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Ergonomics : a focus on the Prince George County, Va Emergency Operations Center workstations

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RESEARCH QUESTION

(1) This research paper examines the current ergonomic characteristics of the Prince George County Emergency Operations Center Workstations. Further, the research attempts to answer the following question: How do the Prince George County Emergency Operations Center Workstations compare with conventional wisdom, and literature on the topic of workstation ergonomics?

APPROVAL PAGE

I certify that I have read this thesis and find that, in scope and quality, it satisfies the requirements for the degree of Master of Disaster Science.

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ERGONOMICS: A FOCUS ON THE PRINCE GEORGE COUNTY, VA. EMERGENCY OPERATIONS CENTER WORKSTATIONS

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KEYWORDS
Prince George County, Va., Occupational Health and Safety Administration, Langley Research Center Ergonomics Program, Orange County, Calif. Grand Jury

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INTRODUCTION

(2) Prince George County, Virginia, is a mostly rural county that is experiencing steady growth. In large part, this is due to its proximity to United States (US) Interstate 95, US Interstate 295, and US Route 460. The County is located just South of the City of Richmond, which is the Virginia State Capitol. In addition, the Tri-Cities of Petersburg, Hopewell, and Colonial Heights border the County on the North and West. Moreover, Fort Lee, a United States Army base, sits within the boundaries of the County and is the home to a variety of military schools, and is currently experiencing tremendous growth.

(3) The increasing population has created an increased demand for emergency services. Table 1 shows the demographics from the year 2000, and the estimated annual growth rate up to the year 2013.

Table 1

Population Growth	Population	Annual Growth Rate
2013 Total Population	38,338	0.6%
2008 Total Population	37,208	1.5%
2000 Total Population	33,047	-
July 2007 Certified Population Estimate	-	-
July 2007 Certified Population Growth	-	-
July 2007 Certified Net Migration	-	-

Source: Economic Development Intelligence System 2009

(4) This increasing population is not the only concern for the County. Like most localities the County is also subject to disaster events, natural and man-made, which require coordinated efforts for effective mitigation. Some examples of disaster

events, or events where the activation of the Emergency Operations Center has been necessary, are as follows:

- December 1999 ice storm
- September 2003 Hurricane Isabel
- Random wind and flooding events
- Missing/endangered people

One of the most significant natural disaster events to affect this region was a tornado on 6 August 1993. According to VCU (Virginia Commonwealth University) Libraries,

> "The first tornado touched down around 12:45 in the afternoon. It traveled 38 miles and was on the ground for about 45 minutes. Unfortunately this tornado went unreported and undetected because the next tornado to touch down struck Petersburg at 1:30pm, just as the first one was dissipating. This was a violent F4 tornado causing major damage to the Old Towne section of Petersburg and destroying the historic community on adjacent Pocahontas Island." (2009, "Petersburg/Colonial Heights Tornados")

(5) In 2003, the County recognized the need for a progressive emergency operations center and started to move forward with construction in 2004. The facility would serve to update the existing communications center, and be the newly established emergency operations center. The facility was completed on 24 January 2006, and is equipped with ergonomically progressive workstations. To that end, these workstations provide a prime example of current ergonomic practices.

(6) The research conducted for the preparation of the paper focuses on the Prince George County Emergency Operations Center Workstations. Further, the study compared and contrasted the ergonomic qualities of the workstations in relationship to desired ergonomic features. In addition, the desired outcome of the research is to provide a benchmark for localities that are considering new ergonomic features or simply want to improve upon existing features.

BACKGROUND

(7) Ergonomics can encompass a wide variety of aspects related to the comfort and safety of people, and their relationship with manmade objects or activities. The Ergonomic Society describes ergonomics in the following manner:

"Most people have heard of ergonomics and think it is something to do with seating or with the design of car controls and instruments. It is...but it is much more! Ergonomics is the application of scientific information concerning humans to the design of objects, systems and environments for human use. Ergonomics comes into everything which involves people. Work systems, sports and leisure, health and safety should all embody ergonomic principles if well designed." (2008, "What is ergonomics," 1st paragraph)

This is especially true for people who work under the repetitious conditions, which are outlined in the Review of the Literature chapter, associated with emergency operations center workstations. Ergonomics will continue to play an important role as technology improves and develops in an ever-changing world. In 2007 Ergonomist Vicky Ball observed that:

"Ergonomics originated in World War II as a formal discipline when it was realized that many systems and products had been designed without consideration of human and environmental factors and as a result failed to be safe and/or effective. Although it has only been around for just over 50 years, as a discipline ergonomics relies on research carried out in many, older, established scientific areas such as engineering, physiology and psychology. Ergonomics looks at the person, their task, the systems and equipment involved and the work environment and identifies the best ways of working to maximize potential and minimize risk to the individual." (2007, 2nd paragraph)

As ergonomic issues become more recognized, a wider view of possibilities with regard to work related injuries and illnesses must be considered. Consider the thoughts of Doctor Sheik N. Imrhan, when he properly identified the main ergonomic issue over ten years ago:

"Before the middle of the twentieth century, occupational illnesses were virtually unrecognized as illnesses of the workplace. It was common to ascribe the causes of injuries and illnesses to workers. The workplace and its equipment were often treated as harmless entities, and accidents were often ascribed to human error. This way of thinking took the blame away from poor equipment design or work methods." (1996, page 24)

STATEMENT OF THE PROBLEM AND PURPOSE

(8) The issue at hand is an evaluation of the ergonomic features of the Prince George County Emergency Operations Center Workstations. The evaluation will create a benchmark for others to consider during new construction or ergonomic improvements. The research compares ergonomically correct workstations contained within a recently constructed emergency operations center to conventional standards identified in recent literature. To that end, the impact of the research is improved health and performance on the part of the people who use these workstations.

ASSUMPTIONS

(9) The study assumes that the Prince George County Emergency Operations Center Workstations are ergonomically correct in design and function. Further, an assumption is made regarding the process used by the County to determine ergonomic quality for its employees and volunteers. The assumption is that the purchase of the workstations, and the construction of the County Emergency Operations Center, was based on providing an ergonomically friendly environment that would increase work effectiveness and reduce injuries.

SCOPE

(10) The scope of the research examined the Prince George County Emergency Operations Center Workstations, which are used for extended periods of time on a continuous basis. For the purpose of the research, a workstation includes a desk with numerous computer screens, a variety of communication interfaces, and other devices that may be necessary for effective emergency operations.

SUMMARY OF THE METHOD

(11) The research was conducted as a qualitative case study of the ergonomic qualities of the primary Workstations utilized within the Prince George County Emergency Operations Center. The research considered relevant documents, standards, and literature pertaining to ergonomics to develop a model of current

practice. In addition, direct observation of the Prince George County Workstations and a survey of the people who use the Workstations on a regular basis was conducted to determine ergonomic quality. Finally, a comparison was made between the Prince George County Workstations and the model to create a benchmark of current practices.

LIMITATIONS

(12) The major limitation that restricted the research was the narrow focus on just the Workstations that are primarily used within the Emergency Operations Center. It is plausible that there are satellite issues related to the workstations that impact ergonomics that were not fully investigated in the paper. Further, the facility also utilizes other workstations that the paper does not examine.

THE RESEARCHER'S PERSPECTIVE

(13) Prince George County, and the emergency services associated with this jurisdiction, are quickly growing. This rural county sits in a prime location for extended growth and development. The Tri-Cities of Hopewell, Petersburg, and Colonial Heights are adjacent to the northwest portion of Prince George County. In addition, Fort Lee military base is located within the boundaries of Prince George County, and has experienced significant growth that will continue in light of the Base Realignment and Closing (BRAC) effort. To that end, the establishment of ergonomic standards during the growth of the County would benefit all employees as opposed to "playing catch up" after significant development.

DEFINITIONS

(14) Because of the potential for accessibility of the paper through the World Wide Web, it is necessary to clarify some of the terms used throughout the paper. The following definitions will provide the reader with a reference point for those terms:

Ergonomist: there are a wide variety of definitions for the ergonomist, all of them very closely related, but the Underwriters Laboratories offers the following summary definition for a person who specializes in the application of ergonomics:

"The science of ergonomics, also known as human factors engineering, helps design safe, productive, "user friendly" products and workplaces. Utilizing ergonomic/human factors can increase company profits by lowering or eliminating redesign costs and reducing insurance and product liability costs." (2008, "Ergonomic Assessment Demonstrates Products are User-and Marketplace-Friendly")

Musculoskeletal disorders (MSDs): "work-related disorders caused by improper job, tool, and workstation design, by application of excessive force on the body, or by unusual postures. In general, the term MSD only applies to injuries received from chronic exposures rather than acute injuries such as strains and sprains. Other terms commonly associated with MSD are Cumulative Trauma Disorder (CTD) and Repetitive Stress Injury (RSI)." (Langley Research Center Ergonomics Program 2004, page 13)

Occupational Safety and Health Administration (OSHA): the federal agency, which was created in 1970, is administered through the United States Department of Labor. The agency is responsible for setting and enforcing safety standards for workplaces in the United States. It is important to note that many individual states have their own safety standards as well.

Prince George County Emergency Operations Center: "the facility from which government directs and controls its emergency operations; where information about the status of the emergency situation is officially collected, assimilated and reported; where coordination among response agencies takes place; and from which outside assistance is officially requested." (Prince George County Emergency Operations Plan 2003, page 20)

Prince George County, Va: Prince George County is best described by the Prince George Strategic Economic Development Plan as follows: "Prince George County is centrally located in southeastern Virginia. The County is bordered by the James and Appomattox rivers, the cities of Petersburg, Colonial Heights and Hopewell and the counties of Surry, Sussex and Dinwiddie. The Richmond Metropolitan Statistical Area (MSA) includes Prince George County. Prince George County provides access to all major East Coast and Sunbelt markets via Interstates 95 and 295. The Port of Hampton Roads is accessible via US Route 460 and rail, which runs parallel." (Prince George Economic Development 2006, "About Us")

Workstations: refers to the workstations that are utilized for long periods of time, typically where the communication computers are located.

LITERATURE REVIEW

(15) Because of the vast amount of information that relates to ergonomics, the research paper approached the Literature Review utilizing a general to specific

examination. This approach created a foundation and better understanding of the potential impact of ergonomics. Further, the Literature Review made use of information from a broad range of sources, which may not specifically be related to emergency management.

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

(16) A significant battle over ergonomics started when OSHA proposed federal regulations related to ergonomic standards. The proposal was issued on 13 November 2000 and would have likely created a tremendous burden, both logistically and financially, on all complying parties. As a result, Senate Joint Resolution (SJR) 6 was passed by Congress and signed by the President. SJR 6 prevented OSHA from further proposals that were similar in purpose. After the enactment of SJR 6, it was the preference of OSHA to administer guidelines as opposed to attempting another set of ergonomic rules. According to OSHA:

> "Congress passed, and the President signed, Senate Joint Resolution 6, which rescinded the original ergonomic rule, and under the Congressional Review Act, prohibits the agency from issuing a rule that is substantially the same as the former one.
>
> There are a number of reasons why guidelines are preferable to doing a rule. OSHA must follow certain criteria in doing a rule – any rule. In terms of ergonomics, there are factors that make doing a rule very difficult:
>
> - There are a variety of different hazards and combinations of different hazards to be addressed;
> - Exposure to the hazards is not readily measured in some cases;
> - The exposure-response relationship is not well understood;
> - Cost and feasibility of abatement measures may be uncertain and may be very high in some cases; and
> - It is very difficult, except in the most general terms, to prescribe remedies for abating such hazards in a single rule." (United States Department of Labor 2002, "Guidelines: Why aren't you doing another rule?")

In this case, guidelines are more realistic because of the possible financial burden that a rule would impose on private and government agencies. A guideline is a suggested and realistic course of action compared to a rule, which is a requirement. (17) It is important to provide a brief explanation of the "General Duty Clause," as it relates to OSHA's ability to issue citations under certain circumstances. The following summary is consistent with a broad range of sources on this topic, including OSHA. Ergoweb.com summarizes the "General Duty Clause" as follows:

> "In order to include the consideration of ergonomic hazards in normal work place inspections without the use of specific standards, OSHA has turned to the provisions of Section 5 of the OSHA Act or the "General Duty Clause" which states:
>
> Section 5:
>
> A. Each Employer:
>
> - shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or likely to cause death or serious physical harm to his employees;
>
> - shall comply with occupational safety and health standards promulgated under this Act.
>
> B. Each employee shall comply with occupational safety and health standards and all rules, regulations and orders issued to this Act which are applicable to his own actions and conduct." (2008, "OSHA General Duty Clause," 1st paragraph)

According to The National Council for Occupational Safety and Health, and in addition to the General Duty Clause, OSHA can issue a citation for violations that meet the following criteria:

> "Workers can and should look to the General Duty Clause. Before OSHA will issue a 5(a)(1) citation, however, a number of conditions must be satisfied. These conditions are:
>
> - there must be a hazard
>
> - the hazard must be recognized
>
> - the hazard causes or is likely to cause serious harm or death
>
> - the hazard must be correctable." ("no date," "OSHA's Criteria for Issuing a General Duty Clause Citation," 8th paragraph)

(18) OSHA has a significant history with ergonomics. The agency has made considerable contributions in the areas of enforcement, education, and standards. Table 2 provides a summarized history of the agency's commitment to ergonomics. Table 2 also shows some of the private companies and their associated ergonomic issues that OSHA has addressed.

OSHA Ergonomic Chronology

Table 2

Early 1980s	OSHA begins discussing ergonomic interventions with labor, trade associations and professional organizations. OSHA issues citations to Hanes Knitwear and Samsonite for ergonomic hazards.
August 1983	The OSHA Training Institute offers its first course in ergonomics.
May 1986	OSHA begins a pilot program to reduce back injuries through review of injury records during inspections and recommendations for job redesign using NIOSH's [The National Institute for Occupational Safety and Health] Work Practices Guide for Manual Lifting.
October 1986	The Agency publishes a Request for Information on approaches to reduce back injuries resulting from manual lifting. (57 FR 34192)
July 1990	OSHA/UAW [United Auto Workers]/Ford corporate-wide settlement agreement commits Ford to reduce ergonomic hazards in 96 percent of its plants through a model ergonomics program.
August 1990	The Agency publishes "Ergonomics Program Management Guidelines for Meatpacking Plants."
Fall 1990	OSHA creates the Office of Ergonomics Support and hires more ergonomists.
November 1990	OSHA/UAW/GM [General Motors] sign agreement bringing ergonomics programs to 138 GM plants employing more than 300,000 workers. Throughout the early 90s. OSHA signed 13 more corporate-wide settlement agreements to bring ergonomics programs to nearly half a million more workers.
July 1991	OSHA publishes "Ergonomics: The Study of Work," as part of a nationwide education and outreach program to raise awareness about ways to reduce musculoskeletal disorders.
July 1991	More than 30 labor organizations petition Secretary of Labor to issue an Emergency Temporary Standard.
January 1992	OSHA begins a special emphasis inspection program on ergonomic hazards in the meatpacking industry.
April 1992	Secretary of Labor denies petition.
August 1992	OSHA publishes an Advance Notice of Proposed Rulemaking on ergonomics.
1993	OSHA conducts a survey of general industry and construction employers to obtain information on the extent of ergonomics programs in industry and other issues.

March 1995	OSHA begins a series of meetings with stakeholders to discuss approaches to draft ergonomics standard.
January 1997	OSHA/NIOSH conference on successful ergonomic programs held in Chicago.
April 1997	OSHA introduces the ergonomics web page on the Internet.
February 1998	OSHA begins a series of national stakeholder meetings about the draft ergonomics standard under development.
March 1998	OSHA releases a video entitled "Ergonomic Programs That Work."
February 1999	OSHA begins small business (Small Business Regulatory Enforcement Fairness Act (SBREFA) review of its draft ergonomics rule, and makes draft regulatory text available to the public.
April 1999	OSHA's Assistant Secretary receives the SBREFA report on the draft ergonomics program proposal, and the Agency begins to address the concerns raised in that report.
November 1999	OSHA publishes proposed ergonomics program standard.

Source: United States Department of Labor 1999

(19) In addition to the brief history, it would also benefit the reader to be familiar with some of the more common ergonomic related injuries that would likely be associated with workstations. The Langley Research Center Ergonomics Program has established a thorough, but not necessarily complete table for common musculoskeletal disorders in Table 3 below:

ERGONOMIC INJURIES AND THEIR SYMPTOMS

Table 3

Injury	**Symptoms**
Carpal tunnel syndrome	Symptoms include tingling, numbness and burning sensation in the thumb, index and/or middle finger. Aching sensation and wrist pain (often at night) are also common. It is caused by compression of the median nerve, which runs through the middle of the wrist.
Tendonitis	Symptoms include pain, tenderness, swelling and/or weakness of the hand, arm or shoulder. Redness of the hand or wrist may also occur. It is caused by the tendons of the wrists, hands, or shoulder becoming inflamed from overstretching or constriction.

Tenosynovitis	Symptoms include swelling, pain and/or tenderness of the hand. It is caused by inflammation of the tendon and the sheath that it passes through.
Rotator cuff injury	Caused by inflammation of one or more of the rotator cuff tendons in the shoulder, symptoms include pain and limited mobility of the shoulder.
Raynoud's syndrome (White finger)	Caused by damage to blood vessels in the finger from use of vibrating tools, especially in cold climates. Symptoms include paleness, tingling or burning sensation in the fingers.
Epicondylitis (Tennis elbow)	Tendonitis of the elbow. Symptoms include pain, swelling and/reduced mobility of the elbow.
Trigger finger	This is due to swelling in the tendon sheaths of the finger causing the tendon to lock in the sheath. It results in snapping or jerking movement when attempting to move the finger.
Synovitis	Swelling of the bursae (fluid filled sac's used to cushion movement) in the knee, elbow, or shoulder.
Back injuries	Static postures can add a tremendous amount of pressure to the back muscles and spinal discs. Sitting in a slouched position can overstretch the spinal ligaments and strain the spinal discs. A load that slips or shifts as it is being lifted, and slip and fall can jolt the back with resulting muscle strain or tearing of soft tissue in the back.

Source: Langley Research Center Ergonomics Program 2004

ORANGE COUNTY RESEARCH

(20) On the topic of emergency operations center workstations, the overall ergonomic characteristics should be of paramount concern. By implementing ergonomic standards, agencies can improve the health, safety, and productivity of employees. The following summary of a case study involving ergonomics is beneficial in order to understand the scope of ergonomics, but more specifically some

of the issues directly related to workstations. Consider the following study conducted by the Orange County Grand Jury.

(21) According to Orange County, California, "Beginning August 2000, the Grand Jury visited the EOC for the purpose of evaluating the present working conditions and environment. Interviews were conducted with employees of the County directly related to the EOC, including dispatchers." (2000, "Orange County," page 3)

(22) According to Orange County, "The Grand Jury conducted site visits to compare the working environments, staffing, workloads, illness reports and salary ranges at the following communications centers:

- Santa Ana Police Department
- Anaheim Police Department
- Irvine Police Department
- The City of Garden Grove's Communication Center." (2000, "Orange County," page 3)

(23) The findings of the study were:

"1. Dispatchers assigned to all shifts experience illness, stress, and fatigue that compromise the ability of the EOC to function at maximum performance levels. Because of dispatcher shortages, selected personnel are required to work overtime. This situation is causing morale problems for dispatchers and budgetary problems for the EOC.

2. The overall working environment, which includes computer consoles, keyboards, monitors and chairs, is not "ergonomically friendly."

3. Cramped conditions within the dispatch area have contributed to stress and fatigue. Additionally, lighting and sound are not conducive to an ideal working environment.

4. Well-trained staff dispatchers have resigned in large numbers to accept jobs in the same field throughout the County where the pay and working environment are better.

5. Because [of] personnel shortages, dispatchers do not take mandated rest and meal breaks as outlined in the Memorandum of Understanding, 1998-2000, with the Orange County Sheriff-Coroner Department, County of Orange, and The Orange County Employees Association. This practice causes stress and fatigue and is a major factor in the problems at the EOC.

6. The County Executive Office, Division of Risk Management, was not

consulted when the new computer equipment was considered for purchase in August of 1998." (2000, "Orange County," page 4)

(24) The preceding list provides a good explanation of ergonomic issues that can arise in an emergency operations center. Particular attention should be given to item 2, which identifies components typically associated with workstations, and the negative impact they may have if they are not ergonomically correct. In addition, item 3 shows the importance of overall ergonomically correct working conditions.

(25) California law required the Orange County government to respond to the following recommendations based on the study:

"1. Recruit, hire and train thirteen radio dispatchers, an additional radio dispatch supervisor and four additional Centrex operators.

2. Replace existing computer console workstations with new workstations to conform to Federal Occupational Safety and Health Administration (OSHA) standards and guidelines and consider the implementation of height adjustable tabletops.

3. Expand the existing facility to accommodate additional workstations and and support personnel. Improve lighting and acoustical characteristics.

4. Adjust pay scale levels to be equivalent to comparable positions within the County of Orange.

5. Enforce rest and meal breaks as outlined in the current Memorandum of Understanding, 1998-2000, with the Orange County Sheriff-Coroner Department, County of Orange, and The Orange County Employees Association.

6. Consult the County Executive Office, Division of Risk Management when new equipment is being considered for purchase and seek advice from safety officers." (2000, "Orange County," page 5)

(26) Special attention should be given to the improvements that Orange County was instructed to make. Item 2 specifically addresses the core topic of the paper, and highlights the importance of workstation design and implementation. Item 3 addresses the need for an adequate number of workstations, among other related ergonomic issues. Finally, item 6 points out the importance of consulting experts in order to avoid ergonomic related issues. Although this may seem like a burden, in

the long run it is clear from the study that it may curtail the loss of employees, reduce sick or stress related issues, and in this case, avoid a costly investigation.

WORKSTATION SUGGESTIONS

(27) Anthony Andre, PhD. further offered specific suggestions concerning workstations that are consistent with the other sources that were examined during the research of this paper. Andre stated, "Computer [workstation] users are encouraged to explore ways to improve their computer interaction efficiency and seek training in the software programs and operating systems they use in their workplaces (2005, "Easy Ergonomics for Desktop Computer Users," page 34)." Based on the previous suggestion, Dr. Andre has provided the following "TIPS TO IMPROVE THE WAY YOU WORK," which are as follows:

- "Take micro-breaks from repetitious activities or static postures every 30 minutes for one or two minutes before resuming that activity or posture. Find opportunities to get out of your chair and move around.
- Place the telephone on your non-dominant hand side. Your dominant hand will be free for writing, and cradling the telephone between your ear and shoulder while writing will not be necessary.
- Use a telephone headset or the speaker when performing tasks simultaneously with the telephone. This practice prevents awkward neck and shoulder postures associated with cradling the telephone between your ear and shoulder.
- Type with the tip of the fingers. Less force is needed to depress the keys with the tips of the fingers. Use a light touch when keying.
- Change postures frequently throughout the day. Alternate working from a sitting to a standing position whenever possible. Change the tilt of the back of the chair frequently.
- Use shortcut keys whenever possible, instead of a pointing device (mouse, trackball, etc.)
- Alternate hands when using the pointing device, OR alternate between pointing devices (e.g. alternate between mouse and trackball). Use larger muscles by moving from the elbow and shoulder, rather than from the wrist, when operating the pointing device.
- Stand up to reach into overhead bins rather than reaching up from a sitting position, OR, lower overhead storage bins if possible." (2005, "Easy Ergonomics for Desktop Computer Users," page 35)

The list above compliments good workstation ergonomics and for that reason is relevant to the research.

(28) The information outlined by Dr. Andre for workstation ergonomics is consistent with a wide variety of sources that examined this issue. According to OSHA, "There is no single "correct" posture or arrangement of components that will fit everyone." (2008, "Computer Workstations," 1st paragraph)

In addition to this statement, consider the following general suggestions from OSHA:

- "Top of monitor [should be] just below eye level.
- Head and neck balanced and in-line with torso.
- Shoulders relaxed.
- Elbows close to body and supported.
- Lower back supported.
- Wrists and hands in-line with forearms.
- Adequate room for keyboard and mouse.
- Feet flat on the floor." (2008, "Computer Workstations," 1st paragraph)

PRINCE GEORGE COUNTY WORKSTATIONS

(29) The following research considered the current ergonomic features that pertain to the County's Emergency Operations Center Workstations. Communications officers typically use these Workstations for long periods of time, but the Workstations are extremely versatile and it is likely that other personnel will use them under designated conditions.

(30) In September 2003, Prince George County issued a Request For Proposal (RFP) for construction of the County's Emergency Operations Center, with responses due by 7 November 2003. Part of the request was specifically for Workstations within the Emergency Operations Center. The RFP specifically addressed the desire for ergonomically friendly workstations. The RFP indicated that, "This section describes a state-of-the-art communications console that is "user friendly," and incorporates

radio control in a manner that shall provide for efficient and simple operation by the dispatchers in any combination of functions available." (Prince George County, Virginia: Request for Proposals Simulcast Radio System 2003, "Dispatch Console" page 94)

(31) Further, the RFP indicated the specific ergonomic features that would be considered acceptable for use in the Emergency Operations Center. Those items are listed below:

- "Free standing.
- Modular for expansion and rearrangement.
- Adjustable legs for non-level floors.
- Durable materials for 24 hour by 365-day use.
- Multiple panel heights (30",48").
- Separator walls.
- CRT mounts (as applicable).
- CPU storage area (as applicable) free of interference to legs and feet.
- Keyboard tray [fully adjustable through controls].
- Soft materials to be fireproof.
- Soft materials to be sound absorbent.
- All metal edges to be smooth finished with no spurs.
- 19 inch EIA rack mounting capability.
- Access to mounting areas from the top, bottom, front and rear.
- Faceplates/Bezels.
- Cable accommodation within the furniture.
- Vented equipment area.
- One piece fixed and adjustable (Americans with Disabilities Act compliant) laminated writing surfaces.
- Writing surface cutouts for cables and keyboard.

- Color matched rolling drawer pedestals.

- Fully adjustable ergonomically sound five-star based chairs." (Prince George County, Virginia: Request for Proposals Simulcast Radio System 2003, "Console Furniture" Page 96)

(32) This list is self explanatory in most respects, but a further explanation of the major components of the Workstations currently used is helpful. The Workstations utilized by Prince George County are designed and constructed by Watson Furniture Systems. Watson offers the following descriptions in reference to ergonomics:

Ergonomic Design

"Our furniture is designed to reduce the incidence of Carpal Tunnel Syndrome by providing an adjustable, articulating keyboard platform for the primary keyboard functions. In fact, the powered primary work surface allows fingertip control of height adjustment. So, an operator can go from a seated to standing operating position in a manner of seconds." (Watson Furniture Systems 2007, "Ergonomic Design," 1st paragraph)

Passive Ergonomics

"Watson Dispatch Furniture uses laminate, wood and fabric (as opposed to metal) to provide a calm, comfortable and quiet environment to an otherwise hectic and stressful occupation." (Watson Furniture Systems 2007, "Passive Ergonomics," 2nd paragraph)

(33) The "powered primary work surface" mentioned above also includes the following ergonomic features not listed under the above quote titled "Ergonomic Design:

- "Integrated Control- Integrating all ergonomic adjustments and comfort controls into a single device.

- Mobile Air Delivery- Cooling fans with washable air filters.

- Single Point Interface- All adjustments are made via a single moveable device featuring ergonomic design and user-intuitive controls.

    - Surface height adjustment
    - Mobile fan speed control
    - Area light on/off
    - Task light dimming
    - Heating device control
    - Adjustable foot stool

- Precision Adjustment- Microprocessor-based "black box" system controls all functions including ergonomic height adjustments of both primary surface

and input platform.

- Heating Regulation- Control up to three designs of radiant heat output." (Watson Dispatch 2005, "Total Comfort System," Page 8)

(34) The County further recognized the fact that the appropriate level of training is equally as important as the physical ergonomics of the Workstations. This is true because the appropriate level of training will allow people to accomplish specific tasks more efficiently. In turn, this reduces stress and strains that are commonly associated with ergonomic related injuries. It is for this reason that the RFP indicated the following in regard to workstations:

"Vendors shall fully describe their training courses in their response. This shall include, as a minimum, classroom style instruction, operational style classes, a detailed training plan, description of available training material, resume of potential course instructors and a customer reference list of trained personnel (to include: names, telephone numbers, company, and system description)." (Prince George County, Virginia: Request for Proposals Simulcast Radio System 2003, "Operational, Technical and User Training" Page 156)

The training requirements listed in Table 4 gives the reader a reference point for the type of training, needed personnel, and resources that may be utilized in an effort to eliminate or reduce ergonomic related problems.

Table 4

Type of Training	# of Students	Additional Hard Copies	CD ROM Copies	Video Tapes
Radio System Operational	8	6	6	0
Management System Operational	2	6	6	6
Subscriber Train the Trainer	10	40	10	0
Dispatch Operator (4 Sessions of 4)	16	2	2	2
Alarm System Operational	5	6	6	0

Source: Prince George County, Virginia: Request for Proposals Simulcast Radio System 2003, "Training Requirement"

(35) The following summary gives the reader an idea of the expenses that are related to the ergonomic qualities of the Prince George County Workstations. Table 5 shows the primary components only.

Table 5

Quantity	Description	Unit Price	Total
4	Synergy 3642 Full Lift Positions	$7,544.00	$30,176.00
3	Total Comfort System with Radiant Heat Panel		$6,594.00
1	Total Comfort System Storage Unit 40" Diameter		$1,013.00
1	Deliver, Install and 3 Year Service and Maintenance		$11,802.00
			TOTAL = $49,585.00

Source: Watson Furniture Group 2005, "Purchase Order No. 06-069"

METHOD

DESCRIPTION OF THE METHOD

(36) A qualitative research method was used for the preparation of the paper. This approach was supported by documentation and literature that discusses ergonomics in general, and then takes a more direct approach on the topic of workstations. In addition, a case study of the Workstations contained within the Prince George County Emergency Operations Center was utilized. The qualitative approach was the best approach for this research topic because the literature and case study documentation was well established.

DESIGN OF THE STUDY

(37) The design of the study can be summarized as follows:

- A review of the documents and literature that relate to ergonomics. It is important to note that there is a vast amount of information available on the topic of ergonomics in general, and specifically to workstations. It is for that reason that the literature section of the paper was limited to information

that was consistent with a variety of reliable sources, but also summarized the information so that it was manageable.

- Direct observation of the Workstations contained within the Prince George County Emergency Operations Center. This was done over a period of time, and on a regular basis.

- The paper also incorporated, to a limited extent, a case study approach to the characteristics of these Workstations. This was done by examining the literature provided by Watson Furniture Systems "Ergonomic Design" descriptions and comparing that literature to the actual workstations.

SAMPLE AND POPULATION

(38) The research in the paper considered two aspects. First, a limited case study of the Prince George County Emergency Operations Center Workstations was considered. The Emergency Operations Center is a vital support section of the Prince George County Police Department. The support section was chosen because it allowed direct and regular access to the Workstations for personal observation and study. In addition, the workstations used in the facility were based on recent and specific ergonomic standards. Further, supporting documentation consistent with the ergonomic standards found within the Prince George County Emergency Operations Center was considered. Moreover, a review of the supporting documentation from the "Request For Proposal (RFP)" was also examined.

(39) The second population that was examined was the people that interact, on a regular basis, with the Workstations within the Emergency Operations Center. This population was chosen for their "hands-on experience" with the Workstations. This population will be able to provide a "real world" evaluation of the ergonomic qualities of the Workstations.

DATA COLLECTION AND ANALYSIS

(40) The data collection process for the first population was done by reviewing the available literature and documents related to workstations. The literature and documents that were examined are specific to the Workstations and the company that won the contract for the construction of the facility.

In addition, direct observation of the Prince George County Emergency Operations Center Workstations was also utilized. These results were reported in the Research Results Chapter.

(41) The final data collection process consisted of a survey in reference to the Workstations. The survey asked the users to rate the ergonomic effectiveness of the Workstations. The Workstation Survey with the accompanying instructions is listed below in Table 6.

Table 6

SURVEY

In the following survey you must rate the questions from one of the following categories: Poor, Good, Very Good, or Excellent by placing an "X" below the appropriate category. Please rate the following criteria according to its ergonomic value based on your experience with the Workstations that you use.

Ergonomics can be defined as follows:

The science of ergonomics, also known as human factors engineering, helps design safe, productive, "user friendly" products and workplaces. Utilizing ergonomic/human factors can increase company profits by lowering or eliminating redesign costs and reducing insurance and product liability costs (2008, "Ergonomic Assessment Demonstrates Products are User-and Marketplace-Friendly").

SURVEY QUESTIONS

1. How would you rate the integrated controls of the Workstation?

Poor	Good	Very Good	Excellent

2. How would you rate the adjustability of the Workstation surface?

Poor	Good	Very Good	Excellent

3. How would you rate the air delivery system (desk top fans)?

Poor	Good	Very Good	Excellent

4. How would you rate the heating device (floor heater)?

Poor	Good	Very Good	Excellent

5. How would you rate the adjustable footstool?

Poor	Good	Very Good	Excellent

6. How would you rate the Workstation related training?

Poor	Good	Very Good	Excellent

Source: Leach 2009

MEASURES OF RELIABILITY

(42) As stated previously, the qualitative method for the research was incorporated with a limited case study approach. There are, without a doubt, widespread opinions on whether qualitative or quantitative data is more valuable or accurate. For the purpose of the paper, the topic is better served through the use of a qualitative approach. The results of the survey will be quantified, so that the research employs "mixed methods" to a limited extent. There are many well-established methods for confirming the reliability of research. In order to confirm the reliability and validity of the research, I used the following criteria cited by Cohen Crabtree:

- "Credibility- Confidence in the 'truth' of the findings.
- Transferability- Showing that the findings have applicability in other contexts.
- Dependability- Showing that the findings are consistent and could be repeated.
- Confirmability [Confirmation]- A degree of neutrality or the extent to which the findings of a study are shaped by the respondents and not researcher bias, motivation, or interest." (as cited in, Robert Wood Johnson Foundation: Qualitative Research Guidelines Project 2006, "Lincoln and Guba's Evaluative Criteria" 1st paragraph)

(43) The credibility of the research is well documented through the use of sources that can be checked, not only by the author, but through the use of independent research. The research is also redundant on a certain level. This means that the information from one source is supported by many other sources.

(44) The level of transferability of the research is to some extent without bounds. The ergonomic qualities of a workstation have far reaching comparisons in regard to other ergonomic standards. For example, people who work at a computer station for long periods of time, but not necessarily in an emergency operations center, would benefit from the research. This is true because there are other occupations, such as data entry, which require people to sit at a workstation for long periods of time completing repetitive movements while interacting with computers, telephones, and

other devices. This occupation is similar, in regard to the workstation use, and the research outlined in the paper could be used as a point of reference or direction on the topic of workstation ergonomics.

(45) The dependability of the research was proven through the variety of documented sources. In addition, there are many other sources that echo the same research findings. These sources were not included in the Literature Review in an effort to reduce repetition of consistent information.

(46) In order to establish confirmation (confirmability) of the research, a neutral person or persons would have to conduct an independent audit of the sources. This can be done in short order by reviewing the sources cited through books, the World Wide Web, and other documentation. The sources documented for the research were a part of a fact-finding mission. It is for these reasons that a neutral party would come to the same or similar conclusions.

RESEARCH RESULTS

(47) The study yielded three distinct result topics, which are as follows:

- A literature review that supports desired ergonomic features consistent with the Prince George County Emergency Operations Center Workstations.
- Direct observation of the ergonomic features.
- A survey of the communications officers that have regular interaction with the workstations.

(48) The Literature Review indicated that the Prince George County Emergency Operations Center Workstations are similar in form and function to conventional wisdom on workstation design. This is evident in the recommendations made based on the Orange County research.

(49) The observations that were conducted on the Prince George County Emergency Operations Center Workstations are a direct result of ten personal observations conducted by the author. These observations are summarized with Table 7. Table 7

shows that documented dates and periods of time were utilized in an effort to report the use of ergonomic features. In addition, the Prince George County Emergency Operations Center contains four primary Workstations, which were the subjects of the observation. It is important to point out that not all of the Workstations are operational all of the time, which explains the discrepancy under the column listed "Number of Workstations Observed."

Table 7

Observer	Date	Length of Time Observed	Number of Workstations Observed	Ergonomic Features Utilized
Leach	2008-09-19	Approximately One Hour	Four	Four Total
Leach	2008-09-30	Approximately One Hour	Three	Two Total
Leach	2008-10-03	Approximately One Hour	Three	Three Total
Leach	2008-10-14	Approximately One Hour	Three	Three Total
Leach	2008-10-25	Approximately One Half Hour	Three	Four Total
Leach	2008-11-07	Approximately Two Hours	Four	Five Total
Leach	2008-11-20	Approximately One Hour	Four	Three Total
Leach	2008-12-06	Approximately Two Hours	Four	Five Total
Leach	2008-12-11	Approximately One Hour	Three	Five Total
Leach	2008-12-17	Approximately Two Hours	Three	Five Total

Source: Leach 2009

(50) Prince George County currently employs fifteen communications officers with limited workstation experience. There are a total of fifteen full-time communications officers that work 40 hours or more a week. The communications officers work 12-hour shifts, with occasional variances in the hours. One third, or five communications officers, participated in the survey. Table 8 summarizes the results of the survey outlined in Table 6.

Table 8

1. How would you rate the integrated controls of the Workstation?

Communications Officers	Poor	Good	Very Good	Excellent
Number Reported		3		
Number Reported			2	

2. How would you rate the adjustability of the Workstation surface?

Communications Officers	Poor	Good	Very Good	Excellent
Number Reported	1			
Number Reported		2		
Number Reported			1	
Number Reported				1

3. How would you rate the air delivery system (desk top fans)?

Communications Officers	Poor	Good	Very Good	Excellent
Number Reported	2			
Number Reported		3		

4. How would you rate the heating device (floor heater)?

Communications Officers	Poor	Good	Very Good	Excellent
Number Reported	1			
Number Reported		3		
Number Reported				1

5. How would you rate the adjustable footstool?

Communications Officers	Poor	Good	Very Good	Excellent
Number Reported	2			
Number Reported		1		
Number Reported			1	
Number Reported				1

6. How would you rate the Workstation related training?

Communications Officers	Poor	Good	Very Good	Excellent
Number Reported	1			
Number Reported		4		

Source: Leach 2009

ANALYSIS AND CONCLUSION

SUMMARY OF THE RESULTS

(51) As stated in the "Research Question," the desired focus of the research was to determine how the Prince George County Emergency Operations Center Workstations compare with conventional wisdom and literature in regard to workstation ergonomics.

(52) The research showed that the Workstations contained within the Prince George County Emergency Operations Center are comparable to currently accepted standards for ergonomically correct workstations. This is based on an extensive review of literature on workstations. In addition, the RFP standard indicated that the workstations must be "state-of-the-art," "user friendly," and specific ergonomic

features were identified. Again, these features are consistent with the research, which identifies preferred workstation ergonomics.

(53) The "Research Results" section of the paper indicated that there is a correlation between desired workstation ergonomics and the features identified in the Prince George County Emergency Operations Center. This is clearly reported in Table 7, which represents the number of ergonomic features utilized over a period of time. In addition, Table 8 indicates that the overall satisfaction with the ergonomic features surveyed is a rating of "Good" or better. The survey indicated that only a total of seven "Poor" ratings were given.

(54) The results of the research clearly indicated that the Prince George County Emergency Operations Center Workstations are comparable to industry standards.

INTEGRATION OF FINDINGS WITH PAST LITERATURE

(55) The "Research Results" section identified three primary components, which were analyzed in the following paragraphs. The first component is as follows:

- A literature review that supports desired ergonomic features consistent with the Prince George County Emergency Operations Center Workstations.

The ergonomic features of the Prince George County Emergency Operations Center Workstations echo the desired ergonomic features that were revealed through research. One of the most convincing pieces of evidence is the study that was done by the Orange County Grand Jury, which specifically addressed workstations used by public safety organizations. Further, the investigation addressed mostly ergonomic related issues, and also considered a total of five real life examples that were studied by an investigative body.

(56) A parallel can be drawn between the Prince George County Emergency Operations Center Workstations research, and these desired ergonomics. At the top of desired ergonomic features, without itemizing every detail, is versatility. This is important due to the long hours that are often worked, being restricted to a

relatively small work environment, and the physical differences or needs of the people using these features.

- Direct observation of the ergonomic features.

(57) Direct observation and familiarity with a particular issue over a period of time is an important consideration. Direct observation of the ergonomic qualities of the Workstations can provide small details or inferences that are sometimes not realized, or may not be given sufficient attention. In this case an impartial party observed the ergonomic features available for use with these Workstations. The ergonomic features observed are comparable in form and function with desired ergonomic features.

- A survey of the communications officers that have regular interaction with the Workstations.

(58) The importance of having an ergonomically correct workstation was verified through the use of the survey. This is true based on the mostly positive results revealed in the scores of the survey. The "Literature Review" is consistent with the findings of the survey on several levels. First, it shows that employees are interested in participating in rating the ergonomic features that they use. This is probably true because the information has a direct impact on the users. Although the participation level of the survey was not as high as would be expected, there was an interest shown by one third of the whole. Second, the "Good" rating more than doubled the "Poor" rating overall. This indicates a parallel between recommended ergonomic features and employee satisfaction with similar features. Finally, the survey provides potential areas for improvement or at the very least provides a direction for further investigation of possible ergonomic issues.

IMPLICATIONS OF THE STUDY

(59) Although the study did not address a specific disaster-related issue it does address a very important satellite issue. The comfort and physical wellbeing of the

people tasked with disaster mitigation, on any level, should be of paramount concern. The varied possibilities that ergonomics can have on the future of the Prince George County Emergency Operations Center Workstations is but one example of ergonomic possibilities. Further, the implications of the study may serve a variety of needs and interests not specifically related to workstations, but what could be considered similar in nature. For example, the study could raise awareness on the topic of ergonomics in other areas where people interact with a variety of apparatus specific to their jobs.

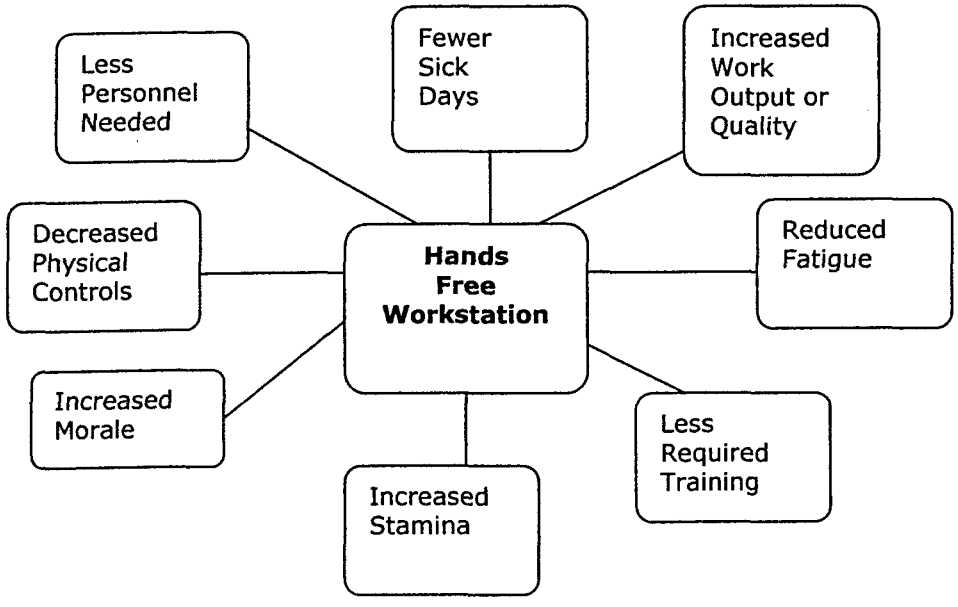
(60) It appears on the surface, and in comparison to the research, that the ergonomic features studied are consistent with desired ergonomic features. Although the research in the paper addressed a narrow ergonomic topic it is important to capitalize on the opportunity of improvement. It is important to evaluate ergonomic needs of employees on a continuous basis. In reference to Prince George County's Workstations, this can be accomplished in a variety of ways.

(61) Since the Prince George County Emergency Operations Center construction is relatively new, so are all of the components contained within the center. The workstations should be placed on an evaluation schedule. This is important to measure the success, or need for change in regard to the Workstations. This could be accomplished by creating a schedule that is divided into periods of time. One possible schedule may include periods of time over the next three, five, and seven years. In addition, a panel consisting of people with relevant experience and qualifications should oversee the evaluations. The findings should then be reported to the proper officials according to the designated periods of time. Moreover, consideration must be given to the approximate money that will be required to update or change these Workstations. If the process is adhered to, and serious review of the findings is conducted, the evaluation would be most beneficial.

(62) In an effort to continue with the improvement or efficiency of the workstations a commonly used method known as "idea mapping" could be considered. In this case, this allows an individual or group of people to consider the possibilities that surround workstation ergonomics. According to Edward Cornish, "Idea maps are a simple but useful tool for thinking creatively about anything." (2004, page 130). This technique does not require costly methods such as computer programs, outside experts, or studies. Cornish further states, "Idea mapping is an excellent technique for generating new ideas; it is especially useful for identifying all the issues and subissues [sub issues] related to a problem, as well as potential solutions and the pros and cons of those solutions." (2004, page 131)

(63) Figure 1 is an example of one possible idea map related to workstations in general. In this case, Figure 1 considers the possibility of a hands free workstation and some of the potential implications related to a hands free workstation.

Figure 1



Leach 2009

AREAS FOR FURTHER STUDY

(64) As stated earlier, the study of ergonomics is vast with a wide range of implications. Too that end, the research conducted for the paper has identified an area of study that may provide valuable insight related to workstations.

(65) The research certainly indicates that the emergency operations center that employs good ergonomic practices is the best course of action. A comparison study that examines the benefits of an ergonomically correct workstation, specifically located within an emergency operations center, would be of great value and a welcomed addition to the research. Some of the more popular topics related to workstation ergonomics are seating, lighting, and computers. These studies fall short because they do not consider the actual workstation, and therefore were not addressed in the research.

CONCLUSION

(66) The research is beneficial on three levels. First, the research gives those who are considering the use or purchase of workstations a realistic baseline, which is endorsed by research. Second, the research provides insight for organizations that may want to improve the overall ergonomic quality of established workstations. For example, ergonomically correct workstation may already be in use by a particular organization, but the relationship between ergonomics and training may not have been considered. Finally, the opportunity to review a survey that was applied specifically to Workstations used in an Prince George County's Emergency Operations Center could be used to support the need for ergonomically correct workstations else where.

(67) Ergonomics, regardless of its application, can often seem like a foreign concept. The reality is that the goal of ergonomics is akin to comfort and safety in an effort to avoid injury or health related problems. This goal is something that we can all agree on, especially if it applies to us. Moreover, ergonomics should be a consideration in

all public safety arenas for the mutual benefit of employers and employees.

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