor Table 4- Emergency Services			
Product	Vendor	Estimated Cost	Figure
Bumper Hoist *call for exact pricing	Western Mule Crane 1-800-288-6853	\$3094-\$4095	
	Sto-Away Power Cranes 1-800-622-9797	\$3513 + installation	
Auto-darkening helmets	Grainger	\$148- \$263	
	Lab Safety 1-800-356-0786	\$447-\$486	
Welding Creeper	Eidos Corp 800 210 9666 Model # 110	\$170	
Tool carrying aides	Duluth Trading Company 1-800-505-8888 Bucket mounted tool organizer, seat top, and bucket with comfort grip	\$36	

MATERIALS SUPPORT

Purpose of the Operation: Receive, inventory, and distribute materials.

Population: Two civilian materials handlers work in the warehouse and office. Three materials controllers work in an office environment.

Injury Data: No recorded injuries

Description of the Operation: All material delivered to the base goes through materials support. Materials arrive by tractor-trailer from Federal Express, United Parcel Service, contractors and vendors. The truck driver brings the items to the edge of the dock. The materials handlers then lift individual items onto carts or use a forklift to retrieve items on pallets. The materials handlers open the arriving materials, inventory the contents, and stock it in the warehouse. The workers usually sit in a task chair and bend over a low dolly to inventory incoming items, figure 13. Most items are stored near the door and are quickly moved out of the warehouse. After six months, items that are still in storage are sent for disposal unless they are difficult to retrieve, expensive, or insurance items. Workers mentioned that the most difficult task involves handling pipe. Pipes weigh up to 40 lbs and can be 20 feet in length. Pipes arrive about once a week. Since pipe is hard to move, it is stored near the door, which makes it a trip hazard. Workers also noted storing and retrieving items from tall shelves is also difficult as well as pushing pallet jacks into areas where the forklift isn't feasible.



Figure 13: Inventorying arriving materials

Materials are also retrieved from local vendors in Kinston, Jacksonville, and New Bern. The materials handlers spend about half of their time in the warehouse and the rest of their time in the office. When a shop on base, such as Facilities, needs an item, they contact Materials Support. The materials controllers order the item and notify the shop via email when the part arrives. The shop is responsible for picking up their materials.

JR/PD Summary: The JR/PD survey results indicate that the materials shop is an ergonomics problem area with an overall priority score of **9** on a scale from 1 to 9. A significant number of employees reported pain and discomfort that doesn't abate away from work. One worker has seen a health care professional in the last 12 months that she feels is related to the job. A significant number of employees also report pre-existing MSDs, and other contributing factors, which places them at increased risk of developing additional or more severe MSDs. A score of 5 or higher is considered significant. The shoulder/neck, hand/wrist/arm, back/torso, and head/eye regions all had significant scores. Survey results for less than 3 workers have limited applicability. The results are contained in Table 5.

Table 5		Body Regions				
		Shoulder/ Neck	Hand/Wrist/Arm	Back/ Torso	Leg/ Foot	Head/ Eye
Priority Score		7	5	9	4	7
Risk	Prevalence	100%	50%	100%	100%	100%
	Rating	High	Medium	High	High	High
Discomfort	Prevalence	50%	50%	100%	0%	50%
	Rating	Medium	Medium	High	Low	Medium

Ergonomics Issue Description and Recommendations

Materials handlers are exposed to frequent awkward postures and heavy lifting.

Awkward Postures: Workers sit in awkward postures while bending over incoming materials for inventory. Extended reaches are also examples of awkward postures that require the body to deviate from the neutral in the arms, shoulders, and back. Workers perform extended reaches while accessing upper storage shelves. Accessing lower storage shelves requires bending of the back or kneeling, which places stress on the back and knees. Lifting in an awkward posture increases the stress on the spine. Repeatedly performing tasks in such positions imposes increased stress on the joints and/or spinal discs. Injuries can occur when stressed muscles do not have adequate time to rest and recover.

Excessive Lifting: Materials handlers regularly lift heavy items in order to place them on storage shelves or move them during the inventory process. Forceful exertions can place high loads on the muscles, tendons, ligaments, and joints being used. Increasing the force required to lift a load also means increasing body demands (i.e. greater muscle exertion is necessary to sustain the increased effort) and imposing greater compressive forces on the spine. As force increases, muscles fatigue more quickly. Prolonged or frequent exertions of this type can lead to WMSDs when there is not adequate time for rest or recovery.

Recommendations:

- ∞ Height adjustable scissor lift carts will allow material to be raised or lowered to the height of the shelf it is to be stored on. Scissor lift carts can be adjusted to promote neutral back postures during the inventory process, refer to vendor table 1. A less expensive option would be to use fixed height carts that are taller than the current dollies. A fixed height cart would reduce some back bending, particularly during the inventory process. High lift carts can be used to reach high shelves without having the lift items over shoulder height. Refer to vendor table 5.
- ∞ An electric height adjustable pallet jack will reduce the force required to move pallets in the warehouse and allow the pallets to be raised or lowered to storage height. Refer to vendor table 5.
- ∞ A mobile cart designed for storing pipes will reduce tripping hazards and aide in storing pipes. Contact Ernie Taylor at Peaklogix (703-819-6061) to have a cart designed for the task.

Vendor Table 5- Materials Handlers			
Product	Vendor	Estimated Cost	Figure
High Lift Cart	Grainger Cart lifts up to 51"	\$872	
Elevated dolly	Grainger Stock Picker Cart	\$275	
Powered scissor lift pallet jack	Lab Safety 1-800-356-0783	\$706	
	Grainger	\$2640	
	Global Industrial 1-800-645-1232	\$539	

Appendix I

Job Requirements and Physical Demands Survey Results

Heavy Mobile Equipment Repair

Summary

The Job Requirements and Physical Demands Survey (JR/PD) was administered to the employees of the heavy mobile equipment repair shop. Information regarding the development, instruction, and validation of the JR/PD can be found at http://www.brooks.af.mil/afioh/Health%20Programs/ergonomics_jrpd.htm. The JR/PD is an ergonomics assessment tool endorsed by the Department of Defense Ergonomic Working Group and used by the tri-services to collection occupational health data. The JR/PD is a survey used to assess ergonomics related risk in the workplace.

The results of the JR/PD indicate the heavy mobile equipment repair area is an Ergonomics Problem Area (EPA). The shop scored an Overall or Survey Priority Rank of **nine** (on a scale of 1 to 9), where nine has the highest priority for intervention. A score of five or greater indicates an Ergonomics Problem Area. The JR/PD assesses five distinct body regions: shoulder/neck, hand/wrist/arm, back/torso, leg/foot, and head/eye. The (body region) priority scores are a combination of identified ergonomics risk factors and employee reported discomfort. The shoulder/neck, hand/wrist/arm, back/torso, and leg/foot regions had significant priority scores. A significant number of employees reported experiencing work-related pain or discomfort that does not improve when away from work and has caused them difficulty in carrying out normal activities. Eighty percent of the survey respondents have seen a health care provider within the last twelve months for pain or discomfort that he or she feels is related to the job. A significant number of employees also reported pre-existing Musculoskeletal Disorders (MSDs) as well as illnesses recognized as contributing factors, which places them at a higher risk of additional or more severe Work-Related Musculoskeletal Disorders (WMSDs).

Overall Priority Score

The results of the JR/PD indicate the heavy mobile equipment repair shop is an ergonomics problem area with an overall score of **nine**. 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 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

5 (workers/respondents) completed the JR/PD survey, resulting in a 100% response rate. The population demographics are contained in Table 1.

Table 1: Population Demographics

Gender:	Male: 100%
Group:	Civilians: 100%
Age:	20% between the ages of 45 and 50
	60% between the ages of 51 and 60
	20% over the age of 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 ergonomics risk factors and discomfort. Workers indicate their duration of exposure for different ergonomics risk factors. Ergonomics 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 2 demonstrates the relationship between body region, discomfort, and risk.

Table 2 Body Region, Discomfort and Risk

		Body Regions				
		Shoulder/ Neck	Hand/Wrist/Arm	Back/ Torso	Leg/ Foot	Head/ Eye
Priority Score		8	5	8	9	1
Risk	Prevalence	60%	60%	60%	80%	20%
	Rating	Medium	Medium	Medium	High	Low
Discomfort	Prevalence	80%	60%	100%	80%	20%
	Rating	High	Medium	High	High	Low

Risk Prevalence and Rating

The percentage of respondents exposed to specific ergonomics risk factors for a given body region, for longer than two hours per day, assesses the prevalence of risk. A low rating represents 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 shoulder/neck, hand/wrist/arm and back/torso regions have medium levels or reported risk while the leg/foot region is high.

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 3. Low ratings represent less than 30% prevalence, medium 31% to 60% and high is greater 61%. The shoulder/neck, back/torso, and leg/foot regions have high levels of discomfort while the hand/wrist/arm region is medium.

Table 3: Discomfort Matrix

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

The Priority matrix in Table 4 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 heavy mobile equipment repair area is equal to the highest body region priority value, which is a nine. All of the body regions except head/eye had significant scores.

Table 4 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 **high**, which indicates job stress factors are of significant concern. 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 **10.6**. 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 10 is hard, indicating a physically demanding task.

Health Care Provider Score

According to the health care provider score, **4 (80%)** of the respondents 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

60% 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. Significant discomfort is apparent in the workers' inability to recover after the cessation of work.

Activity Interruption Score

60% 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

80% 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

60% 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.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
 - ∞ Front end alignment
 - ∞ Working on fire trucks
2. Which tasks take the most effort?
 - ∞ Alignments
 - ∞ The work on fire trucks. Working under forklifts on your back on the floor.
3. Are there any tools or pieces of equipment that are notoriously hard to work with?
4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest?
 - ∞ More than one lift to raise a vehicle, to a height comfortable for tall people.

Appendix II

Job Requirements and Physical Demands Survey Results

Mobile Equipment Servicer (Tire Shop)

Summary

The Job Requirements and Physical Demands Survey (JR/PD) was administered to the employees of the tire shop. Information regarding the development, instruction, and validation of the JR/PD can be found at http://www.brooks.af.mil/afioh/Health%20Programs/ergonomics_jrpd.htm. The JR/PD is an ergonomics assessment tool endorsed by the Department of Defense Ergonomic Working Group and used by the tri-services to collection occupational health data. The JR/PD is a survey used to assess ergonomics related risk in the workplace.

The results of the JR/PD indicate the tire shop is an Ergonomics Problem Area (EPRA). The shop 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 Ergonomics Problem Area. The JR/PD assesses five distinct body regions: shoulder/neck, hand/wrist/arm, back/torso, leg/foot, and head/eye. The (body region) priority scores are a combination of identified ergonomics risk factors and employee reported discomfort. The shoulder/neck, hand/wrist/arm, back/torso, and head/eye regions had significant priority scores. Sixty-six percent of the survey respondents have seen a health care provider within the last twelve months for pain or discomfort that he feels is related to the job.

Overall Priority Score

The results of the JR/PD indicate the tire shop is an ergonomics 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 are the shoulder/neck, hand/wrist/arm and back/torso 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

3 (workers/respondents) completed the JR/PD survey, resulting in a 100% response rate. The population demographics are contained in Table 1.

Table 1: Population Demographics

Gender:	Male: 100%
Group:	Civilians: 100%
Age:	33% between the ages of 25 and 30
	67% between the ages of 41 and 45

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 ergonomics risk factors and discomfort. Workers indicate their duration of exposure for different ergonomics risk factors. Ergonomics 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 2 demonstrates the relationship between body region, discomfort, and risk.

Table 2 Body Region, Discomfort and Risk

		Body Regions				
		Shoulder/ Neck	Hand/Wrist/Arm	Back/ Torso	Leg/ Foot	Head/ Eye
Priority Score		7	7	7	4	5
Risk	Prevalence	67%	67%	100%	100%	33%
	Rating	High	High	High	High	Medium
Discomfort	Prevalence	33%	33%	33%	0%	33%
	Rating	Medium	Medium	Medium	Low	Medium

Risk Prevalence and Rating

The percentage of respondents exposed to specific ergonomics risk factors for a given body region, for longer than two hours per day, assesses the prevalence of risk. A low rating represents 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 shoulder/neck, hand/wrist/arm, back/torso and leg/foot regions have high levels or reported risk while the head/eye region is medium.

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 3.

Low ratings represent less than 30% prevalence, medium 31% to 60% and high is greater 61%. The shoulder/neck, hand/wrist/arm, back/torso, and head/eye regions have medium levels of discomfort.

Table 3: Discomfort Matrix

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

The Priority matrix in Table 4 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 tire shop is equal to the highest body region priority value, which is a seven. All of the body regions except leg/foot had significant scores.

Table 4 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 of minimal concern. 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 **10.33**. 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 10 is hard, indicating a physically demanding task.

Health Care Provider Score

According to the health care provider score, **2 (66%)** of the respondents 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

0% 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. Significant discomfort is apparent in the workers' inability to recover after the cessation of work.

Activity Interruption Score

0% 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

0% 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

0% 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.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
 - ∞ Under a vehicle
 - ∞ Inflating large heavy equipment tires
2. Which tasks take the most effort?
 - ∞ Under a vehicle
 - ∞ Heavy equipment tires
3. Are there any tools or pieces of equipment that are notoriously hard to work with?
 - ∞ Heavy equipment lifts
4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest?
 - ∞ Make sure all equipment works properly

Appendix III

Job Requirements and Physical Demands Survey Results

Mobile Equipment Metal Mechanic (Paint & Body Shop)

Summary

The Job Requirements and Physical Demands Survey (JR/PD) was administered to the employees of the paint and body shop. Information regarding the development, instruction, and validation of the JR/PD can be found at http://www.brooks.af.mil/afioh/Health%20Programs/ergonomics_jrpd.htm. The JR/PD is an ergonomics assessment tool endorsed by the Department of Defense Ergonomic Working Group and used by the tri-services to collection occupational health data. The JR/PD is a survey used to assess ergonomics related risk in the workplace.

The results of the JR/PD indicate the paint and body shop is an Ergonomics Problem Area (EPRA). The paint and body shop scored an Overall or Survey Priority Rank of **nine** (on a scale of 1 to 9), where nine has the highest priority for intervention. A score of five or greater indicates an Ergonomics Problem Area. The JR/PD assesses five distinct body regions: shoulder/neck, hand/wrist/arm, back/torso, leg/foot, and head/eye. The (body region) priority scores are a combination of identified ergonomics risk factors and employee reported discomfort. The shoulder/neck, hand/wrist/arm, back/torso and leg/foot regions had a significant priority score. The employees reported pain and discomfort that has caused him difficulty in carrying out normal activities and pre-existing MSDs, and other contributing factors, which places him at increased risk of developing additional or more severe MSDs.

Overall Priority Score

The results of the JR/PD indicate the paint and body shop is an ergonomics problem area with an overall score of **nine**. An Overall Job Priority score of five or greater establishes a task/job as an ergonomics problem area. The Overall Job Priority score is determined by selecting the highest Body Region Score for the job which in this case are the shoulder/neck, hand/wrist/arm, back/torso, and leg/foot 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

2 (workers/respondents) completed the JR/PD survey, resulting in a 100% response rate. Survey results with fewer than 3 respondents have limited applicability. The population demographics are contained in Table 1.

Table 1: Population Demographics

Gender:	Male: 100%
Group:	Civilian: 100%
Age:	100% between the ages of 51 and 55

Priority Score

The JR/PD prioritizes five distinct body regions based upon a combination of ergonomics risk factors and discomfort. Workers indicate their duration of exposure for different ergonomics risk factors. Ergonomics 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 2 demonstrates the relationship between body region, discomfort, and risk.

Table 2 Body Region, Discomfort and Risk

		Body Regions				
		Shoulder/ Neck	Hand/Wrist/Arm	Back/ Torso	Leg/ Foot	Head/ Eye
Priority Score		9	9	9	9	4
Risk	Prevalence	100%	100%	100%	100%	100%
	Rating	High	High	High	High	High
Discomfort	Prevalence	100%	100%	100%	100%	0%
	Rating	High	High	High	High	Low

Risk Prevalence and Rating

The percentage of respondents exposed to specific ergonomics risk factors for a given body region, for longer than two hours per day, assesses the prevalence of risk. A low rating represents 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 were associated with high 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 3. Low ratings represent less than 30% prevalence, medium 31% to 60% and high is greater 61%. All of the body regions except head/eye were associated with high levels of discomfort.

Table 3: Discomfort Matrix

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

The Priority matrix in Table 4 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 paint and body shop area is equal to the highest body region priority value, which is a nine. All of the body regions except head/eye had maximum priority scores.

Table 4 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 of minimal concern. 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 **12.0**. 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 12 is very hard, indicating a very physically demanding task.

Health Care Provider Score

According to the health care provider score, **two (100%)** of the respondents 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

0% 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. Significant discomfort is apparent in the workers’ inability to recover after the cessation of work.

Activity Interruption Score

100% 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 | Ganglion Cyst |
| Trigger Finger, | Epicondylitis (Tennis Elbow) |
| Bursitis | Carpal Tunnel Syndrome |
| Thoracic Outlet Syndrome | Back Strain, Knee or Ankle Strain |
| Overuse Syndrome” | |

100% 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 | | |

100% 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.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
 - ∞ Sanding overhead
2. Which tasks take the most effort?
 - ∞ Hand sanding vehicles
3. Are there any tools or pieces of equipment that are notoriously hard to work with?
 - ∞ Straight line sander, hander grinder
4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest?
 - ∞ A lift in the shop, air tools that fit better

Appendix IV

Job Requirements and Physical Demands Survey Results Industrial Equipment Maintenance Mechanics and Industrial Equipment Repair (Emergency Services)

Summary

The Job Requirements and Physical Demands Survey (JR/PD) was administered to the employees of the emergency services area. Information regarding the development, instruction, and validation of the JR/PD can be found at http://www.brooks.af.mil/afioh/Health%20Programs/ergonomics_jrpd.htm. The JR/PD is an ergonomics assessment tool endorsed by the Department of Defense Ergonomic Working Group and used by the tri-services to collection occupational health data. The JR/PD is a survey used to assess ergonomics related risk in the workplace.

The results of the JR/PD indicate the emergency services area is an Ergonomics Problem Area (EPRA). The shop scored an Overall or Survey Priority Rank of **nine** (on a scale of 1 to 9), where nine has the highest priority for intervention. A score of five or greater indicates an Ergonomics Problem Area. The JR/PD assesses five distinct body regions: shoulder/neck, hand/wrist/arm, back/torso, leg/foot, and head/eye. The (body region) priority scores are a combination of identified ergonomics risk factors and employee reported discomfort. All of the body regions were associated with significant scores, but the back/torso region was the highest. A significant number of employees reported experiencing work-related pain or discomfort that does not improve when away from work and has interfered with normal activities. Eighty-three percent of the survey respondents have seen a health care provider within the last twelve months for pain or discomfort that he feels is related to the job. A significant number of employees also reported pre-existing Musculoskeletal Disorders (MSDs) as well as illnesses recognized as contributing factors, which places them at a higher risk of additional or more severe Work-Related Musculoskeletal Disorders (WMSDs).

Overall Priority Score

The results of the JR/PD indicate the emergency services area is an ergonomics problem area with an overall score of **nine**. 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 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

6 (workers/respondents) completed the JR/PD survey, resulting in a 60% response rate. The population demographics are contained in Table 1.

Table 1: Population Demographics

Gender:	Male: 100%
Group:	100% Civilian
	33% between the ages of 46 and 50
	67% between the ages of 51 and 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 ergonomics risk factors and discomfort. Workers indicate their duration of exposure for different ergonomics risk factors. Ergonomics 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 2 demonstrates the relationship between body region, discomfort, and risk.

Table 2 Body Region, Discomfort and Risk

Table 4		Body Regions				
		Shoulder/ Neck	Hand/Wrist/Arm	Back/ Torso	Leg/ Foot	Head/ Eye
Priority Score		8	8	8	9	5
Risk	Prevalence	33%	33%	50%	67%	33%
	Rating	Medium	Medium	Medium	High	Medium
Discomfort	Prevalence	67%	67%	67%	83%	33%
	Rating	High	High	High	High	Medium

Risk Prevalence and Rating

The percentage of respondents exposed to specific ergonomics risk factors for a given body region, for longer than two hours per day, assesses the prevalence of risk. A low rating represents 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 shoulder/neck, hand/arm/wrist, back/torso and heady/eye have medium reported levels of risk and leg/foot is high.

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 3. Low ratings represent less than 30% prevalence, medium 31% to 60% and high is greater 61%. The shoulder/neck, hand/arm/wrist, back/torso, leg/foot have high reported levels of discomfort and head/eye is medium.

Table 3: Discomfort Matrix

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

The Priority matrix in Table 4 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 emergency services area is equal to the highest body region priority value, which is a nine. All of the body regions have significant priority scores.

Table 4 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 **Medium**, which indicates job stress factors are of some concern. 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 **8.83**. 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, indicating a nominally physically demanding task.

Health Care Provider Score

According to the health care provider score, 5 (**83%**) of the respondents reported having been to a health care provider in the last 12 months for pain or discomfort that he feels is related to his job.

Recovery Time Score

67% 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. Significant discomfort is apparent in the workers' inability to recover after the cessation of work.

Activity Interruption Score

50% 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

67% 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

50% 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.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
 - ∞ Removing materials from the back of
 - ∞ Many bldgs aboard XXXX do not have permanent access ladders installed, but they have equipment that requires maintenance
 - ∞ Working inside close tight areas
 - ∞ Working overhead
2. Which tasks take the most effort?
 - ∞ Working inside Gensta.
 - ∞ Putting screw in frame overhead in blindside of unit.
3. Are there any tools or pieces of equipment that are notoriously hard to work with?
 - ∞ Ratchet.
4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest.
 - ∞ Reinststitute tool repair and maintenance keeping tools repaired and operational
 - ∞ A screw driver batter power/small size it will work wonders.

Appendix V

Job Requirements and Physical Demands Survey Results

Materials Support

Summary

The Job Requirements and Physical Demands Survey (JR/PD) was administered to the employees of the materials shop. Information regarding the development, instruction, and validation of the JR/PD can be found at http://www.brooks.af.mil/afioh/Health%20Programs/ergonomics_jrpd.htm. The JR/PD is an ergonomics assessment tool endorsed by the Department of Defense Ergonomic Working Group and used by the tri-services to collection occupational health data. The JR/PD is a survey used to assess ergonomics related risk in the workplace.

The results of the JR/PD indicate the materials shop is an Ergonomics Problem Area (EPRA). The materials shop scored an Overall or Survey Priority Rank of nine (on a scale of 1 to 9), where nine has the highest priority for intervention. A score of five or greater indicates an Ergonomics Problem Area. The JR/PD assesses five distinct body regions: shoulder/neck, hand/wrist/arm, back/torso, leg/foot, and head/eye. The (body region) priority scores are a combination of identified ergonomics risk factors and employee reported discomfort. The shoulder/neck, hand/wrist/arm, back/torso and head/eye regions had a significant priority score. The employees reported pain and discomfort that did not go away outside of work and pre-existing MSDs, and other contributing factors, which places him or her at increased risk of developing additional or more severe MSDs. One worker has seen a health care professional in the last 12 months that he or she feels is related to the job.

Overall Priority Score

The results of the JR/PD indicate the materials shop is an ergonomics problem area with an overall score of **nine**. An Overall Job Priority score of five or greater establishes a task/job as an ergonomics 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 back/torso 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

2 (workers/respondents) completed the JR/PD survey, resulting in a 100% response rate. Survey results with fewer than 3 respondents have limited applicability. The population demographics are contained in Table 1.

Table 1: Population Demographics

Gender:	Female: 100%
Group:	Civilian: 100%
Age:	50% between the ages of 41 and 45
	50% between the ages of 51 and 55

Priority Score

The JR/PD prioritizes five distinct body regions based upon a combination of ergonomics risk factors and discomfort. Workers indicate their duration of exposure for different ergonomics risk factors. Ergonomics 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 2 demonstrates the relationship between body region, discomfort, and risk.

Table 2 Body Region, Discomfort and Risk

Table 5		Body Regions				
		Shoulder/ Neck	Hand/Wrist/Arm	Back/ Torso	Leg/ Foot	Head/ Eye
Priority Score		7	5	9	4	7
Risk	Prevalence	100%	50%	100%	100%	100%
	Rating	High	Medium	High	High	High
Discomfort	Prevalence	50%	50%	100%	0%	50%
	Rating	Medium	Medium	High	Low	Medium

Risk Prevalence and Rating

The percentage of respondents exposed to specific ergonomics risk factors for a given body region, for longer than two hours per day, assesses the prevalence of risk. A low rating represents 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 shoulder/neck, back/torso, leg/foot, and head/eye regions were associated with high levels of risk while the hand/are/wrist was medium.

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 3. Low ratings represent less than 30% prevalence, medium 31% to 60% and high is greater 61%. The shoulder/neck, hand/arm/wrist/ and head eye regions were associated with medium levels of discomfort while the back/torso was high.

Table 3: Discomfort Matrix

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

The Priority matrix in Table 4 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 materials shop area is equal to the highest body region priority value, which is a nine. All of the body regions except leg/foot had significant priority scores.

Table 4 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 of minimal concern. 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 **11.0**. 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 12 is very hard, indicating a very physically demanding task.

Health Care Provider Score

According to the health care provider score, **one (50%)** of the respondents 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

50% 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. Significant discomfort is apparent in the workers' inability to recover after the cessation of work.

Activity Interruption Score

50% 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

50% 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

50% 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.

Date: 6/6/05

Location/Installation (Base name):– Materials Handler (Forklift Operator)

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?
 - ∞ When I am getting on and off the fork lift, the fork lift we have is not a new model fork lift
 - ∞ Looking for items in warehouse
 - ∞ Pulling and refilling purchase orders

2. Which tasks take the most effort?
 - ∞ Lifting material to stage
 - ∞ Lifting items of carts when received when material receiving are not here
 - ∞ Pulling and refilling purchase orders

3. Are there any tools or pieces of equipment that are notoriously hard to work with? (If possible, provide manufacturer and model)

4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest?
 - ∞ A bigger space to work in

14 September 2007

Appendix VI

Additional Job Requirements and Physical Demands Survey Results

Job Type Ergonomic Problem Areas are highlighted	Number of Surveys	Total Eligible	Number	JR/PD Score
Sign Painter	1	1		9
Sprinkler Systems Mech (Plumber)	1	1		4
Pest Controller	2	2		9
Laborer	1	4		6
Locksmith	1	1		4
Machinist	1	1		6
Weigh Scale Clerk	1	1		4
Welder	1	1		1
Eng. Equipment Operator / Coal Handling**	3*	6		9
Pipe Fitter	3	6		7
Hazardous Waste Disposer	4	4		5
HVAC Mechanic and HVAC Repairer	5	7		5
Motor Vehicle Operator	5	8		8
Industrial Equipment Maint. Mechanic, Industrial Equipment Repairer	6	10		9
Maintenance Worker (carpenter/painter, carpenter/plumber)	9	15		7
Electrician/Electrical Worker	12	15		7
Unknown Task*	1	1		

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*These two tasks are combined

**This task was eliminated since the task was unknown

Job Type Ergonomic Problem Areas are highlighted	Number of Surveys	Total Eligible	Number	JR/PD Score
Auto Equipment Repair Inspector	2	4		5
Auto Heavy Equipment Mechanics Inspectors	2	2		1
Electromotive Equipment Mechanics	2	2		4
Heavy Mobile Equipment Repair Insp.	5	5		9
Mobile Equipment Metal Mechanic	2	2		9
Mobile Equipment Servicer	3	3		7
Motor Vehicle Operator Supv	5	5		7
Supply Clerk	2	2		1
Transportation Assistant	2	2		9
Materials Handler	2	2		9
Shop Materials Controller	3	3		8

Date - 5/18/2005

Process Improvement Opportunities — Pipe Fitter

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.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
 - ∞ Under Bld face up, with 24 inch of room to do the work.
 - ∞

2. Which tasks take the most effort?
 - ∞ Sewer stoppage up and down motion on my knees.
 - ∞

3. Are there any tools or pieces of equipment that are notoriously hard to work with?
 - ∞ Sewer machine.
 - ∞

4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest.
 - ∞ Spread the work out equally to people, and not putting out and other working there butts off!
 - ∞

Date - 5/20/2005

Process Improvement Opportunities– Pest Controller

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.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
 - ∞ Treating termites under or beneath buildings
 - ∞ Termite Treatment-crawl space, cockroach-baiting

2. Which tasks take the most effort?
 - ∞ Termite treatment
 - ∞ Termite Treat, Nerbieiding

3. Are there any tools or pieces of equipment that are notoriously hard to work with?
 - ∞
 - ∞

4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest.
 - ∞
 - ∞

Date - 5/20/2005

Process Improvement Opportunities– Motor Vehicle Operator

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.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
 - ∞ Working in the back of the truck (packer) cleaning out debris
 - ∞ Climbing lifting

2. Which tasks take the most effort?
 - ∞ Climbing Lifting
 - ∞

3. Are there any tools or pieces of equipment that are notoriously hard to work with?
 - ∞
 - ∞

4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest.
 - ∞ A new truck (period)
 - ∞ Being a lot younger would help

Date - 5/18/2005

Process Improvement Opportunities - Maintenance

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.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
 - ∞ Welding items, projects from the floor position.
 - ∞ Removing & installing blower motors in barracks rooms, awkward twisting of hands & using ratchets to install screws.
 - ∞ Roofing floor tiles.
 - ∞ Removing floor tile, edging parque & flooring

2. Which tasks take the most effort?
 - ∞ Lifting Bending Kneeling.
 - ∞ Removing floortile
 - ∞

3. Are there any tools or pieces of equipment that are notoriously hard to work with?
 - ∞ Crow bar sledge hammer
 - ∞ Floor sanding edger
 - ∞

4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest.
 - ∞ More helpers for mechanics.
 - ∞ We have recently switched over to small work van. This has created lots of bending and twisting (together at the same time)

Date - 5/18/2005

Process Improvement Opportunities– HVAC Mechanic and HVAC Repairer

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.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
 - ∞ Working from step ladder
 - ∞

2. Which tasks take the most effort?
 - ∞ Pulling equipment and tools on roof with rope
 - ∞

3. Are there any tools or pieces of equipment that are notoriously hard to work with?
 - ∞
 - ∞

4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest.
 - ∞ Work van set up for trade it is used for such as ladder racks, Freon cylinder racks, console for paper work, lights for night work
 - ∞

Date - 5/20/2005

Process Improvement Opportunities– Hazardous Waste Disposer

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.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
 - ∞ Some PPE have to work with
 - ∞ Working in confined space
 - ∞ Squatting Bending

2. Which tasks take the most effort?
 - ∞ Cleaning equipment, tools
 - ∞ Squatting

3. Are there any tools or pieces of equipment that are notoriously hard to work with?
 - ∞
 - ∞

4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest.
 - ∞ More people same job
 - ∞

Date - 5/20/2005

Process Improvement Opportunities– Eng. Equipment Operator

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.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
 - ∞ Limbing trees w/ bucket and chainsaws, cleaning out gutters on roofs and ladders
 - ∞ The climbing of ladders & steps crawling, kneeling (coal handling 5/24/05)

2. Which tasks take the most effort?
 - ∞ Picking up tree limbs
 - ∞

3. Are there any tools or pieces of equipment that are notoriously hard to work with?
 - ∞ JLG's or platform lifts
 - ∞

4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest.
 - ∞ Multiple occupations require different physical demands. My physical conditioning for multi-tasking is minimal
 - ∞

Date - 5/18/2005

Process Improvement Opportunities– Electrician/Electrical Worker

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.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
 - ∞ I am required on a non-routine basis to break down sprinkler valves with large bolts and covers, often in awkward locations
 - ∞ Working in lift stations.
 - ∞ Working in high voltage gloves when thinner gloves are available for lower voltages
 - ∞ Bending Squatting Lifting.
2. Which tasks take the most effort?
 - ∞ I am required on a non-routine basis to break down sprinkler valves with large bolts and covers, often in awkward locations
 - ∞ Lighting, working with a 12 foot ladder or handy herman lift.
 - ∞ Lifting
3. Are there any tools or pieces of equipment that are notoriously hard to work with?
 - ∞ Tall ladders, lifts such as handy herman.
 - ∞ Tripod
 - ∞ Rotter machine. Pluming.
4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest.
 - ∞
 - ∞

Date - 5/18/2005, 5/20/2005, 5/24/2005

Process Improvement Opportunities

Combined results for groups of only one worker – job type is listed following the comment

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?
 - ∞ Typing or using the mouse (sign painter)
 - ∞ Working off a ladder (sprinkler)
 - ∞ Walking (laborer)
 - ∞ Work off extension ladders (machinist)
 - ∞ Fitting and tack welding heavy parts (welder)
 - ∞ Reaching (unknown)

2. Which tasks take the most effort?
 - ∞ Working on a ladder (sprinkler)
 - ∞ Pick heavy cans (laborer)
 - ∞ Lifting (machinist)
 - ∞ Reforming damaged equipment (welder)
 - ∞ Valve opening/closing (unknown)

3. Are there any tools or pieces of equipment that are notoriously hard to work with?
 - ∞ Hand shears, tin snips, pop rivet tools (machinist)
 - ∞

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 tool control program (machinist)
 - ∞ More people, more help (weigh scale clerk)

Date: 6/28/05

Process Improvement Opportunities – Motor Vehicle Operator, Motor Vehicle Supervisor

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.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
 - ∞ Securing loads with chain and chain binders
 - ∞ Lifting heavy boxes
 - ∞

2. Which tasks take the most effort?
 - ∞ Securing loads
 - ∞ Lifting battery boxes out of wrecker to jump start another vehicle. I feel that the wrecker is high in the air and I am standing on the ground. The box could be externally mounted!
 - ∞ Climbing in & out of truck beds

3. Are there any tools or pieces of equipment that are notoriously hard to work with?
 - ∞ Chain binders
 - ∞
 - ∞

4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest?
 - ∞ Make sure all equipment works properly
 - ∞
 - ∞

Date: 6/28/05

Process Improvement Opportunities — Supply Clerk

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.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
 - ∞ Picking up parts that are awkwardly shaped or boxes not normal size
 - ∞

2. Which tasks take the most effort?
 - ∞
 - ∞
 - ∞

3. Are there any tools or pieces of equipment that are notoriously hard to work with?
 - ∞
 - ∞
 - ∞

4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest?
 - ∞ I always ask for assistance when lifting
 - ∞

Date: 6/28/05

Process Improvement Opportunities – Transportation Assistant (Fleet Management)

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.

1. Which tasks are the most awkward or require you to work in the most uncomfortable position?
 - ∞ Computer work looking at the screen constantly and handling the mouse daily
 - ∞

2. Which tasks take the most effort?
 - ∞
 - ∞
 - ∞

3. Are there any tools or pieces of equipment that are notoriously hard to work with?
 - ∞
 - ∞
 - ∞

4. If you could make any suggestions that would help you do your job more easily or faster or better, what would you suggest?
 - ∞ Cordless telephones in all offices
 - ∞

End Notes:

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.