

CHAPTER SEVEN

A HUMAN FACTORS GUIDE FOR AVIATION MAINTENANCE

7.0 INTRODUCTION

Maintenance for air carriers is conducted under a myriad of pressures caused by strict flight schedules, new aircraft technologies, aging aircraft issues, personnel working conditions, and economic factors. Irrespective of these pressures, the quality of maintenance must be high if industry safety standards are to be achieved. Also, the efficiency of maintenance must be high if the airline industry is to remain economically viable. These industrial imperatives can only be met with a maintenance workforce that is both productive and rigorous. Maintenance tasks must be accomplished expeditiously and accurately. A Human Factors Guide can be valuable in supporting and enhancing the performance of aviation maintenance personnel and thereby aid in meeting the industry's goals.

The Federal Aviation Administration (FAA) program on Human Factors in Aviation Maintenance is developing, as one end product, a guidebook presenting human factors information to support the work activities of maintenance technicians. The philosophy of the guide is that a maintenance technician represents one operating element in a "maintenance system," with other elements being the aircraft, the maintenance facility, supervisory forces, and maintenance equipment. In this context, we need to know the "operating characteristics" of the technician just as we would those of any other operating element. Information is necessary concerning the capabilities and limits of humans, the effect of environmental factors, and the way in which humans operate most effectively in a human-machine relationship. In short, we need to understand the "human factors" of aviation maintenance.

The Human Factors Guide was prepared on the basis of stated preferences of maintenance personnel. This was done to ensure that the guide is usable and that its potential for helping maintenance is not degraded by problems of acceptance or by its physical characteristics. Selection of topics and the presentation of materials was guided by information obtained through a series of [FAA](#)-sponsored human factors meetings as well as input gained from a participatory panel of maintenance personnel.

7.1 STATUS OF HUMAN FACTORS GUIDE

During the past twelve months, the *Human Factors Guide for Aviation Maintenance* has progressed through the following stages: (1) **Concept Definition**; (2) **Methodology Development**; (3) **Data Collection and Analysis, Data Synthesis and Abstraction, and Draft Section Authoring**; (4) **Advanced Technical Data Solicitation**; and (5) **Preliminary Draft Review**. Copyright and Permission Approvals are being obtained as required.

Concept Definition was addressed through two means that involved key members of the air carrier maintenance community: (1) A topic selection meeting and (2) a data gathering phase.

The topic selection meeting was held in January 1992 prior to the convening of the Sixth [FAA](#) Meeting on Human Factors Issues in Aircraft Maintenance and Inspection. Attendees included invited individuals representing the interests of experienced Air Transport Association Inspection Panel Members, manufacturers, carriers, unions, universities, the [FAA](#), and [FAA](#) support contractors. The topic selection meeting resulted in preliminary recommendations relative to the Guide's scope and purpose, primary target audience, writing style and tone, and suggested topical sections.

During June-July 1992, a **concept definition** for the Guide was sought from 60 key members of the air carrier maintenance community. Information solicited was designed to ensure that the real needs of aviation maintenance personnel would be met and that the Guide would be authored and constructed consistent with likely end-user needs. The information obtained addressed issues of target audience identification, as well as Guide content, size, and style.

A detailed analysis of information obtained from the air carrier representatives was presented in August 1992 at the Seventh [FAA](#) Meeting on Human Factors Issues in Aircraft Maintenance and Inspection: "Science, Technology and Management, A Program Review." Also included as part of the [presentation](#) was a **methodology development** strategy, along with a prototype topical section on Area and Task Lighting. Subsequently, draft Guide sections have been developed using the outline shown in **Table 7.1**.

Table 7.1 Outline for *Human Factors Guide* Sections

- Importance of Topic in Industrial Operations
 - Industrial Experience
 - Related Research
- Application in Aviation Maintenance
 - Industry Practices
 - Opinionnaire/Audit/Research Findings
- Human Factors Guidelines
 - Brief Discussion
 - Specific Guidelines
- Procedures for Evaluating the Situation

Also, as part of **methodology development**, a broad outline for the entire Guide was established, including the following:

- Part I: Introduction
- Part II: Maintenance and Inspection
- Part III: Workplace Design
- Part IV: The Human Operator
- Part V: Workplace Issues.

Data Collection and Analysis, Data Synthesis and Abstraction, and Draft Section Authoring has progressed sequentially for all sections of the Guide. Primary data sources are shown in **Table 7.2**.

Table 7.2 Primary Data Sources

- Proceedings from the [FAA](#) Meetings on Human Factors Issues in Aircraft Maintenance and Inspection
- Aviation maintenance manufacturers and carriers
- Professional journals and publications
- Copyrighted human factors and performance enhancement textbooks and publications
- Professional society and/or association conference proceedings
- Government and Professional guidelines and standards
- National Research Council, Committee on Human Factors
- University human factors and behavioral technology research laboratories and aviation maintenance programs

Information was abstracted and synthesized, with concepts and ideas condensed to present key information concisely. Relevant information is presented in either a bullet format or in short listings and statements. Illustrations are used to support textual material, as appropriate.

Advanced Technical Data. Because of the technical nature of some Guide sections, data were solicited from organizations such as the Industrial Engineering Laboratory, State University of New York at Buffalo; ATA Committees on Standardized/Simplified Language and Maintenance Manual Data/Format; the Equal Employment Opportunity Commission; and the U.S. Department of Health and Human Services.

A **preliminary review of draft** Guide sections was held at BioTechnology on 9 March 1993. The meeting's purposes were to (1) review the draft Guide and (2) to discuss efforts needed to bring the Guide to completion. Issues addressed at this review meeting included a final discussion of target audience to ensure that sponsor and contractor personnel were in full agreement; illustrations and photographic support; Guide size, cross referencing, and format; copyrights and approvals; air carrier and air manufacturer aviation maintenance technical review comments; and publication, printing, and distribution issues.

Many, but not all, **copyright and permission** requirements have been identified (e.g., for scanned images, photographs and quoting/abstracting more than 500 words of copyrighted textual material). A complete audit of each Guide section relative to copyright obligations continues. To date, letters have been sent to 35 publishers. Fourteen have responded positively.

Not all copyright and permission letters have been prepared. Of those copyright and approval letters for which responses have been received, **Table 7.3** is a composite summary of permission requirements established by publishers:

Table 7.3 Permission Requirements

- Publishers require copyright credit lines.
- Permissions typically:

- Are restricted to print reproduction only and *do not include electronic media or any type of electronic format*
- Are limited to the English language distribution (some publishers restrict distribution to the U.S., its territories and dependencies, the Philippines, and Canada; other publishers allow distribution in the English language world-wide)
- Do not extend to any copyrighted materials credited to other sources
- Are non-exclusive and are not transferable
- Require one copy of the final work to be provided to the publisher
- Require that any changes to the draft submission be approved
- Require a signed agreement.

The *Human Factors Guide for Aviation Maintenance* will undergo final review by the Federal Aviation Administration 199. The Guide will be available to the air carrier maintenance industry upon completion of the review cycle and subsequent publication. Distribution of the Guide will be controlled through the Office of Aviation Medicine, Federal Aviation Administration.