FOREWORD/INTRODUCTION

GUIDE TO THE GUIDE

CHAPTER 1

Human Factors. Describes the field of Human Factors and Ergonomics and defines important terminology and concepts

CHAPTER 2

Establishing a Human Factors/Ergonomics Program. Describes what an ergonomics program is and why aviation organizations should establish a program

CHAPTER 3

Workplace Safety. Describes the major hazards associated with industrial workplaces and the steps maintenance supervisors and planners can take to mitigate the hazards

CHAPTER 4

Shiftwork & Scheduling. Describes the major research findings related to various shift scheduling practices

CHAPTER 5

Facility Design. Describes the major Human Factors concepts related to facility design, with emphasis on elements found in the aviation maintenance environment such as movable scaffolding

CHAPTER 6

Work Design. Describes the most prominent Human Factors concepts related to designing both the workplace and the job to incorporate human capabilities and limitations
CHAPTER 7

Training

Describes the overall training requirements in the aviation maintenance environment and the training methods that are appropriate for teaching various types of knowledge and skills

CHAPTER 8

Testing & Troubleshooting

Describes the concepts and techniques related to testing and troubleshooting, such as fixation, tunnel vision, and uncertainty

CHAPTER 9

Automation

Describes the major concepts related to automation and how to decide which workplace functions are most amenable to automation. Discusses some of the myths and potential pitfalls of automation

CHAPTER 10

Disabilities

Describes the requirements of the ADA and provides a Human Factors perspective on adjusting to the capabilities and limitations of disabled individuals

CHAPTER 11

Sexual Harassment

Describes the underlying social and legal concepts related to sexual harassment. Describes the latest court decisions and regulatory requirements regarding this topic

CHAPTER 12

Personal & Job Related Factors

Describes the most common personal and job-related factors that adversely affect workers' job performance, such as substance abuse, job-related stress, financial problems, and family problems
financial problems, and family problems. Discusses the use and misuse of Employee Assistance Programs.

CHAPTER 13

Communication. Describes the process and elements of communication. Provides guidelines for evaluating effective communicators and for establishing effective communication in the workplace.

CHAPTER 14

Human Error. Defines human error as it relates to the aviation maintenance domain. Provides methods for identifying errors and error-causing circumstances, minimizing the risk of error, and dealing with the consequences of errors.

CHAPTER 15

Information Transfer. Describes the various types of information transfer that occur in the aviation maintenance workplace. Provides guidelines for evaluating the human-machine interfaces that allow information to be transferred among various elements of the maintenance system.

CHAPTER 16

Maintenance Resource Management. Defines MRM, describes current practices, and provides approach to designing and developing an MRM training program.
LIST OF FIGURES

Chapter 1

Figure 1-1  Forward fuselage of B-737 following inflight structural failure
Figure 1-2  The SHEL model
Figure 1-3  Relationship among the three components of usability

Chapter 2

Figure 2-1  Example of awkward posture due to a restricted workspace
Figure 2-2  Example of awkward lifting
Figure 2-3  Poor control/display relationships on access equipment
Figure 2-4  Tool left in an aircraft structure
Figure 2-5  Example of cover with closure markings difficult to see
Figure 2-6  Waterfall and cyclic design processes
Figure 2-7  Hierarchy of system detail
Figure 2-8  Example of an "ergonomic priority" scale
Figure 2-9  Graph showing combined "importance" and cost criteria for various solutions

Chapter 3

Figure 3-1  Overall process for developing a workplace safety program
Figure 3-2  Example of eye and respiratory PPE
Figure 3-3  Complete suit of PPE
Figure 3-4  Neutral working postures
Figure 3-5  NIOSH lifting formula - 1991
Figure 3-6  Example of a lifting task
Figure 3-7  Example Lifting Analysis Worksheet
Figure 3-8  Usage of pneumatic tools in aviation
Figure 3-9  Format for warning signs
Figure 3-10 Example of motivational technique that might increase stress
Chapter 4

Figure 4-1  Approximate daily (circadian) cycle for body temperature
Figure 4-2  Example of a desynchronized circadian rhythm

Chapter 5

Figure 5-1  Typical scale of a large maintenance hangar
Figure 5-2  Movable dock scaffolding
Figure 5-3  Roof-mounted, telescoping work platform
Figure 5-4  Plan view of the facility
Figure 5-5  Plan view with work platforms
Figure 5-6  Plan view with common areas
Figure 5-7  Initial work area layout
Figure 5-8  Aisles and exits
Figure 5-9  Recommended width for aisles and corridors
Figure 5-10 Aisle and corridor width for equipment and people
Figure 5-11 Aisle and corridor width when equipment maneuvering is required
Figure 5-12 Ramp dimensions that will accommodate powered equipment and wheelchairs
Figure 5-13 Minimum exit requirements and egress capacity calculation
Figure 5-14 Angular limits and recommendations for vertical transitions
Figure 5-15 Recommended dimensions for interior stairs
Figure 5-16 Recommended dimensions for stair ladders
Figure 5-17 Recommended dimensions for portable ladders
Figure 5-18 Recommended for fixed ladders
Figure 5-19 Recommended dimensions and features of work platforms
Figure 5-20 Thermal comfort zone for typical hanger-type work
Figure 5-21 Recommended reflectance values for facility elements
Figure 5-22 Direct and indirect glare
Figure 5-23 Recommended viewing angles to avoid direct glare
Figure 5-24 Sound pressure levels for some common sounds
Figure 5-25  Methods for reducing facility noise
Figure 5-26  Acceptable maximum reverberation periods for different volumes

Chapter 6
Figure 6-1  Example task analysis form showing an NDI activity
Figure 6-2  Anthropometric measurement points
Figure 6-3  Good postures for standing and seated work
Figure 6-4  Standing workplace dimensions
Figure 6-5  Seated workplace dimensions
Figure 6-6  Horizontal workplace dimensions
Figure 6-7  Computer workplace dimensions
Figure 6-8  Chair dimensions
Figure 6-9  Handle dimensions
Figure 6-10 Choose handtool handles to keep the wrist straight
Figure 6-11 Speed and errors associated with various corridor widths
Figure 6-12 Speed of exit as a function of emergency exit door width
Figure 6-13 Speed of maintenance task performance as a function of hand opening clearance

Chapter 8
Figure 8-1  Typical aviation maintenance troubleshooting scene
Figure 8-2  Example of a system used to study general troubleshooting strategies
Figure 8-3  A logical troubleshooting diagram for an automobile engine
Figure 8-4  Example of a readout unit for built-in test equipment
Figure 8-5  SOCBI depiction of an ECS control panel
Figure 8-6  Example of a functional/logic diagram from an SOCBI module

Chapter 9
Figure 9-1  Pen-based computer systems for FAA Inspectors
Figure 9-2  A modern BITE user interface
Figure 9-3  General diagram of a person-machine system
Figure 9-4  Function allocation process
Figure 9-5  Function allocation decision surface

Chapter 10
Figure 10-1  Testing and accommodation process

Chapter 13
Figure 13-1  Communication Through Line and Staff Positions
Figure 13-2  Abstraction Ladder

Chapter 14
Figure 14-1  Trends in accident causation
Figure 14-2  General Human Performance Model
Figure 14-3  Stages in the development of an organizational accident
Figure 14-4  The Bolts and Nuts example
Figure 14-5  Example of a Small Error Reporting Form
Figure 14-6  Local accident-producing factors

Chapter 15
Figure 15-1  Control & burner arrangements and percent user errors for simulated ranges
Figure 15-2  Example of movement compatibility
Figure 15-3  Some commonly used controls
Figure 15-4  Basic types of mechanical displays
Figure 15-5  Stereotypical or commonly expected control motions
Figure 15-6  Moving scales cause "reversed" control motion
Figure 15-7  Examples of word labels
Figure 15-8  Rules for control labels

Chapter 16
Figure 16-1  The SHELL model
Figure 16-2  The evolution of MRM and human factors training programs
Figure 16-3  The Instructional Systems Development (ISD) Model
Figure 16-4  ISD phases and activities
Figure 16-5  Task analysis flow chart
Figure 16-6  The four levels of MRM training program design
Figure 16-7  Learning task hierarchy
Figure 16-8  If-Then media selection model
Figure 16-9  Media selection form
Figure 16-10  Categories of learning
Figure 16-11  Instructional Media Evaluation Form
Figure 16-12  Recommended MRM Training Room Layout
Figure 16-13  Co-facilitators presenting an MRM training program
LIST OF TABLES

Chapter 1
Table 1-1 Checklist for the general physical environment
Table 1-2 Checklist for individual workspaces
Table 1-3 Checklist for demographics
Table 1-4 Checklist for task-related elements of a job
Table 1-5 Checklist for job-related elements
Table 1-6 Checklist for elements related to a specific task
Table 1-7 Criteria for selecting products
Table 1-8 Criteria for selecting human factors consultants

Chapter 2
Table 2-1 Typical human-system actions and problem solutions
Table 2-2 Steps required to implement a human factors program
Table 2-3 Typical Mission Statement and specific objectives for a Human Factors Task Force
Table 2-4 Typical Human Factors Task Force composition
Table 2-5 Basic task force organizational issues
Table 2-6 Sample training syllabus for a Human Factors Task Force
Table 2-7 Issues evaluated by audit program
Table 2-8 Typical design requirements from audit and analysis of a workcard

Chapter 3
Table 3-1 Leading work-related diseases and injuries in the U.S. in 1982
Table 3-2 Categories of workplace safety issues
Table 3-3 Frequency Multiplier (FM) Table
Table 3-4 Human performance at various temperatures

Chapter 4
Table 4-1  Compressed, phase-advanced 2-2-1 schedule
Table 4-2  Example of a questionnaire used to evaluate the existing shift schedule
Table 4-3  Topics for supervisors' shift turnover meeting
Table 4-4  Topics for turnover walkthroughs

Chapter 5
Table 5-1  Facility-related OSHA regulations
Table 5-2  Direct measurements for a facility audit
Table 5-3  Example of a questionnaire for use during a facility audit
Table 5-4  Typical topical outline for structured interviews
Table 5-5  Structured walkthrough checklist
Table 5-6  Human factors considerations for facility changes
Table 5-7  Example design for a Facility Review Group Action Record
Table 5-8  Recommendations related to facility lighting
Table 5-9  Methods for reducing facility noise

Chapter 6
Table 6-1  Improvements due to work design in a manufacturing cell
Table 6-2  Anthropometric data for the current U.S. population

Chapter 7
Table 7-1  Instructional systems design approach for computer based training
Table 7-2  Instructional systems design for classroom training
Table 7-3  DAPPER model for on-the-job training
Table 7-4  Guidelines for determining when OJT is appropriate
Table 7-5  Human factors criteria for evaluating computer-based training products
Table 7-6  General guidelines for structured OJT
Table 7-7  Guidelines for delivering structured OJT
Table 7-8  Guidelines for selecting on-the-job trainers
Table 7-9  Common categories of objective task performance criteria
Chapter 8

Table 8-1  Training approaches that do not work well for teaching troubleshooting skills
Table 8-2  Training approaches that improve troubleshooting performance
Table 8-3  Components of meaningful troubleshooting practice
Table 8-4  Elements of context-specific troubleshooting knowledge
Table 8-5  Guidelines for selecting testing and troubleshooting automation
Table 8-6  Steps in automating testing and troubleshooting tasks
Table 8-7  Guidelines for procedures aimed at reducing testing and troubleshooting errors
Table 8-8  Advantages of using computer-based simulation for error-reduction practice
Table 8-9  Time pressure reduction procedure for line technicians

Chapter 9

Table 9-1  Examples of criteria categories
Table 9-2  Starting function definition
Table 9-3  Initial function list

Chapter 10

Table 10-1  Typical frequencies of disabilities in U.S. workers
Table 10-2  Most frequent mental problems in the general population
Table 10-3  Titles of the ADA, topics covered, and responsible agencies
Table 10-4  Myths about people with disabilities
Table 10-5  Top 10 ADA claims
Table 10-6  The most frequent complaints received against GSA facilities over the past 10 years
Table 10-7  Facilities design problems that occur almost always
Table 10-8  Conditions excluded from protection under the ADA
Table 10-9  ADA compliance evaluation checklist
Table 10-10  Information that can be used in the job analysis and description
process

Table 10-11 Some interview DO's and DON'T's
Table 10-12 Recommendations for interviews with people with disabilities
Table 10-13 Job matching check sheet
Table 10-14 Matrix of planning guidelines for accommodating functional limitations
Table 10-15 Job Accommodation Network questionnaire
Table 10-16 Frequency of cases of specific learning disabilities
Table 10-17 Accommodations for the SLDs shown in Table 10-16
Table 10-18 Reasonable Accommodations in Employment - definitions and examples
Table 10-19 Possibly offensive or inaccurate terms and more desirable alternatives
Table 10-20 Suggested disability etiquette rules

Chapter 11

Table 11-1 Demographic characteristics of sexual harassment complaints
Table 11-2 Common reactions to being sexually harassed
Table 11-3 Symptoms composing Sexual Harassment Trauma Syndrome

Chapter 12

Table 12-1 Behavioral indicators of troubled employees
Table 12-2 Components of a company privacy policy

Chapter 13

Table 13-1 How Competently Do You Communicate?
Table 13-2 How many times out of 100 would a thing occur if it happened
Table 13-3 Listening Characteristics

Chapter 14

Table 14-1 Summarizing the main differences between errors and violations
Table 14-2 Selection factors for Pareto analysis
Table 14-3  Information to be noted during Pareto analysis

Chapter 15

Table 15-1  Guidelines for auditory and visual information
Table 15-2  Guidelines for information system based on types of attention
Table 15-3  Control movements and expected effects
Table 15-4  Control-effect relations of common hand controls
Table 15-5  Minimal separation distances (in mm) for hand controls
Table 15-6  Preferred mechanical display indicators for specific types of task
Table 15-7  Guidelines for design of paper-based documentation for aircraft maintenance
Table 15-8  Examples of Maintenance Workcards written in simplified & non-simplified English

Chapter 16

Table 16-1  Leading maintenance problems
Table 16-2  Maintenance Error Categories
Table 16-3  Organizational Analysis
Table 16-4  Organizational Culture Assessment Categories
Table 16-5  Categories for Assessing Baseline Performance
Table 16-6  Determining Training Policies and Procedures
Table 16-7  Factors to be considered in evaluating training resources
Table 16-8  Training Cost Factors
Table 16-9  Methods for obtaining data for organizational analysis
Table 16-10 Factors to consider in describing training audience
Table 16-11 Example of training goals and objectives for program and curriculum levels
Table 16-12 ABCD format for writing performance objectives
Table 16-13 Examples of MRM instructional objectives of Trainees.
Table 16-14 Instructional events for supporting learning
Table 16-15 Examples of training methods and media.
Table 16-16 Factors to consider in training methods and media selection.
Table 16-17  Instructional Facilities Design
Table 16-18  Example of an MRM course outline.
Table 16-19  Example of an MRM lesson plan.
Table 16-20  Evaluation assessment process and outline.
Table 16-21  Example of project budget form.
Table 16-22  Maintenance Training Video Storyboard/Script
Table 16-23  Example of a Storyboard with Powerpoint and Facilitator Notes
Table 16-24  Example of a post-training, trainee questionnaire
Table 16-25  Evaluation Processes