



Dryden Flight Research Center
Edwards, California 93523

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Dryden Centerwide Procedure

Code S

Ergonomics

Electronically approved by
Assistant Director for Management Systems

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1.0 PURPOSE OF DOCUMENT

The document provides guidance and procedures for determining and implementing the accommodations necessary to reduce and control ergonomic injuries known as Musculoskeletal Disorders (MSDs) at DFRC.

2.0 PROCEDURE SCOPE & APPLICABILITY

Scope: This procedure applies to design of workstations and work processes.

Applicability: This procedure applies to all residents on site at Dryden Flight Research Center.

3.0 PROCEDURE OBJECTIVES, TARGETS, METRICS, & TREND ANALYSIS

Objective: Increase employee productivity, moral, and eliminate/control injuries from identified ergonomic related injuries at DFRC

Target: No MSDs.

Metric: The number of MSDs.

Trend analysis: Metrics will be analyzed to determine whether procedural objectives have been met.

4.0 WAIVER AUTHORITY

This procedure may not be waived.

5.0 OVERVIEW OF ERGONOMICS PROGRAM

Ergonomics is the science of designing work and the work environment to fit the worker rather than forcing the worker to adapt to the workplace. Work layout, equipment, and work practices are designed to maximize productivity by minimizing operator fatigue and discomfort. This document provides guidance and procedures for determining and implementing the work design changes necessary to increase productivity and reduce and control ergonomic injuries known as Musculoskeletal Disorders (MSDs).

6.0 ORDER OF PREVENTION

The order of precedence for preventing ergonomic-induced injuries is:

- A. Engineering controls. Design the workplace to fit or to be adaptable to the worker.
- B. Administrative controls. Give the body time for recovery (e.g., organize work to provide breaks from caution zone activities).
- C. Personal protective equipment (PPE). Lessens the stresses placed on the body (e.g., gel pads at keyboards).

7.0 RESPONSIBILITIES

7.1 The Chief, Safety, Health, and Environmental Office (SH)

The Chief of the Safety, Health, and Environmental Office has safety oversight for the Ergonomics Injury Prevention Program.

- A. Appoint an Ergonomic Program Administrator.
- B. Evaluate and update the Ergonomic Injury Prevention Program as necessary.

7.2 DFRC Health Unit

The Health Unit and the Ergonomic Program Administrator will provide the following to civil servants and contractor personnel within contractual limitations. Contractor employees should check with their site managers to determine other means for evaluations.

- A. Provide the patient with an initial assessment of acute MSD and Cumulative Trauma Disorder (CTD) and recommend referral as appropriate.
- B. Notify the Ergonomic Program Administrator with a "Request for Ergonomic Evaluation" of all confirmed ergonomic-induced injuries.

7.3 Ergonomics Program Administrator

- A. Contact the employee to schedule a workstation evaluation when notified by the Health Unit by a Request for Ergonomic Evaluation.
- B. Send ergonomic evaluation findings to the employee, his or her supervisor, and the Health Unit.

- C. Conduct surveys of operations, tasks, or workstations at the request of management, Health Unit, or employees or studies to determine the potential for ergonomic injuries.
- D. Make ergonomic survey findings available to authorized persons involved.
- E. Make recommendations for control or elimination of any undesirable MSD or CTD.
- F. Review OSHA Log 300 for ergonomic disorders.
- G. Communicate ergonomic information to increase the awareness of management, supervisors, and employees.
- H. Provide ergonomic training to DFRC personnel as requested.
- I. Provide consultation on ergonomic solutions to include selection of tools, furniture, and workstations.
- J. Maintain appropriate program documentation and ergonomic worksite and job analysis reports.

7.4 Directorates and Single Letter Offices

Directorates and Single Letter Offices are responsible for enforcing ergonomic-related health and safety policies within their areas of responsibility.

- A. Ensure that ergonomics are considered when conducting hazard and risk assessments.
- B. Provide necessary resources to supervisors and employees to solve ergonomic problems.
- C. Ensure furniture purchased for employee workstations, workshop tools, and work procedures meet the needs of the individual employee.

7.5 Supervisors

- A. Ensure that each employee is provided a workstation that has adequate adjustability and, to the extent feasible, fits the employee's individual needs.
- B. Make ergonomics a part of workplace evaluations using the guidance in this procedure.
- C. Respond to employee's concerns regarding ergonomics.
- D. Request assistance from the Ergonomic Program Administrator for evaluation of potential harmful ergonomic conditions.
- E. Promptly refer persons with potential ergonomic-induced injuries or illnesses to the Health Unit.

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- F. Provide employees who engage in intensive, highly repetitive work with frequent alternate work activities.

7.6 Employee Responsibilities

- A. To the extent possible, adjust your workspace to promote neutral posture and avoid caution zone job conditions. (See Appendix A.)
- B. Contact the Safety, Health, and Environmental Office when severe or persistent muscle pains are experienced to request an ergonomic evaluation before symptoms progress to disability.
- C. Notify supervisor of known or suspected unsatisfactory ergonomic conditions or practices.
- D. Visit Health Unit for diagnosis of potential ergonomic related injuries
- E. Cooperate with supervisors, Health Unit, and the Ergonomic Program Administrator in the elimination of harmful ergonomic conditions and practices.

8.0 CONTROL OF ERGONOMIC HAZARDS

The goal of ergonomics is to minimize the strains on the human body. For office ergonomics, this translates into a work layout and design that promotes neutral posture. For more detailed information regarding ergonomic controls, contact the Ergonomic Program Administrator at the Safety, Health, and Environmental Office. A task analysis or workstation evaluation may be necessary to identify opportunities to minimize physical stressors of caution zone jobs identified in Appendix A.

8.1 Workstations

Office workstations will be designed, as much as possible, to meet the needs of the person(s) utilizing them.

8.2 Keyboards & Other Input Devices

Generally, input devices should be at the same level as the keyboard and directly in front of the operator with the operator's forearms and hands parallel to the floor. Keyboard palm rests may be used to reduce pressure on wrists and forearms from sharp edges of desks. Alternate ergonomic keyboards and mice may be used to correct poor ergonomics.

8.3 Work Surfaces

Work surfaces should be large enough to provide adequate workspace and hold frequently used equipment. Desks should have adequate legroom and be high enough to allow the operator's hands and forearms

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to be parallel to the floor. Under-desk keyboard tray tables are required where the desk height is above the seated elbow height and recommended where there is sufficient room between the operator's legs and the bottom of the desk. Where tray tables are used, they should have a negative tilt to promote a neutral hand-wrist posture.

8.4 Chairs

Ergonomically acceptable chairs should have a stable base (a five-leg base with soft or hard casters compatible with the floor surface). The chair should be adjustable in height, have a separate tilt back, seat pan that adjusts in length and tilt of 128 degrees or greater, and curve downward at the front. If armrests are attached, they should be adjustable for height and be able to pivot in toward the user. A footrest may be necessary for persons whose feet do not touch the floor when seated with eye-level at or near the top of their monitor.

8.5 Monitor Position

Computer monitors should be positioned directly in front of the operator with the top of the monitor at approximately eye level and within arm's reach.

8.6 Document Holders

Where operators frequently work from written notes or printed material, a document holder is recommended to prevent neck and shoulder pain and stiffness. The document holder should either be located just below and in line with the monitor or at the same height beside the monitor.

8.7 Lighting & Vision

- A. Monitor screens should be set at an illumination level only high enough to allow good visual definition for the person using the monitor. Monitors should be placed where window or room lighting does not reflect off the screen causing a glare and should not be placed where there is a strong light behind them such as toward a window. Where glare is inevitable, a glare screen should be provided to allow good visual.
- B. Computer glasses correct for midrange vision and may be helpful for employees who work at a computer for two (2) consecutive hours or for four (4) hours a day. Most optometrists can provide computer glasses when they are required to comfortably read the monitor without leaning forward or tilting one's head when bifocals are worn.

8.8 Hand and Shop Tools

Ergonomic suitability will be considered when hand tools and other equipment that could potentially cause CTDs or MSDs are purchased. Following are some considerations when buying hand tools and shop equipment.

- A. Consider hand tools that have correct fitting nonslip grips and require the least motion, such as twisting and bending.
- B. Avoid hand and shop tools that cause excessive vibration, where possible.
- C. Use stationary tools, such as drills or saws, in place of hand tools for heavy or cumbersome jobs, where possible.
- D. Use tools that are activated by a trigger switch with handles that allow for the middle of the finger to pull the trigger. Energizing the switch with the tip of the finger can cause a cumulative trauma disorder to the finger called "trigger finger".
- E. Never use gloves or other cloth items around spinning or rotating equipment
- F. Items to consider when using hand or shop tools are:
 - 1) Grip Force – This is the force that is required to hold and operate a hand or shop tool. Excessive grip force can cause a CTD. Grips should spread the pressure over a wide area as possible with minimum pressure on the sides of the fingers.
 - 2) Feed Force – The pushing, pulling, or twisting motions that are required to feed stock into a hand or shop tool. The tools that require the least feed force should be considered for purchase.
 - 3) Repetitive Motion – Repetitive motion is a major cause of CTDs. Highly repetitive tasks should be reviewed in order to reduce as much motion as possible. Administrative Controls may be used to institute controls such as planned rest breaks and shorter duration exposure. Repetitive tasks should be shared so that one person is not required to spend excessive time on the task.
 - 4) Vibration – Vibration can enhance the effects of CTDs. Vibrations at 40-90 hertz appear to produce the greatest stress. There are methods to reduce vibrations such as vibration damping gloves, using tools with vibration damping capabilities, reduce the hertz by slowing tool speeds, and taking frequent rest breaks.
 - 5) Torque – Torque is the twisting force that many tools produce. Torque can place unusual stresses on the body. Torque may be reduced by using extension handles to apply more leverage on the tool or the use impact tools where possible.

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8.9 Lifting Heavy Objects

MSDs of the back are preventable, but cause more lost time cases than any other injury.

- A. Check to see the route is clear before moving the load.
- B. Use mechanical or powered lifting devices when available.
- C. Make a unison two-person lift when the lift is not safe for one person (awkward loads or heavy loads) and talk your way through the movement/lift.
- D. Split the load and make more than one lift, if possible.
- E. Avoid lifting heavy objects above shoulder level or overhead.
- F. Use correct body position when lifting loads off floor level.
- G. Turn with the feet rather than twisting at the torso.

8.10 Repetitive Motion Tasks

Vary the types of work performed or take more frequent breaks to provide recovery time for soft tissues.

9.0 TRAINING

Voluntary ergonomic training is provided by the Safety, Health, and Environmental Office. Persons desiring training may sign up for a class by logging onto SATERN on the Dryden Xnet: Ergonomics for the Shop or Ergonomics for the Office. It is recommended that persons receive this training prior to requesting a workstation evaluation. These ergonomic awareness classes cover the following items:

- A. Review of the Dryden Ergonomic Injury Prevention Program.
- B. Proper ergonomic computer workstation setup.
- C. How to recognize MSD-related injuries.
- D. Procedures for reporting known or suspected MSDs.
- E. Proven work practices that reduce or eliminate MSDs.
- F. Importance of choosing proper furniture, tools, and equipment that reduce or eliminate certain MSDs.
- G. Responsibility of management and supervisors to provide a workstation that, as best as possible, fits the person/s using it.

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10.0 MANAGEMENT RECORDS & RECORD RETENTION

Records are preserved, maintained, and disposed of in accordance with NPR 1441.1, NASA Records Retention Schedules, and DFRC records management procedures. Destruction of any records, regardless of format, without an approved schedule is a violation of Federal law.

10.1 Medical Records

- A. Must be kept confidential
- B. Must include results of examinations, evaluations, and follow-up procedures
- C. Must be made available to the subject employee and to anyone authorized, in writing, by the subject employee. See 29 CFR 1910.1020 for details on who may access an individual's medical records.

10.2 Training Records

Training records will be maintained in SATERN.

10.3 Ergonomic Worksite & Job Analysis Reports

Ergonomic worksite and job analysis reports will be maintained with Industrial Hygiene records.

11.0 RELEVANT DOCUMENTS

11.1 Authority Documents

California Code of Regulations (CCR)	Title 8, Section 5110, Repetitive Motion Injuries.
29 CFR 1910.1020	Access to Exposure and Medical Records

11.2 Informational Documents

NIOSH (DHHS) Publication No. 97-117	Elements of Ergonomics Programs: A Primer Based on Workplace Evaluations of Musculoskeletal Disorders
NIOSH Publication NTIS PB 821-789-48	Work Practices for Manual Lifting.

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11.3 Informational Links

[CUergo Cornell University Ergonomics Website](#)

[Ergonomic and Musculoskeletal Disorders / NIOSH Topic Page](#)

[Purdue Ergonomics Website](#)

[NIOSH Elements of Ergonomics Programs](#)

[WISHA Ergonomics website](#)

12.0 ACRONYMS & DEFINITIONS

12.1 Acronyms

CTD	Cumulative Trauma Disorder
MSD	Musculoskeletal Disorder
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration

12.2 Definitions

Caution Zone Jobs (CZJs) Jobs where an employee's typical work activities include any of the specific physical risk factors identified in Appendix A. These jobs have a sufficient degree of risk to require ergonomic awareness education and job hazard analysis. The three major criteria considered when determining work activities in a caution zone job are:

- **Repetitive motions:** If motions are repeated frequently, (e.g., every few seconds with little or no variation) and for prolonged periods such as an 8-hour shift, fatigue and muscle/tendon strain can accumulate. Tendons and muscles can often recover from the effects of stretching or forceful exertions if sufficient time is allotted between exertions. Effects of repetitive motions for performing the same work activities are increased when awkward postures and forceful exertions are involved. Repetitive actions, as a risk factor, can also depend on the body area and specific act being performed.
- **Repetition rate:** Both the number of hand manipulations per 8-hour work shift and the task cycle time have been used to rate this factor. Task cycle times of 30 sec or less were defined as high repetition; cycle times greater than 30 sec as low repetition. For hand manipulations, high repetitiveness was described as more than 20,000

manipulations per 8-hour work shift; medium repetitiveness as between 10,000 and 20,000 manipulations per 8-hour work shift; low repetitiveness as less than 10,000 manipulations per 8 hour work shift.

- **Duration:** Duration refers to the amount of time a person is continually exposed to a risk factor. Job tasks that require use of the same muscles or motions for long durations increase the likelihood of both localized and general fatigue. In general, the longer the period of continuous work (e.g., tasks requiring sustained exertions) the higher the risk of injury.

Cumulative Trauma Disorders (CTDs)

A CTD is a subgroup of MSDs that develops in the body over a period of time as a result of repeated micro traumas.

Ergonomics

The science and practice of designing jobs or workplaces to match the capabilities and limitations of the human body.

Neutral Posture

The positioning of the body such that joints are not bent and the spine is aligned and not twisted.

Repetitive Motion Injuries (RMI)

A Repetitive Motion injury is a subgroup of MSDs that involve motions repeated frequently, (e.g., every few seconds) and for prolonged periods such as an 8-hour shift, that may cause fatigue and muscle- tendon strain. Tendons and muscles can often recover from the effects of stretching or forceful exertions if sufficient time is allotted between exertions. Effects of repetitive motions for performing the same work activities are increased when awkward postures and forceful exertions are involved. Repetitive actions as a risk factor can also depend on the body area and specific act being performed.

Musculo-skeletal Disorders (MSDs)

A group of disorders or injuries that occur to the muscles or skeletal systems of the body. This group of disorders include, back injury, muscle pulls and sprains, Tendonitis, vibration trauma, and other disorders affecting the muscles or bones of the body resulting from repeated body movement.

APPENDIX A: CAUTION ZONE JOBS

Caution Zone Checklist Use one sheet for each position evaluated.			
Movements or postures that are a regular and foreseeable part of the job, occurring more than one day per week, and more frequently than one week per year.	If done in this job position <input checked="" type="checkbox"/> the box	Job Position evaluated: Date:	No. of employees in these jobs?
Awkward Posture		Comments/Observations	
	1. Working with the hand(s) above the head, or the elbow(s) above the shoulders more than 2 hours total per day.	<input type="checkbox"/>	
	2. Working with the neck or back bent more than 30 degrees (without support and without the ability to vary posture) more than 2 hours total per day.	<input type="checkbox"/>	
	3. Squatting more than 2 hours total per day.	<input type="checkbox"/>	
	4. Kneeling more than 2 hours total per day.	<input type="checkbox"/>	
High Hand Force		Comments/Observations	
	5. Pinching an unsupported object(s) weighing 2 or more pounds per hand, or pinching with a force of 4 or more pounds per hand, more than 2 hours total per day (comparable to pinching half a ream of paper).	<input type="checkbox"/>	
	6. Gripping an unsupported object(s) weighing 10 or more pounds per hand, or gripping with a force of 10 or more pounds per hand, more than 2 hours total per day (comparable to clamping light duty automotive jumper cables onto a battery).	<input type="checkbox"/>	

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Highly Repetitive Motion		Comments/Observations
	7. Repeating the same motion with the neck, shoulders, elbows, wrists, or hands (excluding keying activities) with little or no variation every few seconds, more than 2 hours total per day.	<input type="checkbox"/>
	8. Performing intensive keying more than 4 hours total per day.	<input type="checkbox"/>
Repeated Impact		Comments/Observations
	9. Using the hand (heel/base of palm) or knee as a hammer more than 10 times per hour, more than 2 hours total per day.	<input type="checkbox"/>
Heavy, Frequent or Awkward Lifting (A simple scale can be used to determine the weight of materials)		Comments/Observations
	10. Lifting object weighing more than 75 pounds once per day or more than 55 pounds more than 10 times per day.	<input type="checkbox"/>
	11. Lifting objects weighing more than 10 pounds if done more than twice per minute, more than 2 hours total per day.	<input type="checkbox"/>
	12. Lifting objects weighing more than 25 pounds above the shoulders, below the knees or at arms length more than 25 times per day.	<input type="checkbox"/>
Moderate to High Hand- Arm Vibration (Closely estimate or obtain the vibration value of the tool in use)		Comments/Observations
	13. Using impact wrenches, carpet strippers, chain saws, percussive tools (jack hammers, scalers, riveting or chipping hammers) or other tools that typically have high vibration levels, more than 30 minutes total per day.	<input type="checkbox"/>
	14. Using grinders, sanders, jigsaws or other hand tools that typically have moderate vibration levels more than 2 hours total per day.	<input type="checkbox"/>

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