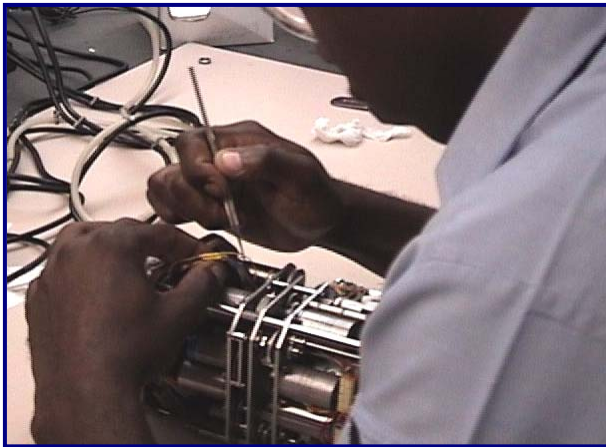


Ergonomic Risk Factors Resolved in Microelectronics Shop at Naval Air Station Jacksonville

Ergonomics is the science of fitting the work task to the worker, instead of requiring the worker to adapt to existing working conditions. The benefits of fitting the work task to the worker include increased productivity and efficiency as well as a decreased risk of work-related injuries and illnesses. Ergonomists contribute to the design and evaluation of tasks, jobs, products, environments, and systems to make them compatible with the needs, abilities, and limitations of the people who will use them.

The goal of an ergonomics program is to reduce the frequency and severity of work-related musculoskeletal disorders (WMSDs) by designing work tasks or workstations that minimize the risk of WMSDs. WMSDs are injuries and illnesses that may affect muscles, nerves, tendons, ligaments, joints, spinal discs, skin, and bones. Symptoms of WMSDs usually involve weakness and discomfort of the affected portion of the



Leaning over work for long periods may lead to a Work-related musculoskeletal disorder of the back, neck or shoulders.

activities to plan and redesign ergonomic hazards to reduce the risk of ergonomic injuries and WMSDs. Frequently, ergonomic risk factors can be minimized or resolved by introducing minor modifications such as adjusting work surface heights to eliminate bending of the back, or using task lighting that is the proper size and placement for reading or inspecting materials. Proper task lighting decreases the need for craning and twisting of the neck and minimizes eyestrain.

The symptoms often improve following medical treatment and the reduction or elimination of the ergonomic hazards. Ergonomically designed work tasks, equipment, and tools help to reduce the risk of work-related injuries and WMSDs by allowing workers to avoid the repetitive motions and awkward postures that can lead to WMSDs.

The Navy Ergonomics Program, which is managed by the Naval Facilities Engineering Command, works in partnership with Navy

During a site visit to the Aircraft Intermediate Maintenance Department (AIMD) at Naval Air Station Jacksonville (NAS Jax), an ergonomist on

staff with the Navy Ergonomics Program observed technicians in the 2M Microelectronics Shop (69 B) continually working in awkward postures and performing tasks that necessitated repetitive motions. The site visit was requested by the AIMD after the 2M Microelectronics Shop supervisor reported ergonomics-related issues to his Safety Petty Officer.



Technician uses microscope to aid in soldering small electronics part.

The technicians in the 2M Microelectronics Shop maintain and repair micro-miniature electronics parts used in aircraft for

communication, radar, etc. Technicians on two shifts routinely remove, repair, test, and replace these aircraft electronics components. Components vary in size from a 1” part to a 12” circuit board. One important repair task involves using the fingers in a “pinch grip” to hold and manipulate small electronics parts while soldering them. Soldering is performed with and without a microscope, depending on the size of the part. The microscopes are also used for performing quality checks on small electronics parts. Workers typically spend up to four hours a day using microscopes.



Using a “pinch grip” to grasp objects and leaning over work for long periods can strain the hands, back, neck and shoulders.

To carry out their assigned tasks, 2M Microelectronics Shop technicians used to have to assume awkward postures while bending over their work benches or looking into microscopes to work on intricate electronic parts. Such postures put strain on backs, necks, and shoulders. In addition, using hand tools to repair electronic parts necessitated repetitive manipulations and awkward postures. Technicians also had to continually stretch to reach some of the equipment needed for repair work.



Extended reaching increases risk of developing a WMSD.

Extended reaching is an example of an awkward posture that requires deviation of the arms, shoulders, and back from the preferred neutral position with straight wrists, elbows close to the body, and head straight and in-line with the torso. Frequent extended reaching increases stress on the joints, muscles, and tendons in the arms, shoulders, and back. This combination of ergonomic risk factors and repetitive motions increased the technicians' risk of developing WMSDs.

Another factor that affected repair shop technicians was the tendency to rest their forearms against the edges of the workbench while



Contact stress can cause pain, discomfort and nerve damage.

manipulating small hand tools. Leaning on the sharp edge of the workbench resulted in *contact stress* when soft tissue of the hands and forearms was squeezed and compressed. Sustained contact stress can compress the tendons, ligaments or muscles that are close to the surface of the skin resulting in irritation and inflammation. Over time or with repeated exposure, the inflammation can cause pain and discomfort. The constant pressure also reduces blood flow to the hands, which may lead to nerve damage.

The Navy ergonomist also found that lighting levels in the 2M Microelectronics Shop averaged about 50 foot-candles, the standard unit for measuring the intensity of light on a given surface. According to NAVAIR Standard Instruction 01-1A 23, the applicable Navy standard on illumination, lighting levels at NAS Jax for precision tasks like those performed in the 2M Shop should be at least 93 foot-candles. The ergonomist also noted the absence of task lighting at repair shop workstations. The absence of task lighting can increase eyestrain and result in awkward postures as a technician bends over while straining to see a part clearly, either with or without the aid of a microscope.

Following observation and examination of the work site, the Navy ergonomist recommended a Job Requirements and Physical Demands (JR/PD) survey of 2M Microelectronics Shop technicians. The JR/PD survey is a self-evaluation ergonomic assessment tool usually administered by the shop supervisor or safety personnel. The survey is endorsed by the Department of Defense Ergonomics Working Group and is distributed and used by Navy ergonomists to assess needs and address concerns regarding ergonomic risk factors. Overall JR/PD survey results for the Microelectronics Shop indicated the presence of

ergonomic risk factors, particularly to the shoulders, neck, head, and eyes.

A request for ergonomic intervention in the Microelectronics Shop was submitted by the Safety Petty Officer at AIMD Jax and approved for funding by the Hazard Abatement and Mishap Prevention Program. The Hazard Abatement and Mishap Prevention Program funded ergonomic solutions recommended by the Navy Ergonomics Program ergonomist for the Microelectronics Shop. The funded ergonomic work equipment included four adjustable microscopes with fiber optic light sources to provide task lighting and eight ergonomically designed industrial workbenches. The workbenches have padded edges that eliminate stress contact to the forearms and task lighting for tasks that do not require a microscope. The adjustable microscopes and task lighting now allow the technicians to work in neutral positions without slouching or other awkward postures. The ergonomic workstations help minimize the need for extended reaching, contact stress, eyestrain, and awkward postures.



Adjustable microscopes allow technicians to work in neutral positions.

Nine months after the arrival of the new equipment, a post-intervention JR/PD survey in the Microelectronics Shop indicated that ergonomic risk factors had been reduced to a minimum. The JR/PD uses a scale of 1 to 9, where 9 is the maximum value for ergonomics-related risk and a score of 5 and higher indicates an ergonomics problem area. Prior to the Navy Ergonomics Program intervention, the JR/PD for the Microelectronics Shop indicated a score of 9. After the intervention, the JR/PD was lowered to a 2. The follow-up survey found no reports of work-related pain or discomfort since the Hazard Abatement and Mishap Prevention Program had provided the adjustable microscopes with fiber optic light sources and upgraded the Shop's workstations.

The Navy Ergonomics Program provides technical support to Navy shore facilities, assistance with their applications for Hazard Abatement and Mishap Prevention Program funding, site visits to evaluate ergonomic risk factors, and assistance with identification and implementation of

ergonomic resolutions. Please visit us at www.navfac.navy.mil/safety, and click on Ergonomics for additional information.

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