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## Human Factors Evaluation of Laptops as a Technical Data Repository in Aircraft Maintenance

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# HUMAN FACTORS: AN EVALUATION OF LAPTOPS AS A TECHNICAL DATA REPOSITORY IN AIRCRAFT MAINTENANCE



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# Personal Backgrounds

## Christopher Groom

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# Overview

Human Factors

Occupational Ergonomics

Cognitive Ergonomics Psychology

Systems Theory

Literature Review

Findings





# Human Factors

The Synthesis of Man and Machine

Torsion Physics Applied to the Human Body

ROM Considerations

Muscular Endurance / Fatigue / Eye Strain

Repetitive Motion Tasks

Biomechanical Orientation



# Occupational Ergonomics

Keyboard Spacing / Layout

Key Size / Pressure-to-Input Ratio

Posture

Mouse Positioning

Pointing Device Location

Display Location



# Cognitive Ergonomics Psychology

Defining Work Mentally & Physically

Objects / Tools

Pro Gear

Processes

Activities



# Systems Theory

End User Task Capabilities

Value Stream Mapping

Process Dissection

Efficiency Modelling





# Literature Review

Maneuvering

Lifting

Engaging

Positioning

Interacting

Human Geometry

Mouse vs. Touchpad vs. Nub vs. Touchscreen

Keyboard Styles

Monitor Types



# Literature Review

Wrist & Hand Motion / Ulnar Deviation / Forearm Pronation

Spinal Alignment / Posture

Knee Positioning

Shoulder Abduction & Induction

Arm Extension

Chin Tilt Angle

Eye-to-Screen Alignment

Hip Angle



# Findings & Contribution

Long Hours Result in Increased Musculoskeletal Risk

Split Keyboard Design is Most Effective

- SK Reduces Ulnar / Wrist / Forearm Motions

Mouse is More Sustainable Than Touch INT or Nub

- Arch and Buttons Must be User-Customized

Blue Light Omitting External Monitors Ideal

- Laptop Flip-Out Screen Performed Very Poorly



# Findings & Contribution

## Workstation Type

- Desk / Shelf / Table / Standing / Sitting

## Seating Arrangement

- Knees Bent at 90 Degrees w/ Foot Stool

## Body Geometry / Sitting vs. Standing

- Standing Overly Not Feasible D2 Constraints
- Vertical Data Entry Ideal For Biomechanics

Stretching & Periodic Movement is Healthiest



# Findings & Contribution

## Laptop Repetitive Motion Tasks

- Should be Avoided or Reduced if Possible

## Compared to Traditional Books Laptops...

- Are Heavier & Increase Eye Strain
- Reduce Range of Motion / Motions Are Less Fluid
- Are Overwhelmingly Unnatural to Employ
- Are Cost-Effective & Easier to Update Than Paper
- Can Hold More Content / Quicker Data Access





# Content Recap

Laptops Are Not Long-Term Cost-Effective

- Laptops Hold More Data / Are Simple to Update
- Keyboard & Mouse Spacing / Angle Are Important

Paper Books Are Easier on the Human Body

- Paper Books Are Difficult to Update
- Standing is Better Than Sitting
- Stretching is Critical to Injury Prevention



# Feedback Session

Ideas

Input

Comments

Questions

