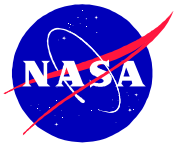
Developing Operating Documents
A Manual of Guidelines -- E-VERSION

NASA/FAA Operating Documents Project

October, 2000



NASA Ames Research Center
Human Factors Research & Technology Division

FAA AAR-100, Office of the Chief Scientific
and Technical Advisor for Human Factors

Developing Operating Documents
A Manual of Guidelines

NASA/FAA Operating Documents Project

Participating Organizations

AIR TRANSPORT ASSOCIATION

AERA

AIR CANADA

ALOHA AIRLINES

AMERICA WEST AIRLINES

AMERICAN AIRLINES

AMERICAN EAGLE

AMERICAN TRANS AIR

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TRANS WORLD AIRLINES, INC.

UNITED AIRLINES

UNITED PARCEL SERVICE

US AIRWAYS

Introduction

This introduction provides background context for the Operating Documents Manual: for whom it is intended, why and how it was developed, what it contains and what are its intended results. It then describes the organization of the Manual so that users can find the information they are seeking. A final section provides additional resources for related questions not addressed in this Manual.

Introduction: How to use the Manual

Statement of Purpose

WHO is this Manual for?

This Manual is intended for anyone involved in the design, development, production, and maintenance of flight operating documents. This includes internal operation departments (e.g., technical publications, flight standards, training, information systems, members of the user community) as well as external organizations such as the FAA, manufacturers, and other associated vendors and service organizations. This Manual focuses specifically on flight operating documents, although many of the guidelines are applicable to other areas that require complex document systems.

WHY was it developed?

There are numerous guidelines applicable to procedure and document development. Nevertheless, it can be difficult for operators to make the best use of these guidelines in their current form distributed across a number of reports and publications. Guideline resources tend to focus on a single aspect of document design, for example, formatting and typography, or to focus on several aspects of a single redesign project, for example, the design of checklists. Rarely does a guideline manual cover the entire document development process. However, it is important for operating documents to be internally consistent with other documents and departments within the organization, and externally consistent with regulations, manufacturer requirements, and human factors principles. This Manual addresses the major aspects of the document development process with the aim of maintaining internal and external consistency.

WHAT does it do?

This Manual presents guidelines that address key issues in the development of operating documents by organizing them according to the way operators develop document systems. The Manual incorporates examples of current best practices discussing both problems and solutions so that lessons learned can be shared. The Manual is based on input from many operators with an emphasis on a high degree of operational relevance. It is important to note that this Manual provides guidance only. It does not represent regulatory requirements or their interpretation.

HOW was it developed?

Operator involvement was critical in every phase of developing this Manual: 1) identifying key issues, 2) collecting current approaches and lessons learned, 3) discussing issues and recommendations, 4) writing the Manual, and 5) reviewing the Manual. The first three phases were accomplished through surveys and industry participation in NASA/FAA Workshops I and II (See Appendix A). Phases 4 and 5 were accomplished through the efforts of several key writers and reviewers and industry participation in NASA/FAA Workshop III.

Survey results provided the basis for organizing operating document guidelines according to five areas of development: 1) organization of documents, 2) standardization of documents, 3) usability of documents, 4) document development process, and 5) transition to electronic media.

In this Manual, the five areas are represented in Parts 1-4 with standardization and usability combined in Part 2. An analysis of survey results indicated differences in priorities among the three categories of operators: 1) Majors, 2) Regionals, and 3) Cargo. While a few topics showed similar rating patterns across all operators, other topics showed variation based on operational differences as well as organizational and economic factors. This Manual was organized to address those topics common to most operations, in such a way that developers can access a particular issue or interest without reading the entire Manual.

In spite of standard requirements for what information must be carried in flight, operators organize, distribute and locate their operating documents in a variety of ways. Local and national level regulatory differences partially account for this diversity. Hence, this Manual attempts to provide general guidelines as well as specific examples. The general guidelines can be used for any document system, but specific examples are relevant to issues in the context of actual document systems, and must always be verified as a viable option within one's particular regulatory environment.

There was consensus that information requirements for time critical procedures in flight are of primary importance within the overall information system. This theme ran through several topics; for instance, the importance of determining abnormal procedure flows from one procedure or document to another with an effective indexing system. Reflecting the survey results, this Manual covers a wide range of topics identified by the operators and emphasizes issues of their highest concern.

WHAT are the results for users?

This Manual closely follows the priorities set in the workshops and incorporates the recommendations and examples provided by the participants. Thus, users of this Manual will find the issues that their colleagues find to be most important in the design, development, production and maintenance of operating documents. Guidelines on these topics are assembled from various sources and supplemented with examples of current resolution strategies. This approach provides practical guidance on the most important aspects of operating documents and presents them in a way that conforms to the development process. This Manual reflects the issues and participant feedback current at the time it was developed. Because these issues may change over time, the Manual should be seen as part of an ongoing process of continued operator input, feedback and update. Similarly, the Manual cites numerous regulations and advisories current at this writing. It is important to re-check these references for changes and updates as well.

Manual Organization

Structure of the Manual

This Manual has been organized in the way one would approach the design and development of documents. It is intended to be a working Manual and resource rather than to be read from cover to cover. The Introduction presents the purpose and organization of this Manual (see Figure I.1 for the overall structure of the Manual). Part 1 covers issues related to the organization of the entire operating documents system regardless of information media (paper or electronic). Part 2 covers the development of individual documents while Part 3 deals with the document production and maintenance processes.

Both Parts 2 and 3 refer to the development and production of paper-based documents. Finally, issues and guidelines related to electronic media are presented in Part 4 and the Manual concludes with references, definitions and appendices.

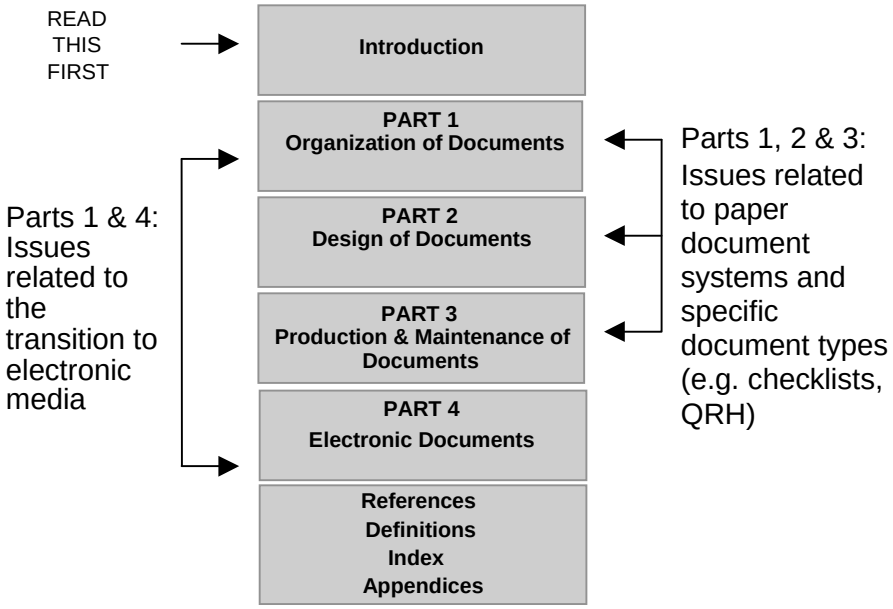


Figure I. 1 Structure of the Manual

Contents of the Manual

The Introduction provides a context for the Operating Documents Manual; its audience, why and how it was developed, its contents and intended results. It also describes the organization of the Manual so that users can find the information they need. Additional resources are provided for related questions not addressed in this Manual.

Part 1, Organization of Documents, focuses on the overall organization of documents; how to compile and organize information necessary for flight operations. It discusses information requirements and criteria for determining how information is distributed and located. Developers of new document systems as well as those merging and splitting documents, changing the location of documents, and creating system-level indexing and cross-referencing should consider the issues and guidelines in this part. Developers focusing on a particular (paper-based) document re-design may start with the guidelines in Parts 2-3, while still considering the system level issues described in Part 1.

Part 2**,** Design of Documents, represents the starting point for specific document re-design projects beginning with a consideration of government regulations, manufacturer recommendations and company policies and standards. Part 2 continues with standardization issues across fleets, documents, procedures and flows, and formatting of documents and indexing strategies for usability and effective information access.

Part 3, Production and Maintenance of Documents, focuses on the introduction of new information and the associated approval processes. It continues with the production process, and concludes with issues related to revision, distribution and tracking. Similar to Part 2, this part refers to a paper-based system, but is concerned with the document development from the production and maintenance perspective. Part 3 is a natural follow-on to specific document design projects such as those discussed in Part 2, but also represents the longer term issues of upkeep, review, revision and tracking.

Part 4, Electronic Documents, begins with general considerations for transitioning to electronic media, planning electronic libraries, and issues related to FAA standards. It continues with electronic document design concerns, and concludes with a discussion of distribution and cost/benefits of electronic media. To some extent, this is a standalone chapter considering both design and development processes together. As with paper-based documents, developers of electronic media must consider the overall document system, the way it is organized and where information is located, as discussed in Part 1.

Format of the Manual

Parts 1-4 all follow the same format (see Figure I.2 for a simplified view of that format). Each Part represents an area of document development and is divided into sections and subsections presenting the key issues. Guidelines are included in the appropriate subsections and are numbered consecutively within their respective Part number (100 series guidelines are in Part 1, 200 series guidelines are in Part 2, etc.). Therefore guidelines within Part 1 are numbered 101, 102, 103, etc. They are not numbered the same as the subsection number because there may be multiple guidelines per subsection.

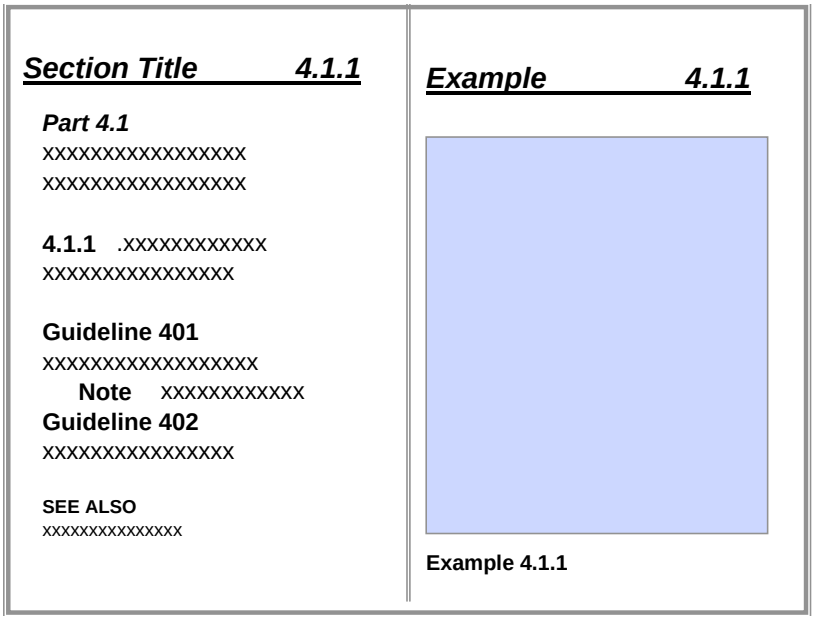


Figure I. 2 Format of the Manual

Examples for these subsections and their guidelines are linked and numbered by subsection. Optional notes are used to amplify guidelines and follow directly after the guideline. At the end of each subsection, optional SEE ALSO references provide additional references and links to related topics.

References and Definitions

Some of the guidelines appearing in this Manual are taken directly from a core set of sources listed in Table I.1 below. In these cases, the guideline sources (as abbreviated in Table I.1) are indicated in parentheses.

Table I.1 Guideline Sources

8400.10	FAA (1994). *8400.10 Air Transportation Operations Inspector's Handbook*. Washington, DC: Federal Aviation Administration.
A&S-97	Adamski, A. J. & Stahl, A. F. (1997). Principles of Design and Display for Aviation Technical Messages. *Flight Safety Digest*, Volume 16: 1-29.
D-92	Degani, A. (1992). *On the typography of flight-deck documentation* (NASA Contractor Report 177605). Moffett Field, CA: NASA Ames Research Center.
D&W-91	Degani, A., & Wiener, E. L. (1991). Philosophy, policies, and procedures: The three P's of flight-deck operations. *Proceedings of the Sixth International Symposium on Aviation Psychology* (pp. 184-191). Columbus, OH: The Ohio State University.
D&W-93	Degani, A., & Wiener, E. L. (1993). Cockpit checklists: Concepts, design, and use. *Human Factors*, *35*, 345-359.
D&W-94	Degani, A., & Wiener, E. L. (1994). *On the design of flight-deck procedures*. (NASA Contractor Report 177642). Moffett Field, CA: NASA Ames Research Center.
FAA-95	FAA (1995). *Human performance considerations in the use and design of aircraft checklists*. Associate Administrator for Aviation Safety, Human Factors Analysis Division. Washington, DC: Federal Aviation Administration.
G-95	Gross, M. S. (1995). Studies suggest methods for optimizing checklist design and crew performance. *Flight Safety Digest*, Volume 14:5, 1-10.
NASA/FAA – 97	NASA/FAA – 97 (1997). *Proceedings of the NASA/FAA - 97 Operating Documents Workshop II*. American Airlines Flight Academy, September 10-11, 1997. Moffett Field, CA: NASA Ames Research Center.
S&M-86	Smith, S. L. & Mosier, J. N. (1986). *Guidelines for Designing User Interface Software*. MTR 10090. Bedford, MA. The MITRE Corporation.
T&H-91	Turner, J. W., & Huntley, M. S. (1991). *The use and design of flight crew checklists and Manuals*. (DOT/FAA/AM-91/7). Cambridge, MA: National Transportation Systems Center.

Finally, we recognize that terminology for some frequently used words varies across the industry both within the United States and outside. In order to maintain consistency within this Manual, we have adopted a few naming conventions listed in Table I.2. In setting these preferred terms, we are aiming for standardization within this document not a recommendation for their adoption beyond this Manual. In addition, we have referred to the Federal Aviation

Administration (FAA) when discussing regulatory functions. Clearly, non-US users of this Manual must re-interpret these discussions within the context of their own regulatory agencies (e.g., JAA, JAR's), and users within the US must recognize potential differences across local and regional FAA facilities.

Table I.2 Preferred Terms

TERM	DEFINITION
Cabin Crew	Those crewmembers such as flight attendants whose primary duty position is in the aircraft cabin.
Flight Crew	Those crewmembers such as pilots whose primary duty position is in the flight deck.
Flight Deck	The forward part of the fuselage or cockpit containing all the instruments needed to fly the aircraft.
Operator	Air carrier or airline engaged in domestic or overseas air transportation. This refers to major, regional and cargo operators.
Crewmember	An individual member of the crew, either from the flight crew or the cabin crew.

E-Version versus Paper Versions

This document was created, bookmarked and linked in Microsoft Word and distilled utilizing Adobe Acrobat 4.05. The compact disk may be utilized on either a pc or mac computer with separate versions created for each platform. In addition, two paper versions and an electronic version of the manual have been created to meet different user needs.

The electronic version of this document, best viewed in Adobe Acrobat Reader 4.0 and higher, provides a navigation pane to the left of the document that is interactive and serves as an electronic table of contents. There are three ways to navigate within the PDF document: the scroll bar, the page change indicator on the bottom toolbar, or the four directional buttons on the top toolbar (first page, previous page, next page and last page). In addition to the navigation pane links, which can be used to move from one section of the document to another, the Manual has internal links that allow the user to move between subsections and from the subsections to the examples, references, definitions and appendices. An electronic index is also provided at the back of the Manual that links the user to the appropriate subsection for each identified term. Appendix B and Appendix C provide links to individual guidelines and examples used to illustrate the Manual.

To utilize internal links, position the cursor under the highlighted text so that a pointing finger is visible and click. To return to the original page, click on the "previous view" arrow in the top toolbar. Where appropriate, hyperlinks to sites on the World Wide Web have also been included. Note that Internet links will only work if the computer is actively connected to a server with access to the World Wide Web. In addition, email links work differently depending on software utilized. If clicking on the email link doesn't automatically create a "Mail to" feature, you may need to cut and paste the address into your email program.

The two paper versions of this document have been created from the electronic document and are suitable for printing as a one-sided or two-sided document. The margins on the single-sided paper document are adjusted to the left so that the paper version may be printed, hole punched or bound. The double-sided paper version has mirror margins. In both paper versions, the examples follow the subsection they illustrate. Blank pages have been inserted to separate the document into its larger parts: Introduction, Parts 1-4, References, Definitions, Index and Appendices.

Acknowledgments

The NASA/FAA Flight Operating Documents project is funded by FAA AAR-100, Office of the Chief Scientific and Technical Advisor for Human Factors, and supported by NASA Ames Research Center, Human Factors Research & Technology Division. The project's success is due to the participation of industry operators and manufacturers who contributed their expertise and insights at every phase. Initially, participants helped to identify key issues in the development of operating documents starting with 35 participants in Workshop I, to over 70 in Workshop II. More recently, 46 participants performed an extensive review of the final draft of this Manual in Workshop III. We would like to thank the individuals from the more than 30 organizations that have contributed to this Manual (see Appendix D). This collaborative effort between operators and researchers has helped to restructure guidelines and has highlighted the need for the examples and best practices that have become a significant part of the Manual.

Special recognition goes to those individuals that made outstanding contributions to this Manual. The main ideas about the organization of operating documents (see Part 1) came from Ron Thomas and his work at US Airways. Norm St. Peter from American Airlines was instrumental in developing an operational structure for the Manual, and he provided his expertise on the production and maintenance of documents (see Part 3). Bill LeRoy from US Airways has shaped Part 4, Electronic Documents and provided guidance on producing the paper and electronic versions of this Manual. John Bollin from America West, Mike Quinn from Bombardier and Grover Trask from FedEx provided insightful review and many of the examples. Finally, Hester Coan from NASA Ames was responsible for the review and editing process that led to the final format for publication.

Additional Information

Users may have questions not addressed in these pages. Several of the participants working on this Manual have volunteered to serve as points of contact for additional information (see Table I.3 for their addresses and phone numbers).

Table I.3 Points of Contact for Additional Information

(Current as of October, 2000)

TOPIC	NAME COMPANY	EMAIL ADDRESS	PHONE NUMBER
General Design Of Documents	Barbara Kanki NASA Ames Research. Ctr	BKanki@mail.arc.nasa.gov	650 604-5785
General Design Of Documents	Tom Seamster Cognitive & Human Factors	Seamster@qwestinternet.net	505 466-1445
Organization of Document Systems	Ron Thomas US Airways	Ron_Thomas@usairways.com	412-747-5274
Production & Maintenance of Documents	Norman St. Peter American Airlines	Norm_Stpeter@amrcorp.com	817-967-5453
Electronic Documents	Bill LeRoy US Airways	Bill_LeRoy@usairways.com	412-747-1097
Standards for the Exchange of Document Information	Rick Travers Air Canada	Rtravers@aircanada.ca	905-676-4300

Part 1 Organization of Documents

Part 1 addresses the main issues that operators face in compiling and organizing the information necessary to operate the flight department of an airline. This part starts with a discussion of how to create a document organizing database or table, followed by a determination of what information is required and identification of what additional information may need to be included. Finally, Part 1 discusses creating, testing and periodically reviewing your document system.

1.1 Organizing System

1.1.1 Developing Document Systems

The operator who is developing a new document system, or reorganizing an existing system, should review the entire document system as well as the complete operating documents process. That process includes not only the planning and organization for the document system, but the design, review, production, maintenance and distribution of system manuals and publications. Each part of the process will affect the entire system.

The FAA has developed the Air Transportation Oversight System (ATOS) to assist individuals applying for a new air carrier operating certificate. The ATOS Certification Standards Evaluation Team (CSET) will assist the applicant to successfully develop all required operating manuals. Information about ATOS can be found in the Air Transportation Operations Inspector's Handbook (8400.10), Appendix 6 (http://www.faa.gov/avr/afs/atos/). FAA requirements are addressed in Subsection 1.2.2.

Organizing a document system is driven by FAA requirements and operational constraints and is further shaped by the large amounts of information required on the flight deck. With such a complex system and demanding deadlines, two fundamental goals might be overlooked. First, operators should develop a user-centered system with the primary objective of meeting user needs. The end user (e.g., flight crewmembers, cabin crewmembers, maintenance technicians, dispatchers) is a major focus of the entire organizing system as well as the development process. Second, operators should aim beyond meeting operational requirements--viewing each new effort as an opportunity to introduce positive innovations. Advance planning and communication with local FAA Principal Operations Inspectors (POI) will help ensure progressive changes.

Guideline 100

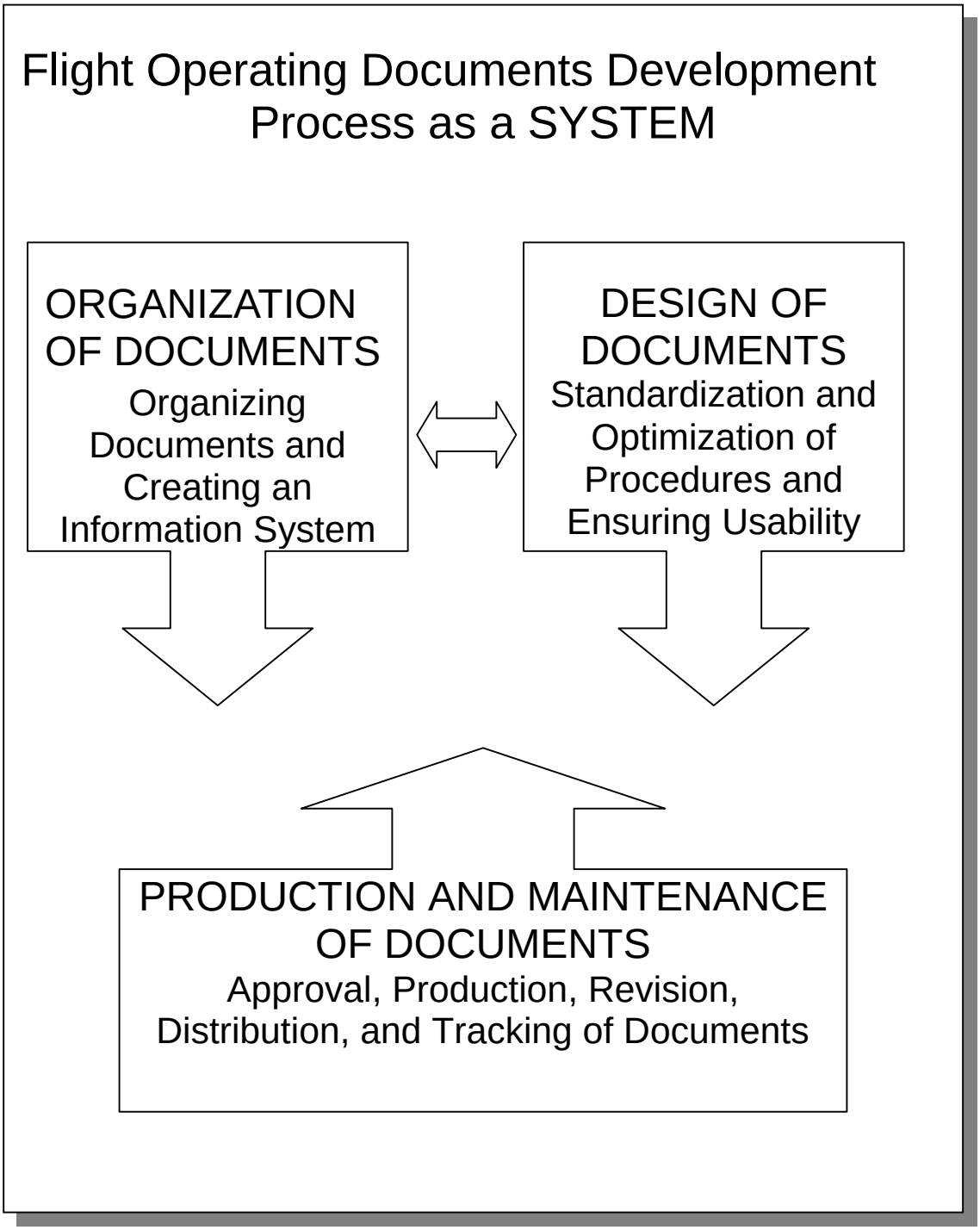
Develop an organizing system based on the entire development process including the planning, design, review, production and distribution of documents. Each part of the process should be considered when developing the overall organization. (NASA/FAA - 97)

Guideline 101

Develop a user-centered organizing system with the primary objective of meeting user needs. (NASA/FAA - 97)

Guideline 102

Treat each new effort or reorganization as an opportunity to introduce positive innovations by coordinating with the local POIs. (NASA/FAA - 97 and 8400.10)



Example 1.1.1 A Documents Database incorporates a systems approach to producing, organizing, testing, revising and maintaining operating documents.
Guideline 100

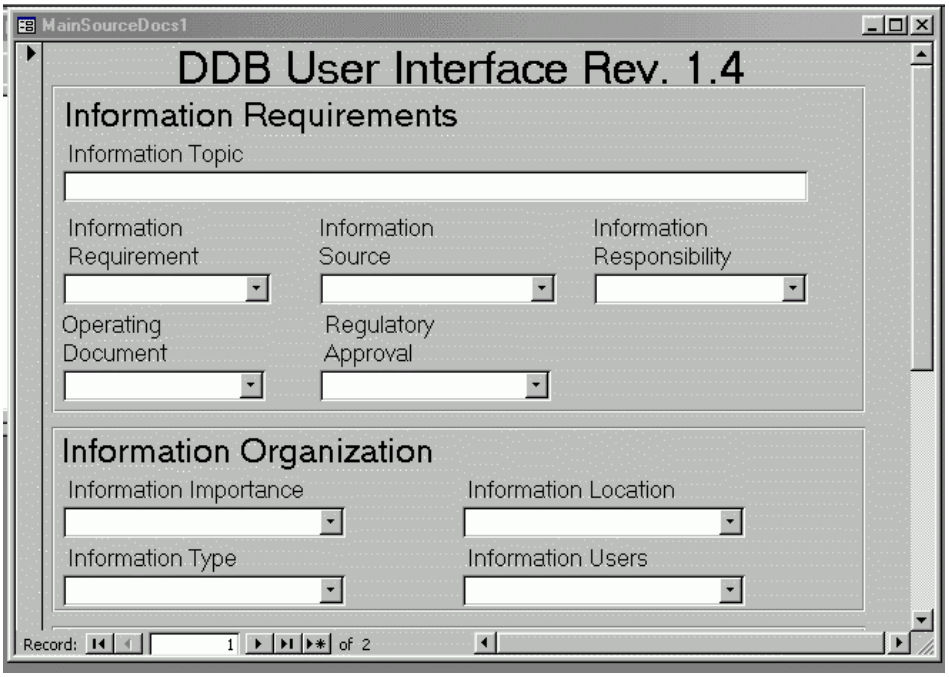
1.1.2 Establishing a Documents Database (DDB)

When gathering information to include in your manuals, it is helpful to create a database, or at least a table, identifying organizing criteria. The Documents Database (DDB) should be tailored to meet the operator's individual needs. An example of how to build and use a DDB is discussed throughout this Part. A task analysis can be linked to such a DDB providing easy access to knowledge and qualification standards information required in training. The DDB should contain the following categories of information:

- Information Topic – Many topics are broad and contain a lot of information, like aircraft systems. Others will probably need further division because they cover more than one requirement, more than one information user, or more than one information type.
- Information Requirement – Put in the reference or references that require this information to be included in your document system, such as 8400.10, a specific Federal Aviation Regulation (FAR) number, Advisory Circular number, Operations Specifications, et cetera. If an item is not required put in something to indicate this, like N/A.
- Information Source – The source document listing will enable the operator to trace an item back for editing and interpretation. The appropriate company department should be listed if information is created internally.
- Information Users – List those who use this information such as flight crews, cabin crews, maintenance technicians, et cetera. This will help you determine where the information must reside when creating your document system.
- Information Type – Determining main types of information such as aircraft specific, general, route/geographic, et cetera. will help you logically divide information into manageable documents. For a good idea of what types of information to create look at how other similar operators have grouped information. Remember to use this just as a guide, since there are many ways to group information and many reasons why operators group in a certain ways that may not apply to your operations. More on this will be discussed under 1.4.1 Determining Organizing Criteria.

Guideline 103

Consider developing some form of a database, such as a DDB, when starting to develop or when reorganizing your operating documents system. This form of database may be used to manage the organization, design, review, revision and distribution of documents. (NASA/FAA - 97)



SAMPLE LIST Information Requirements	**SAMPLE LIST Operating Documents**
FAR 121.101 Weather reporting facilities	Aircraft Operating Manual (AOM)
FAR 121.135 Manual contents	Aircraft Restrictions Manual
FAR 121.391 Flight attendants	Airway Manual
FAR 121.403 Training program: Curriculum	Checklist - Normal
FAR 121.407 Training program: Simulators…	Checklist - Nonnormal
FAR 121.411 Training program: Check airman…	Deicing Guide
FAR 121.413 Check airmen and flight instructors	Flight Operations Manual
FAR 121.417 Crewmember emergency training	Jumpseat Briefing Card
FAR 121.427 Recurrent training	Minimum Equipment List

Example 1.1.2 A Documents Database may be used to manage aspects of your operating documents system such as information organization and requirements. Guideline 103

1.1.3 Identifying Information Topics

In developing a Documents Database (DDB), a good place to start is by identifying the information topics that need to be addressed by the operating document system. There is no best level of detail with some information topics, such as aircraft systems, specified at a relatively high level, and others needing further division as the DDB is developed. This is because some information topics cover more than one information user or more than one information type. Adverse weather is a good example; you may need to divide the topic into several subsections: severe weather avoidance, windshear training and deicing procedures.

Sources of information topics include 8400.10, especially Chapter 15, Sections 3 and 4. Those sections include the topics that should be covered in general operations manuals (GOM) and flight Manuals. In addition, FAR 121.135 lists topics that must be addressed in an operator's GOM. Operators should also review their own document system or those of others with similar operations in order to identify topics and help determine the level of detail.

Information topics should be developed through an iterative process where the operator may start with relatively high-level topics that are then further divided as additional information users or information types are identified. Both topic identification and the DDB should have sufficient flexibility so that they can be easily updated and reorganized.

Guideline 104

Develop initial listings based on company and FAA/regulatory sources to include topics in 8400.10 and FAR 121.135. (NASA/FAA - 97)

Guideline 105

Establish an iterative and flexible process where the DDB in general and specifically the Information Topics can be reorganized, subdivided and updated on an ongoing basis. (NASA/FAA - 97)

SAMPLE LIST Information Topic	TOPIC'S Information Type
Adverse weather	Aircraft Specific
Airport specific operations	Route/Geographic
Authorized operations	General
Basic trainee indoctrination	Training
Differences	Aircraft Specific
Emergency training	Training
Fault reporting	Aircraft/Large Content
Flight planning	General
Flight training	Training
Ground training	Training
Hazardous material	General
Jumpseat	General
Limitations (by aircraft)	Aircraft Specific
Limitations (company)	General
Management structure	General
Minimum equipment lists	Aircraft Specific
Non-normal aircraft operating procedures	Aircraft Specific
Non-normal general policies/procedures	General
Normal aircraft flows and procedures	Aircraft Specific
Normal general policies/procedures	General
NOTAMS	General
Passengers	General
Performance	General
Performance (aircraft)	Aircraft Specific
PIREPS	General
Standard Jeppesen Charts	Route/Geographic
Supplementals	Aircraft Specific
Systems aircraft information	Aircraft Specific
Systems information (general)	General
Techniques	General
Techniques (by aircraft)	Aircraft Specific
Weight & Balance	General
Weight & Balance (by aircraft)	Aircraft Specific
Working agreements	General

Example 1.1.3 A Documents Database establishes an iterative and flexible process where the Information Topics can be reorganized, subdivided and updated on an ongoing basis. Guideline 105

1.2 Required Information

1.2.1 Reviewing Existing Manuals

Your Document System – If you do not already have a Documents Database (DDB), consider developing one. Fill in the DDB with all your existing information. You will probably have to do some research in order to determine the source document and if information is required. Use the information in Subsection 1.2.2 and Subsection 2.11 to help accomplish this.

Other Operator's Manuals- Another source to help ensure you have gathered all necessary information is to review the document system of at least one operator that is similar to yours. Make sure you review the complete document system because required information can be placed in many different locations. Add any required information you find that is not contained in your existing DDB. You should also review the information that is not required to determine if there is anything you want to add that will enhance your document system. Just as in your own document system, the other operator's manuals will probably not identify the source documents and whether the information is required or not. Use the information in 1.2 and 1.3 to help accomplish this.

Manufacturer's Operating Manuals - Manufacturers provide specific information on their products (aircraft, engines, individual systems, etc.) in flight manuals, operating manuals and training manuals. In some cases you may want to use the manufacturer's manuals directly. This information can also be copied into your operating manuals or edited to meet your operational needs. List all applicable information in your DDB.

OPERATING MANUALS AND CHECKLIST SURVEY RESULTS

(25 Operators, 1997)

OPERATING DOCUMENTS	LOCATION						RESPONSES
	With Capt	With F/O	With F/E	On A/C	A/C only	Elec-tronic	# %
Company Policy Manual	20 83%	13 54%	1 4%	3 12.5%	3 12.5%	0 0	24 96%
Normal Procedures Manual	17 68%	20 80%	5 20%	6 24%	4 16%	1 4%	25 100%
Abn/Emerg Procedures Manual	15 60%	18 72%	6 24%	13 52%	6 24%	1 4%	25 100%
Conditionals/Supplemental Normals	7 44%	11 69%	5 31%	6 37.5%	4 25%	0 0	16 64%
Aircraft Systems Manual	7 28%	10 40%	5 20%	11 44%	7 28%	0 0	25 100%
Performance Manual	4 17%	6 26%	4 17%	16 69.5%	13 56.5%	2 9%	23 92%
Airport Manual/Charts	2 17%	1 8%	2 17%	6 50%	6 50%	1 8%	12 48%
Quick Reference Handbook	2 13%	3 20%	1 7%	14 93%	11 73%	0 0	15 60%
Preflight Checklist	11 50%	11 50%	2 9%	18 82%	9 41%	0 0	22 88%
Normal Checklist	12 52%	13 56.6%	5 22%	23 100%	12 52%	0 0	23 92%
Emergency Checklist	7 32%	8 36%	3 14%	21 95%	12 54.5%	0 0	22 88%
Navigation Charts: JEPPS	23 96%	24 100%	3 12.5%	6 25%	0 0	1 4%	24 96%
MEL	3 12.5%	5 21%	3 12.5%	18 75%	16 67%	1 4%	24 96%
De-Icing Guide	10 53%	9 47%	2 11%	8 42%	7 37%	0 0	19 76%

Example 1.2.1 In organizing your document system, it may be helpful to review the way in which other operators' organize and locate their documents.

1.2.2 Working with FAA Requirements

Federal Aviation Regulations (FARs) - Documents must contain information directly required by Federal Aviation Regulations (FARs). There are general requirements in:

FAR 121 Subpart G - Manual Requirements:

- Sec. 121.131 Applicability
- Sec. 121.133 Preparation
- Sec. 121.135 Contents
- Sec. 121.137 Distribution and Availability
- Sec. 121.139 Requirement for Manual Aboard Aircraft: Supplemental air carriers and commercial operators.
- Sec. 121.141 Airplane or Rotorcraft Flight Manual.

FAR 121 Subpart K - Instrument and Equipment Requirements

- Sec. 121.315 Cockpit Check Procedures

There are also numerous FARs that contain specific information that must be included in your document system. Some FAR parts to review are 21, 23, 25, 61, 91, 121 and 135 as applicable. One way to ensure you have all information required by these regulations is to use the National Aviation Safety Inspection Program (NASIP) Checklist. This is the document the FAA uses to ensure you comply with all applicable FARs or Advisory Circulars.

Air Transportation Operations Inspector's Handbook (8400.10) - The Air Transportation Operations Inspector's Handbook (8400.10) (http://www.faa.gov/avr/afs/faa/8400/8400.html) is used by the FAA to provide direction and guidance with respect to the certification, technical administration and surveillance of air carriers operating under FAR parts 121 and 135. It also provides an operator with guidance on what the FAA is looking for. Manual information is in Volume 3, Chapter 15 - Manuals, Procedures and Checklists:

- Section 1: Background and Definitions
- Section 2: Approval and Acceptance of Manuals and Checklists
- Section 3: General Operations Manuals
- Section 4: Flight Manuals
- Section 5: Aircraft Checklists

Operating Specifications - Operating specifications contain information that must be available in manuals to the flight crew. Some operators reproduce the operation specifications and some just include information that is pertinent to the flight crew.

Advisory Circulars - Advisory Circulars may contain information that is applicable to your operations. The title of the Advisory Circular (AC) will usually provide enough description to let you determine if it is applicable. AC numbers start with the FAR part number they are associated with (21, 91, 121, etc.)

SEE ALSO

Incorporating Government Regulations and Manufacturer Recommendations into document design (Subsection 2.1.1).

Excerpt from FAR 121.135

121.135 (a)	Each manual required by Sec. 121.135 must --
(1)	Include instructions and information necessary to allow the personnel concerned to perform their duties and responsibilities with a high degree of safety
(2)	Be in a form that is easy to revise
(3)	Have the date of the last revision on each page concerned; and
(4)	Not be contrary to any applicable Federal regulation and, in the case of a flag or supplemental operation, any applicable foreign regulation, or the certificate holder's operations specifications or operating certificate.
(b)	The manual may be in two or more separate parts, containing together all of the following information, but each part must contain that part of the information that is appropriate for each group of personnel:
(1)	General policies.
(2)	Duties and responsibilities of each crewmember, appropriate members of the group organization, and management personnel.
(3)	Reference to appropriate Federal Aviation Regulations
(4)	Flight dispatching and operational control, including procedures for coordinated dispatch or flight control or flight following procedures, as applicable.
(5)	En route flight, navigation, and communication procedures, including procedures for the dispatch or release or continuance of flight if any item of equipment required for the particular type of operation becomes inoperative or unserviceable en route.
(6)	For domestic or flag operations, appropriate information from the en route operations specifications, including for each approved route the types of airplanes authorized, the type of operation such as VFR, IRF, day, night, etc., and any other pertinent information
(7)	For supplemental operations, appropriate information from the operations specifications, including the area of operations authorized, the types of airplanes authorized, the type of operation such as VFR, IFR, day, night, etc., and any other pertinent information.
(8) – (18) ⬇	

Example 1.2.2 Documents must contain information required by Federal Aviation Regulations (FARs).

1.2.3 Translating from the Manufacturer to the User

Manufacturers provide required information for the operation of specific aircraft. That information must meet FAA or country-of-origin requirements and tends to emphasize the aircraft systems and procedures under conditions that may not fully match the requirements of operators. Operators must take that information and make sure that it meets their information user needs and those of the local airworthiness authority.

For example, operators must review the Flight Crew Operations Manual (FCOM) supplied by the manufacturer and ensure that information taken from the FCOM is translated to support existing operational philosophies, policies, procedures and practices.

Operators and manufacturers collaborate on the definition of terms and the structure of information across the industry. For example, there is a defined aircraft systems data structure developed for maintenance that could be used in flight operations as well. Recently, the Flight Operations Working Group (FOWG) of the Air Transport Association has been working to standardize the definition of Phases of Flight across the industry (see Example 1.2.3). The FOWG's Phase of Flight effort seeks to develop an industry wide standard that will promote consistent exchange of flight operating information between the manufacturers and the operators. In addition, a standard phase of flight would enhance the capability to develop flight operations information databases as the industry transitions to electronic media.

Manufacturers have made substantial progress in providing documentation in forms more usable to operators. Much of that progress is in the area of operational requirements software and format compatibility (see Subsection 3.1.1). With easier techniques for translation, operators must be especially careful in expanding manufacturers' documents to include operator and flight crew-specific information. Operators should take special care to ensure that they include the crew coordination procedures, policies and philosophy unique to their operation (see Subsection 1.3.2). Two key areas of crew coordination are specified in 8400.10: calls that improve crew performance, such as altitude call-outs, and flight crew briefings.

Guideline 106

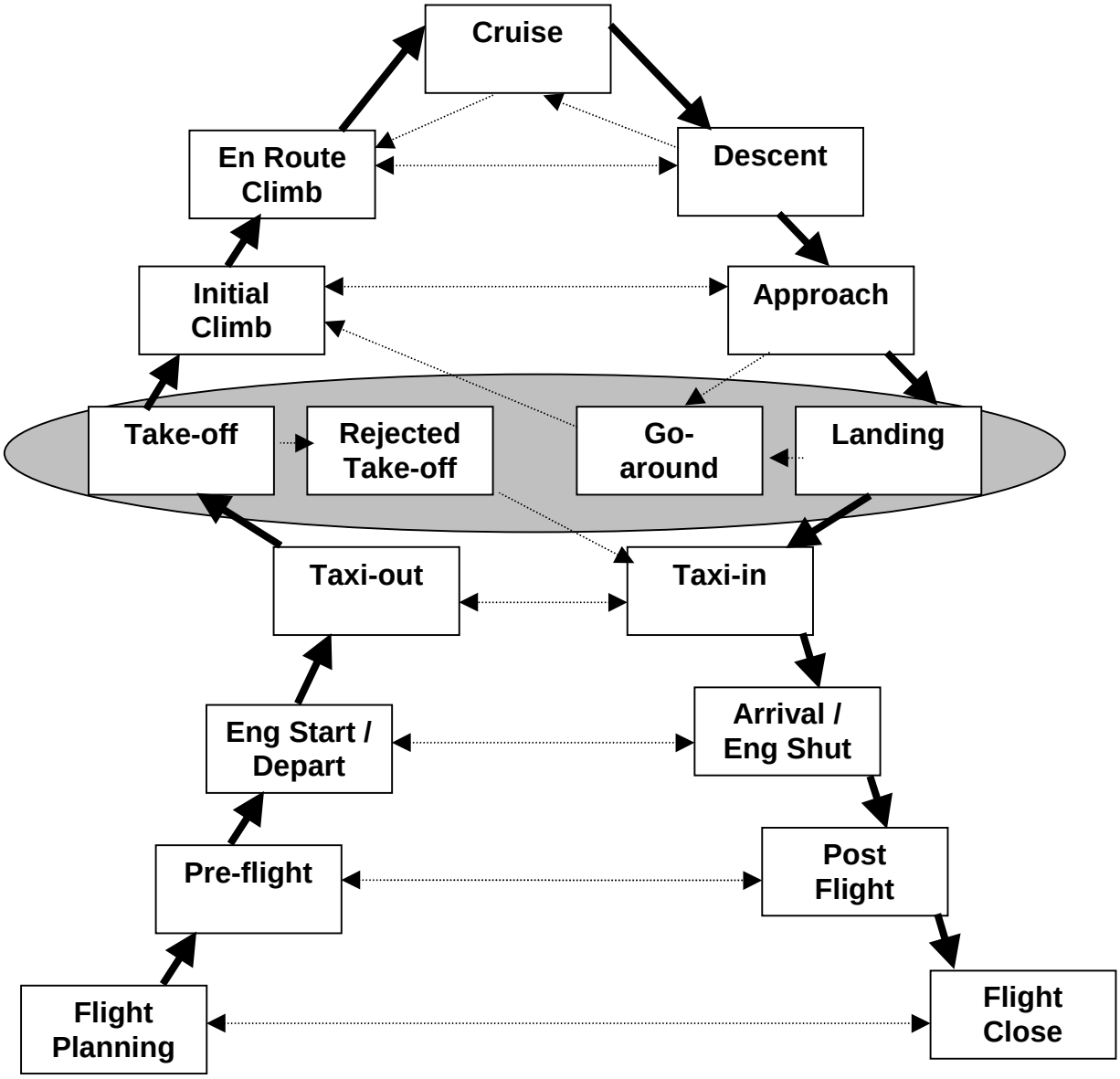
Ensure that manufacturer information taken from the AFM is amplified and translated into a form suitable for flight crews. (NASA/FAA - 97 and 8400.10)

Guideline 107

Ensure that crew coordination procedures, policies and philosophy unique to their operation are included in the appropriate parts of manuals translated from manufacturers. (NASA/FAA - 97 and 8400.10)

SEE ALSO

Emerging standards for the transition to electronic documents (Subsection 4.2.2)



Example 1.2.3 The Flight Operations Working Group (FOWG) of the Air Transport Association has been working to standardize the definition of Phases of Flight across the industry.

1.3 Additional Information

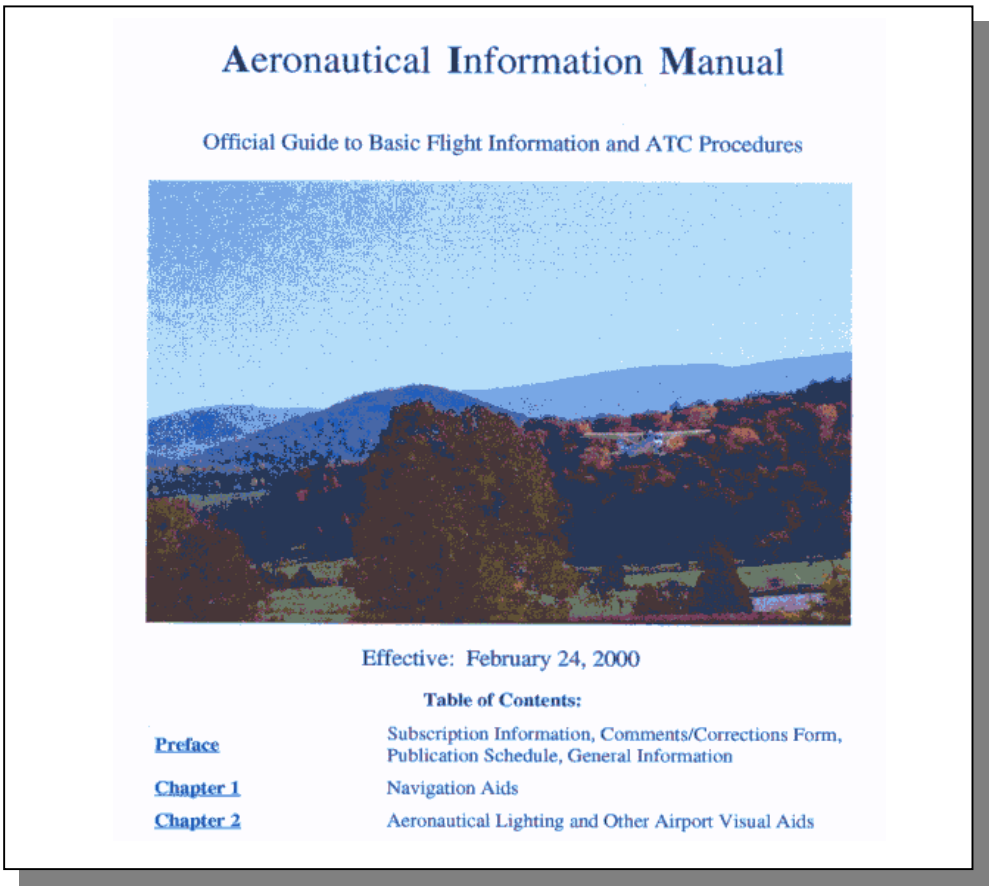
1.3.1 Working with AIM, ATC Handbook and Working Agreements

The information contained in these documents is usually not required to be in manuals but in many cases may help clarify policies and procedures.

The Aeronautical Information Manual (AIM) http://www.faa.gov/atpubs/aim and Air Traffic Control (ATC) Handbook http://www.faa.gov/atpubs/ATC/INDEX.htm contain detailed operationally oriented guidance that is based on regulation or sound operating policies and procedures. This information can help standardize the way your operation runs internally. It will also help standardize your operation with other operators as well as ATC and therefore enhance safety and efficiency.

Working Agreements may necessitate company specific operating policies and procedures. As an example, the FARs have flight crew rest restrictions that may be further restricted by a working agreement. How manuals may be revised, how much a flight crew bag can weigh, who can deice or dispatch an aircraft are just a few other examples of things that can be affected by working agreements. Ensure that as you gather information into your documents database you consider all working agreements.

1.3.1 Working with AIM, ATC Handbook and Working Agreements EXAMPLE



Aeronautical Information Manual

Official Guide to Basic Flight Information and ATC Procedures

Effective: February 24, 2000

Table of Contents:

Preface	Subscription Information, Comments/Corrections Form, Publication Schedule, General Information
Chapter 1	Navigation Aids
Chapter 2	Aeronautical Lighting and Other Airport Visual Aids

Air Traffic Control (7110.65M) | ATC | Effective: 02-24-00 | Until: 08-09-00

Air Traffic Control
7110.65M
Basic

Example 1.3.1 Documents such as the AIM and ATC Handbook contain information that may clarify policies and procedures.

1.3.2 Incorporating Philosophy and Policies

A big part of operating manuals covers procedures, but those procedures should be developed in concert with an operator's philosophy and policies. The philosophy and policies should be developed with regard to the operational environment, and should then be used to guide the tailoring of procedures (see Subsection 2.31, 2.3.2, 2.3.3, and 2.3.4) to make them both operationally relevant and beneficial to users such as flight crews.

Operators should identify or develop a consistent, high level philosophy stating how the operation is to function. Philosophy statements may specify the user-centered nature of the operation and other essential aspects of the operation. Philosophy should not be a generic statement about safety, but rather, should highlight the unique and most positive aspects of the mission. Policies then flow from that philosophy with each policy consistent with the philosophy and other policies. Philosophy and policy may not be a major part of the DDB, but operators may want to trace how specific manufacturer-supplied procedures were modified to conform with policy. It is the philosophy, policies, operational environment and user needs that ultimately shape an operator's procedures and the organization of operating documents.

Standardization of procedures is essential (see Subsection 2.2.2) to a safe and efficient operation, and that standardization starts with a clearly articulated philosophy and consistent policies. That philosophy and policies should follow through to the training of those procedures as well as the checking to ensure standardization.

Guideline 108

Develop philosophy and policies based on the operational environment, and then use them to guide the design of procedures to make them both operationally relevant and beneficial to users such as flight crews. (D&W-91)

Guideline 109

Identify or develop a consistent, high level philosophy stating how the operation is to function. A statement of philosophy should highlight the unique and most positive aspects of the operations mission. Policies then flow from that philosophy with policies consistent with the philosophy and other policies. (D&W-91)

Guideline 110

Start the standardization process with a clearly articulated philosophy and consistent, written policies. Develop the standardization process so it includes not only the development of procedures, but also flight crew training and checking. (D&W-91)

Examples of Checklist Philosophy that Should Guide Design of Procedures
Correct use of the Checklist is essential to safe operation of transport aircraft.
Use of the Checklist is mandatory for all operations, its use is never optional.
All crewmembers have a **RIGHT** to expect standard use of the checklist.
Checklists shall be designed to be easy to learn and use.
Checklists should be as common as practical to ease transition between fleets.
Checklists should be designed for maximum error resistance.
The Checklist should promote a Uniform Standard of Safety for all aircraft and crews.
Examples of Automation Philosophy that Should Guide Design of Procedures
Pilots must be proficient in operating at all levels of automation. The level of automation used at any time should be that most appropriate for the circumstances so that safety and passenger comfort are enhanced.
Although (the company) supports the concept of Automated flight, and teaches it as the primary method of managing flight, all pilots must be proficient in manually executing flight maneuvers.
When the autopilot is in use, the pilot flying should make mode selections. The pilot not flying may select new altitudes if crew duties permit.
When an immediate change of the aircraft path is required, the lowest level of automation, hand flying without flight director guidance, may be necessary until the situation is resolved. Regaining aircraft control should never be delayed to use automation.
Proper execution of Mode Control Panel or Flight Guidance Panel inputs must be verified by checking that the resulting Flight Mode Annunciator is correct. Pilots must continually scan instruments and FMSs to ensue that the aircraft performs as expected in all modes of flight.

Example 1.3.2 Philosophy statements developed by the operator, such as checklist philosophy and automation philosophy, are useful for guiding the design of procedures. Guideline 108

1.4 Creating a Document System

1.4.1 Determining Organizing Criteria by Information Types

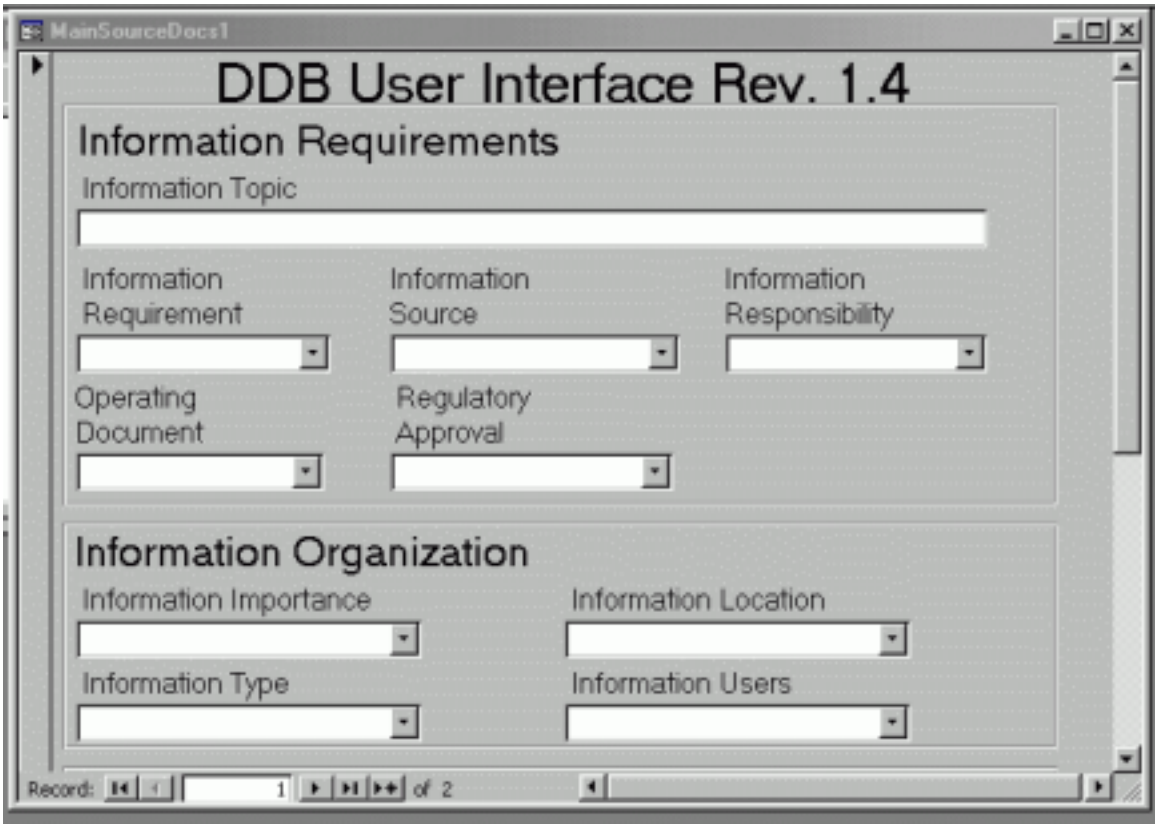
Because it is neither logical nor practical to place all required information into one document, grouping criteria that address the needs of your operation must be assessed to determine the contents of documents. It can be very beneficial to review the document system of other similar operators to give you ideas on how best to organize your document system. As discussed in earlier sections, some essential organizing criteria include the information source, the information requirements and the information users.

Information types are another class of organizing criteria, for example, the most basic information type is whether the information is required in flight. This automatically places an entire class of information in the flight deck. Another grouping criteria is whether information is aircraft specific or company generic, since these types of information serve very different purposes. Quantity of information is also a defining characteristic, since it influences the size and number of documents needed. Information Types may include:

- Aircraft Specific – Most operators create a separate document for aircraft specific information. The Flight Crew Operations Manual (FCOM) or Operations Manual from the manufacturer will already contain a large portion of this information. Some operators use the manufacturer's FCOM unaltered. It is easy for the flight crew to remember to look in this manual if aircraft specific information is needed.
- General – Just as it is logical to organize aircraft specific information in a separate manual, operator generic information can also be placed in its own manual. You may want to consider combining the aircraft specific manual and the company manual together into one manual if the two of them are not too large.
- Large Content – When an information item has a lot of content on its own you may want to consider putting it in a separate document. An example is the Minimum Equipment List (MEL).
- Route/Geographic – Navigation information needs are determined by the operator's route structure and schedule. For instance, if route structure is limited, all navigation documents may be maintained on the flight deck.
- Training – Information that is limited to training may not be required on the flight deck. In many cases, training information may reside at home.

Guideline 111

Guide the organization of a document system by criteria such as information types. The way information is characterized in terms of its requirement in flight, whether it is aircraft specific or company generic, and by the size of its content, helps to determine where the information should fall within the entire document system. (NASA/FAA - 97)



POSSIBLE Information Locations	POSSIBLE Information Types
Aircraft	Aircraft Specific
Flight Bag	General
Domicile	Large Content
Home	Route Geographic
	Training

Example 1.4.1 Information type is one criterion for organizing the document system and may help to determine where information should be located. Guideline 111

1.4.2 Organizing by Information Importance and Users

The importance and users of information are two critical organizing criteria in developing a document system. Although specific issues of usability are covered in Part 2, importance and use of information determine the index of criticality for the entire design and development, production and maintenance of documents. For example, because of the importance and use of emergency procedures, all aspects of the document development process must reflect the high-demand user requirements. When information is important it is in the company's best interest that users can locate it easily and quickly. A few of these organizing criteria are listed below. Information need is highly affected by time constraints during operation. There are four distinct levels of time constraints during operating periods that can be used to classify Information importance.

- Flight Deck Time Critical - in flight information can jeopardize the safety of the flight if not immediately available (e.g., emergency procedures).
- Flight Deck Time Sensitive - in flight information can affect the level of safety or delay the operation if not available in a short time period (e.g., crosswind/tailwind landing tables).
- Flight Deck Frequent - in flight information is required for flight but does not fall under levels one or two.
- Home Reference – not required on the flight deck.

As information is more specific (e.g., Aircraft specific normal procedures and flows pertaining to pushback procedures), the list of information users may be filled out in more detail.

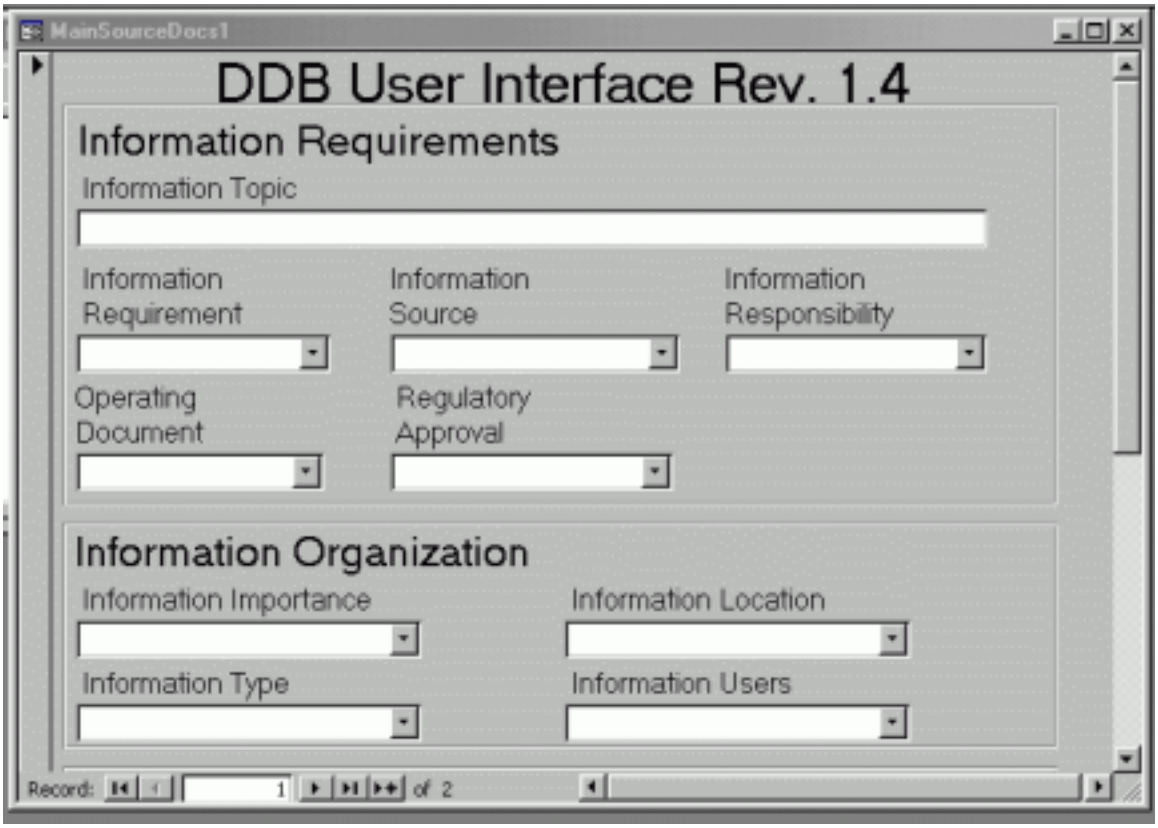
- Information Users – The employees responsible for accomplishing the item are the prime information users. It may be necessary and/or helpful for other employee groups to have this information. For example, pilots need to know how and when to start engines, but the pushback crew must know when this is going to occur in their pushback sequence and what to do if a problem arises.

Guideline 112

Grouping criteria pertaining to importance and use of information are critical determinants for the organization of your document system. In addition, these criteria are the key index of criticality that must be accommodated in all aspects of the document design, production and maintenance process. (NASA/FAA – 97)

SEE ALSO

Document location is also considered in relation to its maintenance and cost (Subsection 1.4.5) and time criticality (Subsection 1.4.6).



POSSIBLE Levels of Information Importance	POSSIBLE Information Users
Flight Deck Time Critical	Flight Crew Only
Flight Deck Time Sensitive	Cabin Crew Only
Flight Deck Reference	Flight and Cabin Crew
Home Reference	Dispatch
	Customer Service
	Maintenance

Example 1.4.2 Grouping criteria such as importance and users are critical determinants for organizing one's document system. Guideline 112

1.4.3 Creating a Preliminary Document System List

A preliminary document system list is created by adding a column to the Documents Database (DDB) called Operating Document(s). Title each document and list the required information it will contain. As you select each item from the DDB, add the document title where it will reside. You may find that information will have to be placed in more than one location. This is common for information on guides, cards and checklists (see Subsection 1.4.7 on redundancy issues). Other information is sometimes repeated for user convenience. Make sure you list each document location in the DDB. This will enable you to keep track of where all the information exists for indexing and editing.

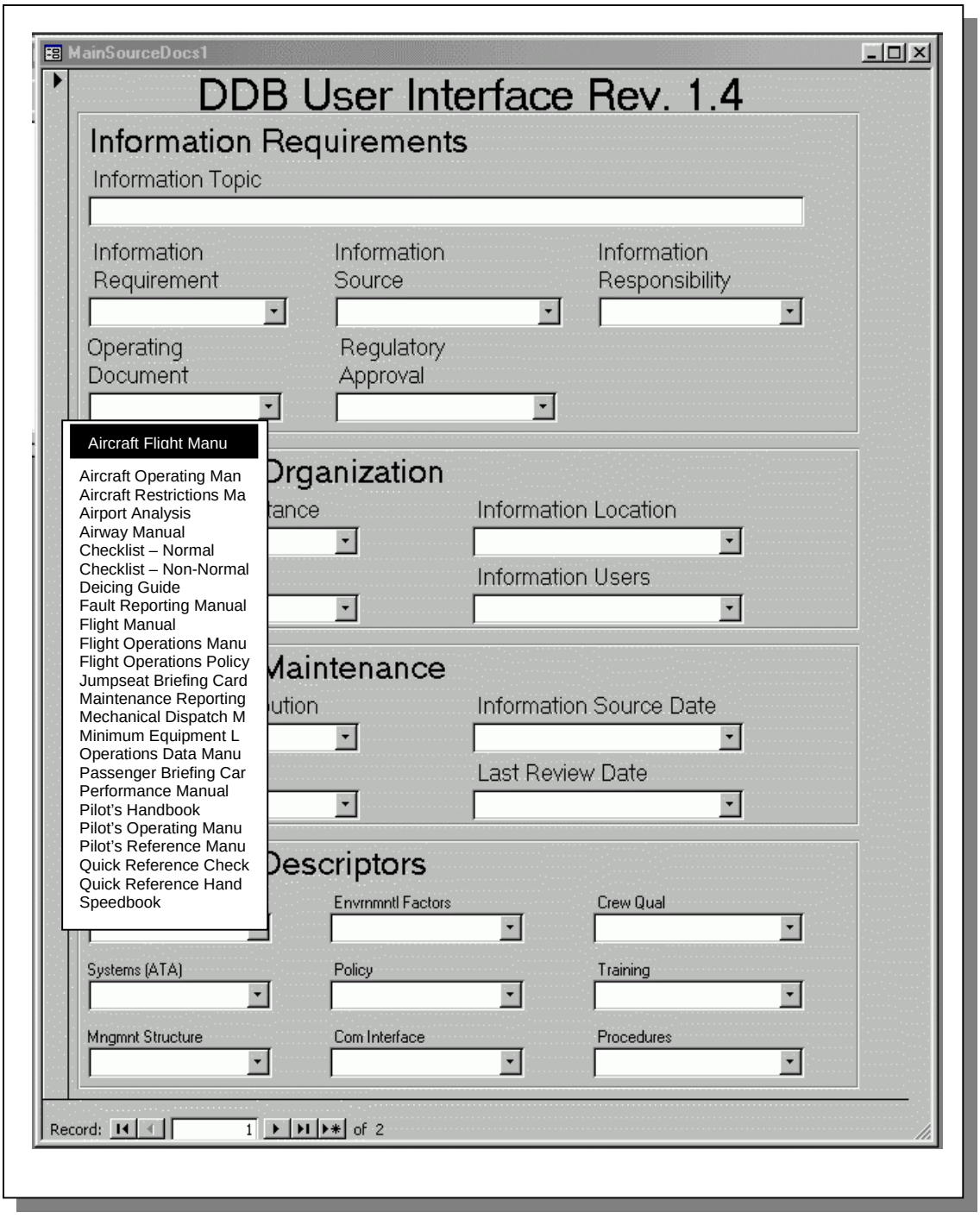
If possible create a mock up of each document to get a feel for its size. Fewer manuals are required if you use large documents leading to less chance of not being able to find the correct manual. But the larger the document, the longer it takes to find specific information and the more difficult it is to manage on a flight deck. If the document must be large, consider using special thin paper to reduce its size and weight.

Guideline 113

The DDB should include a means to match information to actual documents in the system. This will enable an assessment of user accessibility to information and point out issues in consistency and redundancy of information. In addition, this information will be useful in editing and indexing. (NASA/FAA - 97)

Guideline 114

It may be helpful to create a mock up of each document in order to make decisions regarding size of document and quantity of information. This information impacts the ease with which users can navigate a single document vs. accessibility of information distributed across multiple documents. (NASA/FAA - 97)



Example 1.4.3 Creating a list of operating documents will help you match information to an actual document in the system. Guideline 113

1.4.4 Reviewing Document Location Requirements and Usability Considerations

Once you have a preliminary idea of what your document system will consist of, document location considerations should be reviewed. This review will help ensure that those preliminary decisions make sense.

The primary locations for operating documents are in the flight deck, in the flight bag and on the ground. On the ground can include at the pilot's home or crew base and can also include other employees who are responsible for accomplishing the task. An Information Location field should be created for the DDB using the criteria below and/or any other criteria that are pertinent to your operations. An obvious first determinant is that set by FAA requirement. Other criteria for deciding on document location are related to the document maintenance process and those responsible for it.

- Required for flight - A primary consideration is whether it is required for flight. Since space is limited only those documents necessary for flight should be on the aircraft.
- Volume/Weight – While this is important whether the document is in the flight bag or on the flight deck, it is especially important for the flight bag for obvious reasons. Some working agreements may limit the volume/weight. It is common to find flight bag documents that use very thin paper to limit both the weight and volume.
- Wear & Tear – Wear and tear will almost always be highest on the flight deck. This is because one document is being used by multiple employees.
- Electronic versus Paper – This is one criteria that is changing rapidly. While electronic documents reduce volume/weight in the flight bag, increase accuracy and increase timeliness, until recently they have been cost prohibitive. Costs and availability of electronic documents should be reviewed on a regular basis.
- Level of Information – It may be possible to split some information between the flight bag, flight deck and on the ground. As an example, aircraft systems descriptions can usually stay on the ground if enough schematics and controls and indicators information is available in flight. Since the systems information is fairly large and does not change frequently you may decide to put it in a bound volume and place it on the flight deck.

Guideline 115

Determine document location by considering multiple criteria including flight crew requirements, FAA requirements and maintenance and revision issues. (NASA/FAA - 97)

Document Location

ISSUE	COCKPIT	FLIGHT BAG	HOME
Required for flight	Yes	Yes	No
Vol/Wt (Working Agreement)	Somewhat limited	Limited	No Problem
How often revised	Not Often	No Problem	No Problem
Responsibility to ensure pages are correct/up-to-date (Working Agreement)	Develop Procedure	Pilot	Pilot
Responsibility to ensure document is available	Develop Procedure	Pilot	Pilot
Airplane Accessibility (Routing)	Important	Non Issue	Non Issue
Cost	Fewest copies lower	Higher	Higher
Wear & Tear	High		
Electronic Vs. Paper	Reduce revision cost, and volume/weight Increase accuracy, timeliness		
Level of Info (full systems description Vs. subset)	Minimize	Minimize	Maximize

Example 1.4.4 Location of documents is determined by considering numerous factors and tradeoffs. Guideline 115

1.4.5 Reviewing Document Location, Maintenance and Cost Considerations

Some criteria for determining document location are based on physical aspects of the document, how it is used and the cost of producing it such as the following:

- How often revised – Frequent revision increases the complexity and cost of documents on the flight deck. These documents are most often bound volumes because it is easier to ensure the pages are correct. The revision process is simply replace with new and throw away the old.
- Responsibility to ensure availability – Approaches to ensuring document availability depends on location. If the primary location is the flight deck, a system will have to be developed to ensure it is onboard. Spare documents will need to be available for placing onboard when necessary. For documents located in the flight bag or on the ground, individual users of the document will likely assume responsibility. This method usually reduces complexity but requires more copies of the documents.
- Responsibility to ensure pages are correct/up-to-date – Again, ensuring updates are current and pages are correct may require a special system involving more employees than just the user of the document for flight deck documents. Users will probably be responsible for obtaining flight bag and on ground document updates. Working agreements with some operators dictate who can do this.
- Aircraft Accessibility – If all your aircraft pass through one or two hubs on a regular basis, it makes locating documents on the flight deck more rational.
- Cost – Compare all costs associated with document location. For example, fewer copies are needed if placed on the flight deck but higher manpower costs are likely.
- Need to maintain parallel electronic information – If parallel information is being kept up to date electronically, for example an electronic checklist (ECL) system and a paper backup QRH, it may be easier to maintain the primary location of the paper document on the flight deck. That way, the electronic data can be updated as part of the same operation as updating the paper QRH.
- Pilot knowledge of changes – Having pilots file the changes in their personal copy of the document helps to ensure that pilots are familiar with changes.

Once a location is determined, the location and the reasons why should be added to the Information Location field. The content of the document should then be reviewed relative to the new information.

Guideline 116

Document location decisions are aided by considering usability issues as well as cost associated with document production. This information should be included in a Documents Database field. In some cases, it may be possible to split some types of information across different locations. (NASA/FAA - 97)

Quick Reference Handbook Distribution Options

Options	Ease of Distrib	Initial Cost/ Rank	Revision Cost/ Rank	1st Revision Total Cost/Rank	2nd Revision Total Cost/Rank
Revisable QRH to Pilots	1	47,500 **7**	3,850 **1**	51,350 **2**	55,200 **1**
Throw Away QRH to Pilots	1	30,000 **1**	30,000 **6**	60,000 **5**	90,000 **6**
Throw Away QRH to Pilots and Put in A/C	2	33,400 **4**	33,400 **8**	66,800 **8**	100,200 **8**
Throw Away QRH to Pilots and immediate action **card** in A/C	3	30,500 **2**	30,500 **7**	61,000 **6**	91,500 **7**
Throw Away QRH to Pilots and immediate action **book** in A/C	3	36,350 **5**	36,350 **9**	72,700 **9**	109,050 **9**
Revisable QRH to Pilots and immediate action **card** in A/C	3	48,000 **8**	4,350 **2**	52,350 **3**	56,700 **2**
Revisable QRH to Pilot and immediate action **book** in A/C	3	53,850 **9**	10,200 **4**	64,050 **7**	74,250 **5**
Throw Away QRH on A/C and Stay-At-Home B & W 81/2 x 11 copy	3	32,100 **3**	19,125 **5**	51,225 **1**	70,350 **4**
Revisable QRH on A/C and Stay-At-Home 81/2 x 11 copy	4	47,330 **6**	9,000 **3**	56,330 **4**	65,330 **3**

Example 1.4.5 Document location decisions are aided by considering usability issues as well as cost associated with document production. Guideline 116

1.4.6 Developing Cards, Guides and Checklists

Cards, guides and checklists are important for time critical and time sensitive information (these criteria were entered into your documents database earlier). They can also be useful for frequently used information. Benefits from cards, guides and checklists include: reduced dependency on memory and thus the likelihood of error, reduced workload and a more efficient use of time. But, at a certain point, the more cards, guides and checklists you have the less effective they become because too many can become difficult to manage on the flight deck.

Controlling and maintaining the data is also important. A revision system and date should be established unless they are a one-time issue. Even if you think they will be a one time issue it may be beneficial to set this system up just in case a revision becomes necessary (see Part 3.1 and 3.4).

Revising cards, guides and checklists is usually more difficult because this information, in some form, is usually repeated in other documents. This requires careful timing so they are revised together.

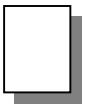
Some considerations for creating and maintaining cards, guides and checklists include the importance criteria addressed in Subsection 1.4.2 and other issues of usability:

- Time Critical Information (e.g., abnormal procedures)
- Time Sensitive Information (e.g., runway friction measurements and guidance)
- Frequently Used Information (e.g., normal checklists)
- Ease of Use for Complicated Items (e.g., FMS Guide, Altitude Capability Card)
- Memory Aids (e.g., Jumpseat Briefing Card, Deicing Guide)
- Allowing detailed information to remain at home or in other documents

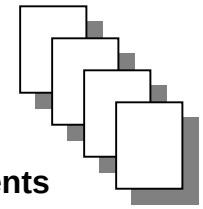
All cards, guides and checklists and the reasons for developing them should be added to the Documents Database. This information may also be linked to the revisions tracking system discussed in Subsection 3.4.2.

Guideline 117

> The decision to develop supplemental cards, guides and checklists can be aided by organizing criteria related to information importance and use. However, the decision involves a tradeoff since too many supplemental information sources can decrease use accessibility and increase the complexity of the document control and maintenance process. (NASA/FAA – 97)



Illogical Grouping Criteria



Single Document vs. Multiple Documents

Always references correct manual but:

- Too big to handle
- Too difficult to navigate
- Inefficient use of space

Easier to navigate within documents but:

- Higher costs
- Constant switching
- Confusion of where to find information

Logical Grouping Criteria

How Often used?
- e.g., Normal Checklist

Importance?
- e.g., Emergency Checklists

How Often Revised?
- e.g., Jepps

Accessibility?
- e.g., QRH

Phase of Flight?
- e.g., MEL, Jepps, Performance

Route/Geographic?
- e.g., International Procedures

Level of Information?
- e.g., Complete systems information at home and system schematics for flight

Not Required for Inflight Reference?
- e.g., Recurrent Training

Aircraft Specific?
- e.g., Aircraft Operating Manual

Company Specific?
- e.g., General Operating Manual

Provided by Outside Source?
- e.g., Dispatch Data where performed by dispatch

Size?
- e.g., Systems information may be large enough to be a single document

Best Medium?
- e.g., Electronic, bound volumes, notebooks, etc

Example 1.4.6 The decision to develop supplemental cards, guides and checklists can be aided by organizing criteria related to information importance and use. Guideline 117

1.4.7 Planning for Indexing and Redundant Information

Indexing the individual documents and the document system is extremely important for the users. No matter how clear and well written your information is, it has little value if it can't be found in a timely manner. If the information on the flight deck is difficult to locate, it may pose a risk to flight safety. In addition to the discussion in Subsection 2.5.4, some indexing considerations follow:

- A master index across documents is very helpful for locating information that may be in one or more locations and should be included in at least one main document.
- Indexing within documents is essential and may be placed in the front of a document for frequent and/or quick reference. Indexing is more critical if information is placed in a document only once and referenced in other locations.
- Abnormal and emergency indexing is critical because of the importance of that information. If this information is not located in a timely manner, safety of flight can be jeopardized. This index should be placed in the front of the document and consist of no more than two or three levels of indexing. Creating a single category of "NONNORMAL" procedures (in lieu of Emergency and Abnormal procedures) can reduce confusion about where a given checklist can be found and can reduce the time required to locate the required checklist. Consideration should be given to tabbing each page for direct access once the page number is known.
- User input in index design is very desirable; at a minimum, the user needs to test the indexing system before it is implemented.
- Operators should ensure that their documentation software will handle their indexing needs to help reduce the time needed to maintain document indexes.

Redundant documents or redundant information in different documents may be needed for safety and reliability purposes; for example, when both pilots carry the same departure, enroute and approach charts. Redundancy conflicts with space limitations. Tradeoffs associated with redundant information must be assessed.

- If you repeat information everywhere that it is needed, user convenience and information accessibility are maximized. However, document size and cost are increased and potential for error in synchronizing the revision of this information in all its location is introduced. Good software linking can minimize this problem.
- If you present information once per document and just reference it in the rest of the document, manuals are smaller and less complicated to manage. This approach can however degrade clarity, information access and convenience to the user.
- If you list the information in one location only and just reference that location everywhere the information is needed, the smallest manuals and lowest potential for error are produced. However, clarity and user convenience are further reduced.

Guideline 118

Use redundancy of information for safety and reliability reasons taking into consideration tradeoffs pertaining to information accessibility, user convenience, complexity and cost of document maintenance. (NASA/FAA - 97)

SEE ALSO

Indexing across and within documents is also an aspect of document design. (Subsection 2.5.4)

Main Indexing Issue: Flight Operations Manual

INDEX

NOTE: This Flight Operations Manual Index also includes selected items from the Delta Airway Manual. Chapter-Page numbers preceded by "AM" indicate reference is to the Airway Manual.

This index will be updated periodically or when referenced documents change substantially.

Numerics

A

Example 1.4.7 Abnormal and emergency indexing is important because of the time-critical nature of that information.

1.5 Reviewing and Testing the Document System

1.5.1 Reviewing and Testing the Document System

The document system should be reviewed and tested by the user under real time conditions on the flight deck or in a simulator. Testing must involve the critical aspects of the information use in order to evaluate its effectiveness. For example, if the document contains time sensitive information for abnormals during a particular phase of flight, these conditions should be targeted in the testing. In addition, interaction with all internal and external groups that can occur during operations (Information Users listed in the database) should also be involved in the review and testing process. Policies and procedures of all these groups should agree and blend together correctly. Feedback from all groups involved can be helpful in testing specific document-level issues as well as system-level issues.

The document system should be reviewed:

- On a continuing basis
- 8400.10 recommends this be done every one to three years in a stable environment
- After major events (e.g., mergers, acquisitions, rapid growth, downsizing)
- After technology advancements

The review process is greatly simplified if you maintain a documents database and a document list. This allows you to retrace initial decisions and determine if they are still the best option.

Guideline 119

The designer of flight deck documentation should search for situations where procedures are tightly coupled, and exploit the opportunity to decouple them (D&W-94)

Guideline 120

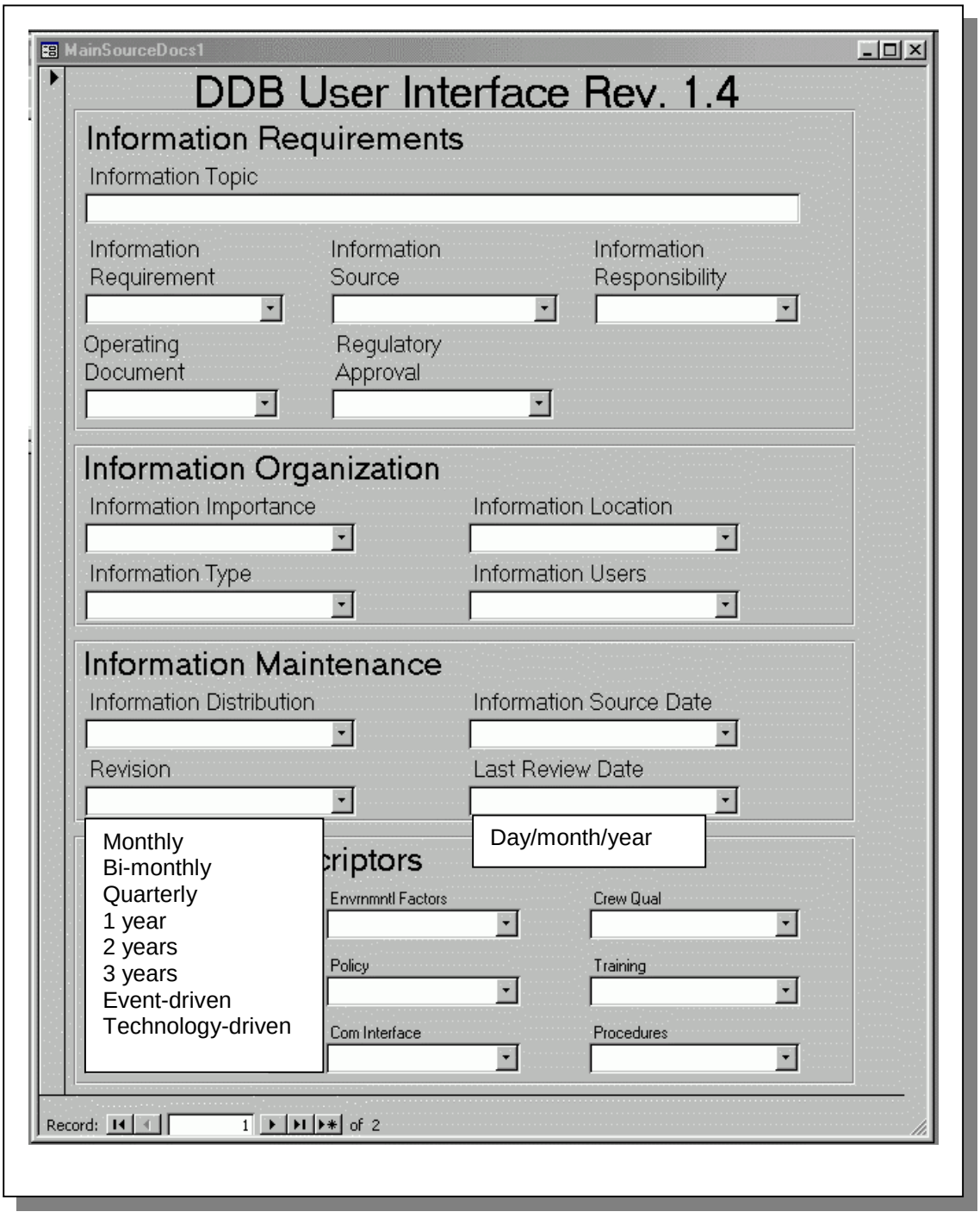
Care must be taken that not only the principal participants of a system (e.g., flight crews in this case), but also others that are affected (e.g., controllers, ground crews, cabin attendants) be involved and informed in the design and modifications of a system procedure. (D&W-94)

Guideline 121

When introducing new technology into the cockpit, the procedure designer should reevaluate all of the existing procedures and policies in light of the new technology and support the new technology via new procedures. (D&W-94)

SEE ALSO

Coordinating procedures with related flight deck tasks (Subsection 2.3.2). Reviewing and testing is related to Working with Internal Input Source (Subsection 3.1.2) and Communicating the New Information (Subsection 3.1.3)



Example 1.5.1 The review process is enhanced if you maintain a Document Database with a document list that includes revision information and last review date.

Part 2 Design of Documents

Part 2 addresses the main issues that operators face in designing one or more operating documents. It should be noted that this Manual is not a substitute for aviation regulations, and it only makes brief reference to some of the main documentation regulations. It covers standardization of documents across fleets and across the document system and presents guidance in the design of operationally usable documents.

2.1 Incorporating Regulations and Manufacturer Recommendations

2.1.1 Working with Government Regulations

FAA regulations specify information that must be incorporated into operating documents (see http://www.faa.gov/aviation.htm). This subsection introduces the relevant parts of the following government sources:

FAR Part 91, Part 121 and Part 135

8400.10

The primary Federal Aviation Regulations for most operators are located in FAR Part 121:

FAR Part 121 Subpart G--Manual Requirements

Section 121.131 Applicability

Section 121.133 Preparation

Section 121.135 Contents

Section 121.137 Distribution and Availability

Section 121.139 Requirement for Manual Aboard Aircraft: Supplemental Operations

Section 121.141 Airplane Flight Manual

Additional requirements may be found in:

FAR Part 91

FAR Part 135 Parts 21 and 23--Manual Requirements

Another important government resource is Volume 3, Chapter 15, of the Department of Transportation, Air Transportation Operations Inspector's Handbook (8400.10) available at http://www.faa.gov/avr/afs/faa/8400/8400.html. That chapter has the guidelines that principal operations inspectors (POIs) use in reviewing and approving operating documents. Chapter 15, Manuals, Procedures and Checklists, contains the following sections:

8400.10 Chapter 15

Section 1 Background and Definitions

Section 2 Approval and Acceptance of Manuals and Checklists

Section 3 General Operations Manuals (GOM)

Section 4 Flight Manuals

Section 5 Aircraft Checklists

SEE ALSO

Working with government regulations is addressed from the perspective of required information (Subsection 1.2.2) and external information (Subsection 3.1.1).

FAR Part 121

Subpart G—Manual Requirements Excerpt

Sec. 121.131 Applicability.

This subpart prescribes requirements for preparing and maintaining manuals by all certificate holders.

Sec. 121.133 Preparation.

(a) Each certificate holder shall prepare and keep current a manual for the use and guidance of flight, ground operations, and management personnel in conducting its operations.

(b) For the purpose of this subpart, the certificate holder may prepare that part of the manual containing maintenance information and instructions, in whole or in part, in printed form or other form acceptable to the Administrator.

Sec. 121.135 Contents.

(a) Each manual required by Sec. 121.133 must--

(1) Include instructions and information necessary to allow the personnel concerned to perform their duties and responsibilities with a high degree of safety;

(2) Be in a form that is easy to revise;

(3) Have the date of last revision on each page concerned; and

(4) Not be contrary to any applicable Federal regulation and, in the case of a flag or supplemental operation, any applicable foreign regulation, or the certificate holder's operations specifications or operating certificate.

Example 2.1.1 Government regulations such as FAR Part 121 subpart G specify information required of operating documents.

2.1.2 Working with Manufacturer Recommendations

Aircraft manufacturers provide required information in their flight manuals, their flight crew operating manuals and flight training manuals. Operators should comply with manufacturer information while ensuring that the resulting documents meet the needs of their flight crew population. As is discussed in Subsection 2.4.3, operators tend to follow manufacturer emergency checklists and procedures closely, especially if they involve aircraft systems.

Operators should tailor normal manufacturer procedures to their specific operational environment. In general, remaining close to the manufacturer's recommended procedures reduces cost and error involved in maintaining those procedures, since updates from the manufacturer can be incorporated with little additional work by the operator. As part of airplane certification, the manufacturer is required to test and validate the nonnormal procedures. If an operator intends to make large changes to the nonnormal checklists they must review the airplane systems architecture and test the revised procedures in all flight phases to assure that the new procedure produces the intended results in all phases of the flight profile.

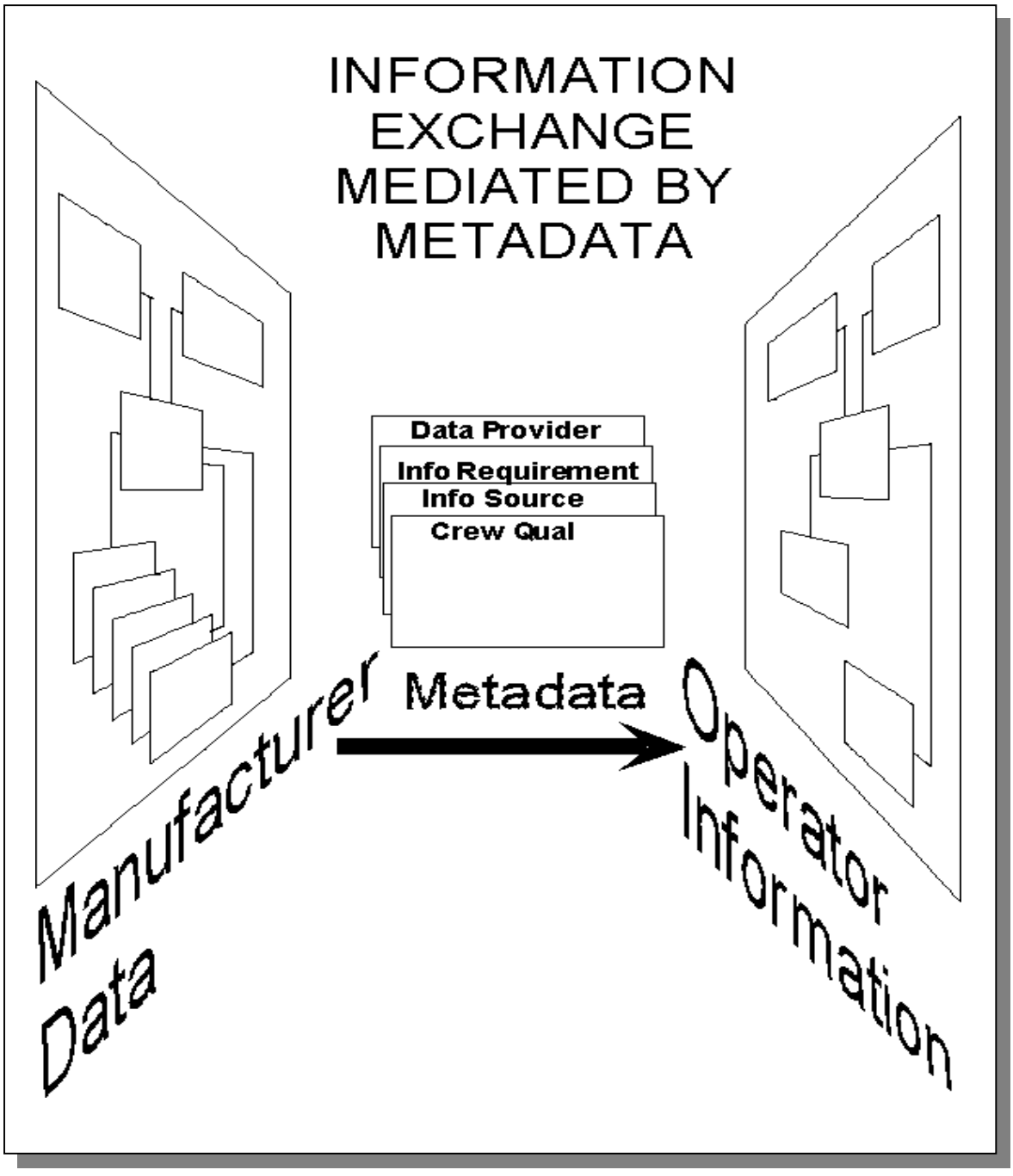
In today's environment, operators tend to work closely with manufacturers in the design and layout of flight deck controls and displays. However, some older flight deck designs and operational procedures did not fully support the rotation of Pilot Flying (PF) and Pilot Not Flying (PNF) roles practiced by most operators. For example, the location of the gear or flap/slat lever may be such that when the captain is the PNF, he or she must reach over the throttles to access those levers. An operator should address such inconsistencies through changes to the manufacturer's procedures. Care should also be taken to identify differences in aircraft configurations within a fleet. A fleet may have one or more sets of aircraft that have different system or subsystem configurations that require different procedures. Careful review should be given to aircraft within a fleet that may have differences in subsystems that are not evident to flight crews.

Guideline 200

Ensure that manufacturers and component suppliers are familiar with general operator procedures and that they use that knowledge in the design of systems and their interfaces. In cases where flight deck design does not support an operator's procedures, the operator should tailor the accompanying procedures to conform to their procedures. (D&W-94)

Guideline 201

Ensure that any operator or developer's procedure is compatible with the engineering of the aircraft and its subsystems. Care must be taken when there are subtle differences between aircraft (especially if these differences are invisible or difficult to detect). Operators should address such incompatibilities in the appropriate procedures. (D&W-94)



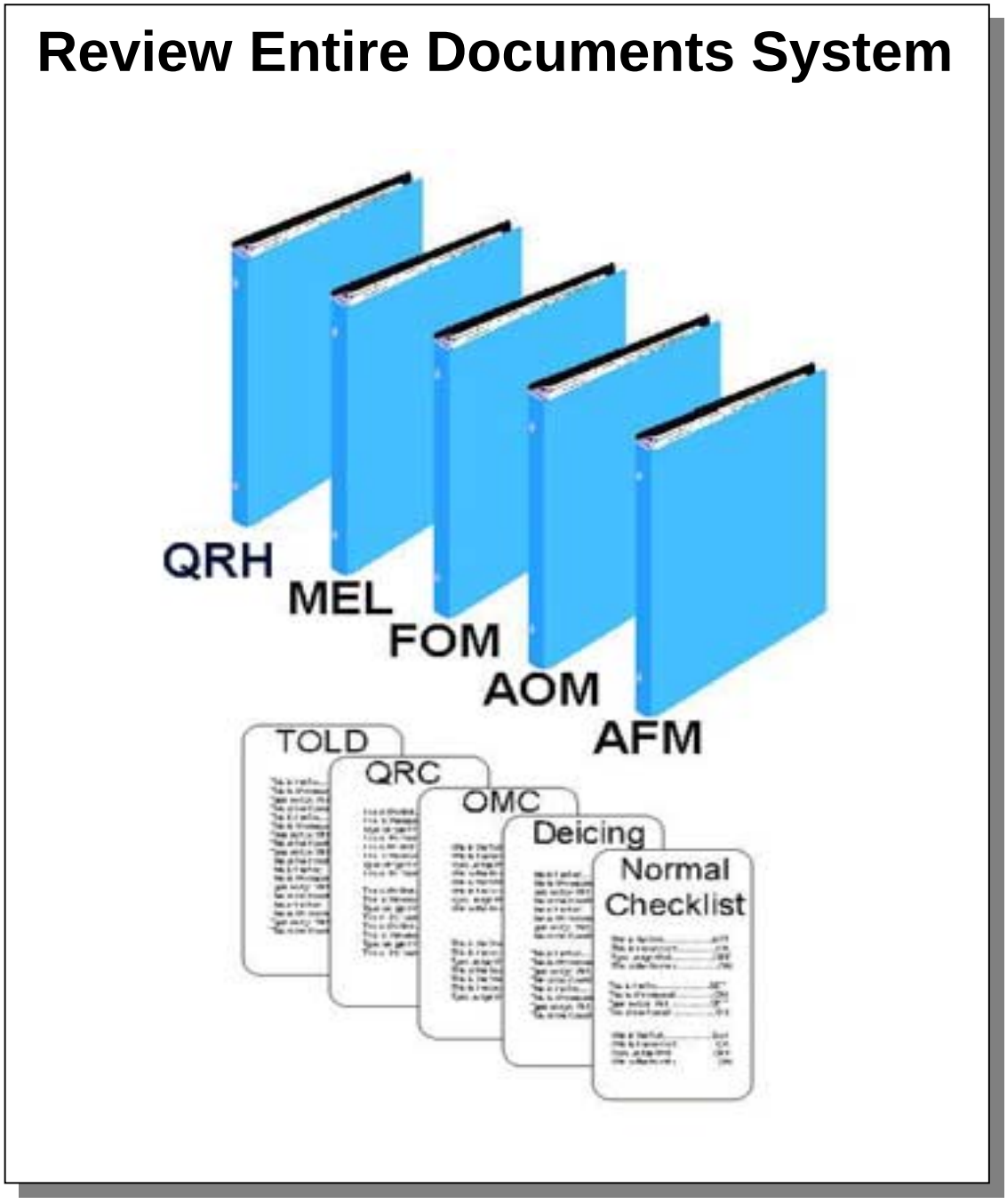
Example 2.1.2 Operators should tailor normal manufacturer procedures to their specific operational environment.

2.1.3 Reviewing Other Operators' Best Practices

Reviewing documents from other operators provides ideas of what can be done in organizing and designing documentation. This type of review is particularly useful when starting a new fleet. The primary source of other operators' best practices can be found in their operating documents. If starting a new fleet, consider working with another operator who has already established such a fleet. Review the operator's complete set of manuals (e.g., QRH, MEL, FOM, AOM, AFM), guides and checklists (e.g., TOLD, QRC, OMC, Deicing, Normal Checklist). This review should be conducted in order to gather general approaches and identify additional documentation that may be required by the new aircraft type. It is important to concentrate on higher-level concepts rather than looking at specific details, because higher-level concepts can be translated to your operation whereas the actual details may not be consistent with your existing operational procedures and document systems.

Guideline 202

Review other operators' best practices to gather the higher-level concepts that can be adapted to your operational environment and requirements. When starting a new fleet, review the operator's complete set of fleet documents to gather general approaches and identify additional documentation that may be required by the new aircraft type. (NASA/FAA - 97)



Example 2.1.3 Consider other operators' best practices by reviewing the operator's complete set of fleet documents. Guideline 202

2.2 Standardization

2.2.1 Standardizing Across Fleets

Across-fleet standardization should be established at several levels, from operational philosophy through procedures, to the use of common formats and terms in the different fleets. Operators should establish formal working groups and processes to ensure standard procedures across fleets. Formal groups should be developed at the fleet manager level as well as at the instructor and evaluator level. Another mechanism for achieving standardization is the operating documents style manual which may specify a writer's guide, word list, use of graphics and formatting.

Developing standard procedures across fleets can facilitate learning, especially when flight crews are likely to transfer between fleets. It is usually easiest to develop across-fleet standardization at the philosophy and policy level. Designers will have additional considerations at the procedure level. If a standard procedure creates inefficiencies in specific fleets, the benefits of standardization will have to be weighed against losses in performance. For example, if only one aircraft type in an operator's fleet is equipped with an electronic checklist (ECL) system, the Quick Reference Handbook QRH for that type may differ from the QRHs of the other aircraft types because the QRH serves a different role in the context of an ECL. The need to take advantage of the benefits of an ECL may outweigh the need to maintain strict fleet standardization.

Guideline 203

Use multiple approaches to establish across-fleet standardization including: (1) Developing a cross-fleet philosophy, (2) Creating an across-fleet standardization forum, and (3) Obtaining input for procedural design from personnel that design, certify, teach, use and check procedures. (D&W-94)

Guideline 204

Use a standard sequence for checklist items across fleets to the degree possible. (FAA-95)

Note Guideline 204 must be tempered by Guideline 205 that suggests the identification of situations where across-fleet standardization is not appropriate.

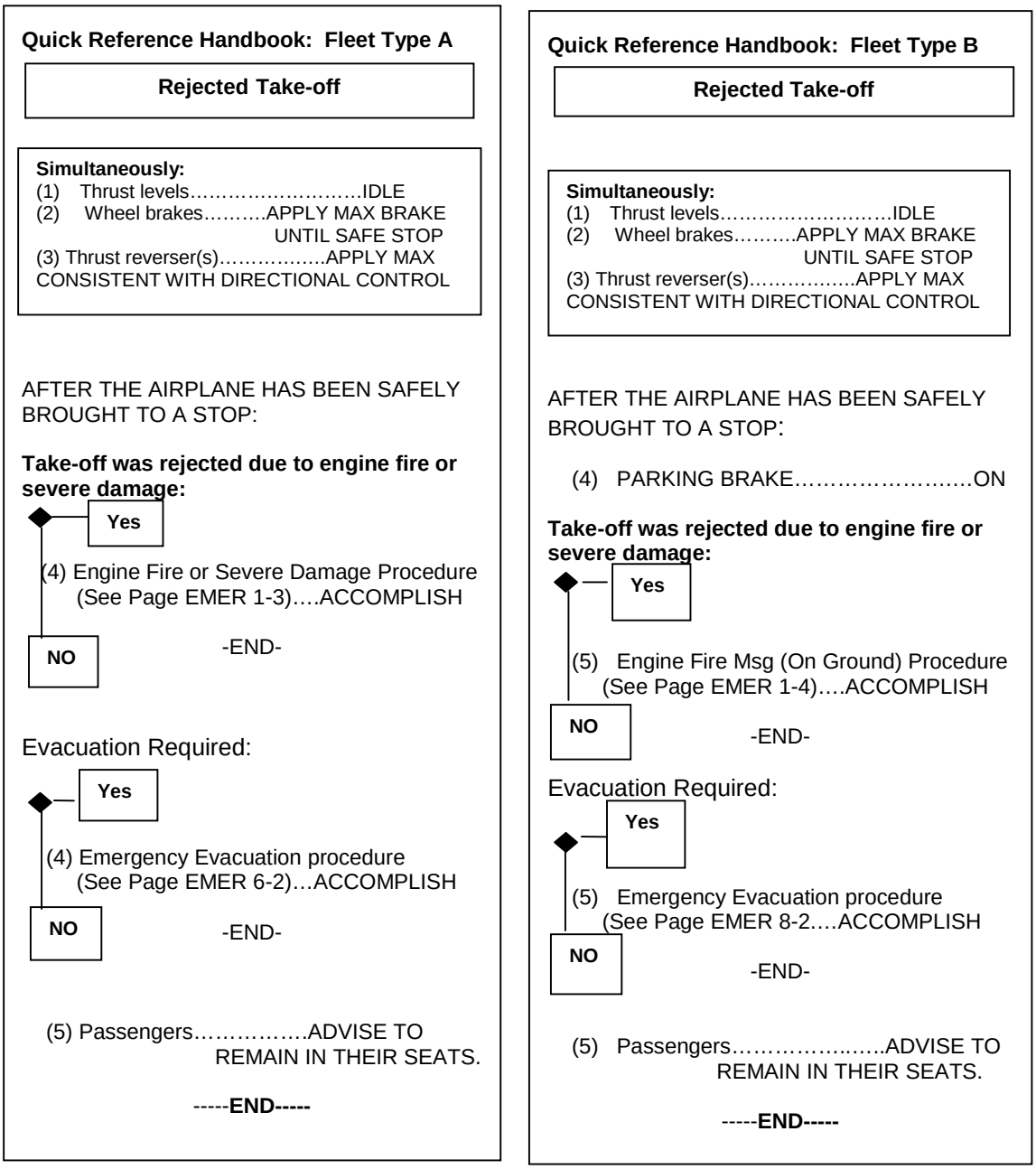
Guideline 205

Identify areas where across-fleet standardization is not appropriate and where standardization may not lead to optimal procedures when procedures that are suitable for one type of flight deck operation are superimposed on another. (D&W-94)

Note Guideline 205 is intended to prevent inappropriate standardization, but it should not be invoked to limit across-fleet standardization.

SEE ALSO

Across-fleet standardization is also achieved by procedure (Subsection 2.2.2) and by terminology (Subsections 2.2.3 and 2.2.4) standardization.



Example 2.2.1 Use a standard sequence for checklist items across fleets to the degree possible. Guideline 204

2.2.2 Standardizing Procedures and Flows

To the extent possible, procedures and flows should be based on a philosophy and policy that establish commonality and consistency for the entire operation. That philosophy and policy should be incorporated into the design of procedures and should also be clearly communicated to flight crews so that they will place a high priority on standardization when following procedures. Standardized procedures and flows can significantly reduce flight crew training costs.

One way to encourage the standardization of procedures and flows is to develop and promote a design and review process based on participation from all fleets. This may be developed as part of the standardization working groups described in Subsection 2.2.1. The review and feedback process should be adapted to the operator's specific organizational structure and should be formally established. This usually involves scheduling meetings including reviews and working with established forms that encourage feedback across fleets.

Guideline 206

Establish a feedback loop from flight crews to flight management and procedure designers. This feedback loop should be a formal process, maintained as a non-punitive, reactive system, with mandatory feedback from management to the initiating flight crewmember about the progress of his or her report and/or suggestion. (D&W-94)

Guideline 207

Include intra-flight deck communication in procedure design. Required communication should be specified, trained and subject to standardization like any other procedure. (D&W-94)

Note Guideline 207 does not imply that checklists should have excessive callouts and crew coordination actions. This guideline should be used with restraint in order to improve flight crew standardization.

SEE ALSO

The standardization of procedures follows from a clear philosophy and policies (Subsection 1.3.2).

Administrative
General

Flight Reference Manual

3.2.1

Publications Change Suggestions Procedure

Users have the best ideas for improving our publications. Your suggestions are important and should be submitted via email to our email address:

Publications Department

However, suggestions may also be submitted to your Chief Pilot or the Director of Training via any written form you wish.

Responses to your suggestion will normally be provided through email. Please include the following information:

- name
- employee number
- phone number
- email address
- Location of current text or graphic
- FOM/FR,/QRH
- chapter & page
- date or revision number of page
- Current wording
- Suggested change
- Rationale for change

Suggestion Processing

Suggestions approved by the Director of Flight Operations for incorporation, or consideration for incorporation in the Flight Operations Manual, Flight Reference Manual, or QRH will be forwarded to the Publications Enhancement Team (PET).
The PET will be responsible for ensuring that the format, phraseology, and placement of material is consistent with the philosophy, conventions, and layout of these manuals.
The PET will convene periodically to consider permanent changes to these manuals. The frequency of their meetings will be determined by the Director of Flight operations.
Changes of an “immediate” nature will be accomplished using the bulletin system. Bulletins will be issued to provide timely guidance to pilots. Bulletin information will be processed for permanent inclusion in manuals by the PET along with other suggested changes.
This process is designed to maintain a high standard of quality in placement and consistency of information in Flight Operations publications.

Example 2.2.2 Standardization of procedures and flows are promoted through a design and review process based on participation from all fleets. Guideline 206

2.2.3 Standardizing Terminology

Consistency in terminology within and across fleets contributes to overall standardization. An operator's style manual can promote the document designer's use of standard names for common items and actions. A style manual should have a glossary of terms, acronyms and their standard definition. Such a glossary should be developed and updated on a regular basis to ensure that document designers have access to the most recent terminology.

In addition to the style manual, operators should develop a philosophy and policy that encourages the use of standard terminology. As stated in Subsection 2.2.1, operators should establish formal working groups to ensure standard procedures across fleets. These groups should promote the standardization of terminology as a way to achieve overall standardization.

Guideline 208

Standardize terminology in operating documents whenever practical. For example, since the terms "throttles" and "thrust levers" refer to the same item, the operator should choose one term and use it consistently throughout operating documents. (8400.10)
Note Guideline 208 may conflict with the specific guidance that the challenges and responses on checklists should be consistent with the labeling on the switches and controls on the flight deck (FAA-95). In general, it is best to have consistent terminology and labeling wherever possible across fleets.

Guideline 209

Evaluate all items that require variable responses. Such items may not actually be required on the checklist, or may be more appropriately included in the system management portion of a checklist. (FAA-95)

Guideline 210

Define all significant terms used in manuals. Further, define all acronyms and abbreviations. (8400.10)

SEE ALSO

The standardization of terminology specific to checklists (Subsection 2.2.4).

Publication Standards
(abbreviated list)

Punctuation and Structure:

- Use “and” or “or” in a bulleted list only when it is necessary for clarity.
- Use “as installed” rather than “As Installed” or “AS INSTALLED.”
- When speaking of braking action, use “good” or “nil”, etc in lowercase and in quotations.
- Capitalize words which are the proper name of a piece of equipment or instrument. For instance, Speed Brake Lever.
- Do not hyphenate words that begin with “re.” For instance, “reissue.”
- Items that are not required to be completed in a sequence should not be numbered.

Words (abbreviated list)

USE	DO NOT USE
Preflight	Pre-flight, pre flight
PRESS	Rather than PUSH when referring to a button
Pretakeoff	Pre-takeoff, pre takeoff
psi	PSI
PUSH	PRESS when referring to activating a button
push time	Pushtime
pushback	Push-back, push back

Example 2.2.3 Standardize terminology in a style manual to maintain consistency within and across fleets. Guideline 208

2.2.4 Standardizing Terminology in Checklists

Economical and precise use of language in checklists is essential. In writing the checklist, terms must be clear and commonly understood by the user population. One problem area with checklist terminology has been the use of variable responses, especially when specifying values such as fuel quantity. Avoid ambiguous or generic terms such as “checked,” “set” or “as required.” Operators should have a clear policy across fleets about the use of variables in checklists, and where possible reduce or limit their usage requiring specific values, quantities or settings rather than generic terms.

Checklist terminology issues interact with across-fleet standardization. Operators should aim for standard terminology across fleet checklists, taking into consideration that checklist terminology should be consistent with the labeling on flight deck switches and controls. This may cause some short-term interference between across-fleet standardization and consistency with labeling. The long-term approach would be to achieve consistency in labeling leading to standard terminology across fleets.

Guideline 211

Avoid ambiguous and excess verbiage on checklists. Require responses that specify the desired status or the value of the item being considered not just "checked" or "set." (D&W-93 and FAA-95)

Note If terms such as “checked,” “tested” or “set” are used in a checklist, the meaning of these items should be clearly defined in the expanded procedure for that checklist item and used consistently. (FAA-95)

Guideline 212

Promote strict use of the terms presented on the checklist to reduce the chance for misunderstanding of the task to be performed and its status. Any attempt on the part of the flight crew to personalize the checklist erodes the safety margin established by the procedure. (FAA-95)

Guideline 213

Evaluate the feasibility of placing common items on checklists with standard titles for all aircraft. (FAA-95)

SEE ALSO

Across-fleet standardization of terminology (Subsection 2.2.3).

FLIGHT MANUAL

Rapid Depressurization/Emergency Descent

Rapid depressurization is recognized by a sudden and complete loss of all the cabin atmosphere in a way that is considered life threatening and may necessitate a rapid descent. Loss of cabin pressure due to failure of the auto controller, or forgetting to turn pack or bleeds on, is not considered life threatening and may not need a rapid descent. The Second Officer is expected to ensure that the pressurization system is in a normal configuration for the existing flight altitude before initiating a descent.

1. **Return-to-Seat Sign..... ON**

2. **Crew Communication ..... ESTABLISH**

3. **Emergency Descent ..... INITIATE (IF REQUIRED)**

A. If descent is required, proceed to Step 5.

B. If descent is NOT required or desired, proceed to Step 14.

4. Ignition ..... FLT / CONTINUOUS

5. Autopilot ..... DISENGAGE

6. Thrust Levers ..... CLOSE

7. Speed Brake Lever ..... EXTEND

8. Descent Speed ..... AS REQUIRED

A. If structural damage is suspected, or any door annunicator light is ON, avoid high maneuvering loads and limit airspeed, preferably at or below the speed at the time the problem occurred. Consider extending landing gear for additional drag.

B. If structural damage is NOT suspected, descent at V MO / M MO.

9. Transponder 7700

10. ATC ..... NOTIFY

11. Boost Pump Switches ..... ALL ON

Example 2.2.4 Where possible reduce usage of generic terms such as “checked” and require specific values, quantities or settings. Guideline 211

2.2.5 Standardizing Across Documents

Operators can use several techniques to ensure standardization across document types. One of the most important tools is an operator's style manual that establishes formatting and writing standards. Such a manual can ensure standard writing style, terminology, use of graphics and formatting across documents. The style manual may contain a glossary of standard terminology that should be used by document designers. That terminology can then be communicated to users through glossaries and standard usage across documents.

One area that is relatively new in the design of operating documents is the use of symbols to communicate specific elements such as decision points or other areas of emphasis. Standards for symbol usage are less likely to exist because using symbols is a new trend. Extra care should be exercised when implementing symbols to ensure consistent use. Incorporate a legend in the Definitions section of each manual to define displayed symbols. Ensure training in the use of symbols is provided to the degree appropriate to the application of the symbols. For example, if symbols are used to guide decision points in emergency checklists, then training and proficiency, including recurrent training in the use of these symbols, should be applied to a very high standard.

Guideline 214

Display information consistently using standards and conventions familiar to the users. This includes a consistent location of specific types of information, using consistent units of measurement and codes. (S&M-86)

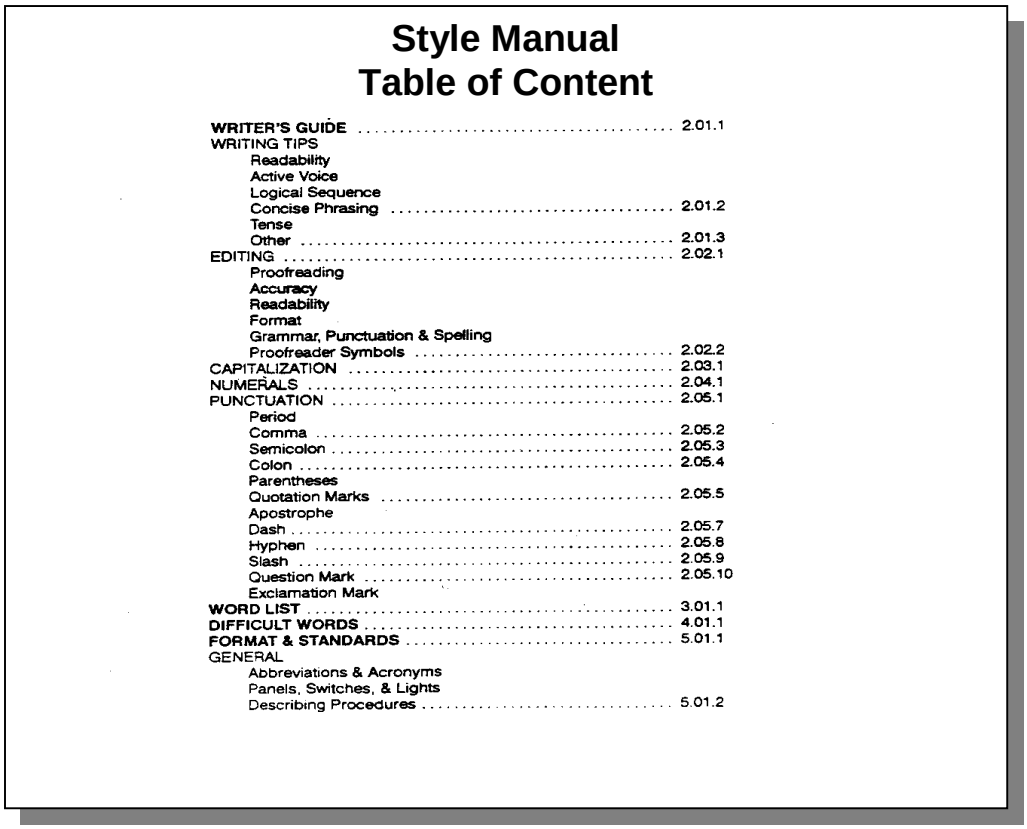
Guideline 215

Define significant terms used in operating documents, ensuring consistent meaning across documents. All acronyms or abbreviations should be defined and included within a document's glossary. (8400.10)

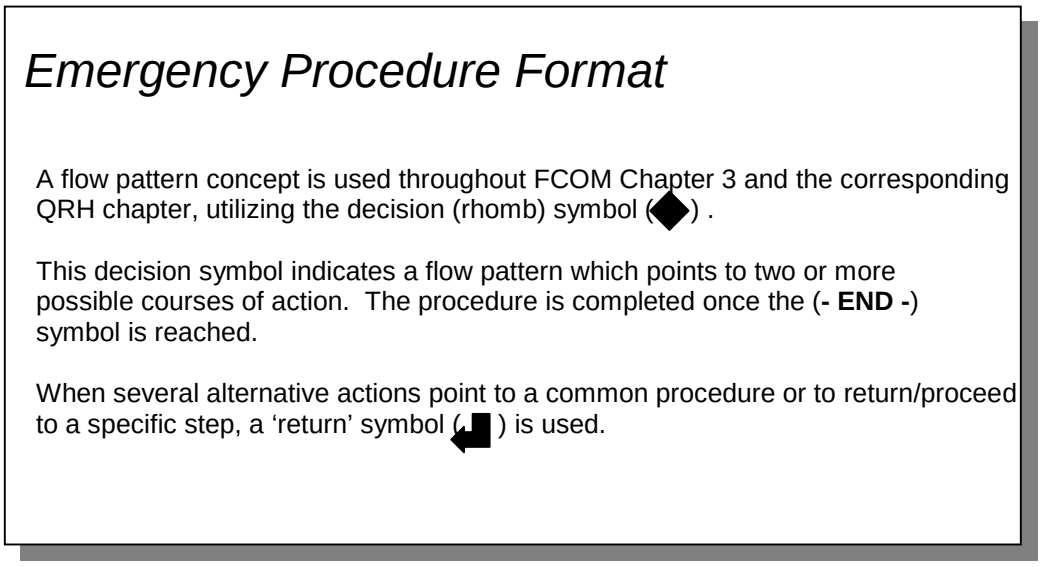
Guideline 216

Establish standard meanings for graphic symbols and use them consistently across documents. (S&M-86)

Note For example, when implementing a symbol for a decision point (see Guideline 234), review all documents where such a symbol is used or may be required. Select the symbol most consistently used and most familiar to the users.



Style Manual
Table of Content



Emergency Procedure Format

A flow pattern concept is used throughout FCOM Chapter 3 and the corresponding QRH chapter, utilizing the decision (rhomb) symbol (◆) .

This decision symbol indicates a flow pattern which points to two or more possible courses of action. The procedure is completed once the (**- END -**) symbol is reached.

When several alternative actions point to a common procedure or to return/proceed to a specific step, a 'return' symbol (↵) is used.

Example 2.2.5 Display information consistently using formatting standards, consistent codes and graphic symbols. Guideline 214

2.3 Optimizing Procedures

2.3.1 Designing Procedures

The design of procedures affects not only the system of procedures, but also the degree of crew compliance and overall crew performance. From a usability perspective, designing procedures should integrate flows, other procedures and crew resource management (CRM) actions into an efficient and effective crew operation. Task analysis (see Example 2.3.1) will aid in the clarification of subtasks and the identification of other activities involved in each task. Thus, procedure design should involve not only the immediate users, but also others within the operation affected by the new procedure.

In addition to involving specific fleets and personnel from across fleets, consider all those outside the flight deck that may be affected by the new procedure. Agents, cabin crews, ground crews and air traffic controllers may all be directly or indirectly affected by a procedure. In cases where others are affected, they should be involved in the design and review process.

Guideline 217

Involve not only the principal users of a system (e.g., flight crews), but also others that are affected (e.g., controllers, ground crews, cabin crews) in the design and modification of procedures. (D&W-94)

Guideline 218

Consider the limitations and capabilities of the device for which the procedure is being designed. Devices that are well designed from a human user perspective require minimal use of procedures. Devices that are not well designed will require more thought on the part of the user, and may require more detailed procedures. (D&W-94)

Guideline 219

Evaluate existing procedures and policies in light of the new technology and procedures when introducing new technology on the flight deck. (D&W-94)

Note Guideline 219 is particularly relevant to the introduction of flight deck automation and the guidelines in Subsection 2.3.3.

Guideline 220

Develop checklists after a careful task analysis and ensure they are consistent with the procedures section of the operator's flight manual. (FAA-95)

SEE ALSO

Procedure design relates to guidelines for standardizing procedures (Subsection 2.2.2).

SAMPLE TASK LISTING FOR THE TASK: Perform Takeoff Roll to V1

SUBTASK ID	SUBTASK DESCRIPTION
2.4.1	Select HDG HOLD on MCP when aligned with runway
2.4.2	Ensure brakes are released
2.4.3	Apply thrust to appropriate level to check engines and allow to stabilize
2.4.4	Observe all engine indications rising normally on EICAS
2.4.5	Observe and evaluate EPR and N1 on EICAS
2.4.6	Advance throttles to approximate takeoff thrust setting
2.4.7	Observe Thrust Ref on PFD
2.4.8	Observe Thrust Hold on PFD at 65 knots
2.4.9	Maintain wings level with aileron control
2.4.10	Maintain runway directional control with rudder
2.4.11	Compare upper EICAS that the EPR indicates reference thrust
2.4.12	Position throttles to match the EPRs reference
2.4.13	Match green line or digital EPR reference on the EICAS
2.4.14	Call "80 KNOTS THROTTLE HOLD" at 80 knots
2.4.15	Ensure throttle adjustments after attaining 80 knots are only to maintain engine parameters within limits
2.4.16	Observe V1 on the Airspeed Indicator
2.4.17	Call "V1"

Example 2.3.1 Develop checklists after a careful task analysis and ensure they are consistent with the procedures section of the operator's flight manual. Guideline 220

2.3.2 Coordinating Procedures with Other Flight Deck Tasks

Coordinating procedures with related flight deck tasks is a challenge that requires a complete understanding of the task sequence and often requires substantial restraint. Too many procedures may result in an operation that lacks flexibility, resulting in low flight crew compliance. Designers can use task analysis results to start that coordination process, but they will ultimately have to work with the users to determine the content, frequency and placement of procedures.

Designers must be sensitive to the multi-tasking environment on the flight deck that leads to tight links between some tasks, subtasks and procedures. This is particularly true during takeoff and landing. The problem with tight coupling is that when unexpected events occur, the time dependency and interrelation between components make it difficult for flight crews to intervene quickly and efficiently in order to contain the unexpected situation. The designer's challenge is to develop procedures that are not too complex or too tightly linked to other tasks. A looser linkage provides flexibility, helping flight crews manage their tasks.

Guideline 221

Tailor procedures that recognize the characteristics of the operation. Ignoring these characteristics will result in low procedural compliance. (D&W-94)

Guideline 222

Identify situations where procedures are tightly linked with other flight deck tasks, and determine whether the procedures and/or checklists can be unlinked, altered in another way or eliminated. (D&W-94, D&W-93)

Note There are examples where operators have placed their takeoff checklist immediately prior to takeoff, making it closely linked with other takeoff activities. From experience, it is better to place such a checklist prior to the concentration of takeoff tasks to ensure that the critical items are completed with minimal interruption.

SEE ALSO

The coordination of procedures with other tasks is related to workload issues (Subsection 2.3.4).

STANDARDIZATION OF FLIGHT AND CABIN CREW PROCEDURES

Sequence	Flight Crew	Cabin Crew
Prior to Aircraft Movement	Monitor door lights and wait for Flight Attendant #1 to verify everyone is seated and closes flight deck door indicating cabin is ready for push back/taxi	Flight Attendant #1 closes boarding door, and makes "**Prepare for Departure and Crosscheck**" PA. Cabin Crew arms/engages and crosschecks doors. Flight Attendant #1 advises Flight Crew "**Cabin Secure**" and closes flight deck door.
Prior to Takeoff	Flight Crew may not start takeoff roll until notified by Flight Attendant #1 that cabin is "**Ready for Takeoff**."	Flight Attendant #1 advises Flight Deck (after the passenger safety briefing is done, all cabin walk throughs are completed and Cabin Crew are in their jumpseats) that cabin is "**Ready for Takeoff**."
After Takeoff	The "No Smoking" sign will be flashed as a signal to Cabin Crew that it is safe to leave jumpseat to begin preparation of service.	Flight Attendant #1 will make appropriate PA and may safely leave jumpseat after signal from Flight Deck.

Example 2.3.2 Designers must be sensitive to the multi-tasking environment on the flight deck that leads to tight links between some tasks, subtasks and procedures. This is particularly true during takeoff and landing. Guideline 222

2.3.3 Designing Procedures and Automation

Flight deck automation has a range of effects on the system of procedures, some not fully understood. In general, automation leads to the reduction of the overall number of procedures by eliminating some of the actions required by flight crews, but automation may obscure some actions and complicate some decisions.

Operators should have a formal mechanism for communicating automation philosophy to flight crews as well as instructors and evaluators. With automation, precise step-by-step procedures may not be possible for tasks such as implementing a level change using the different autoflight modes. This makes the clear statement of automation philosophy more important because everyone must understand that there will be different allowable techniques to accomplish these types of tasks, as long as they follow the controlling philosophy. CRM philosophy and training should also be used in support of automation.

Guideline 223

Develop an operational philosophy that can be used to specify consistent automation policies and procedures. (D&W-94)

Guideline 224

Recognize that tasks involving the use of automation may be too complex and interactive to require a fixed set of procedures. (D&W-94)

Guideline 225

Use briefings as a critical crew coordination tool to reduce the level of ambiguity in the management of automated flight decks. The more one allows for technique, the more one has to stress briefings and crew coordination. (D&W-94)

SEE ALSO

A more general discussion of designing procedures (Subsection 2.3.1).

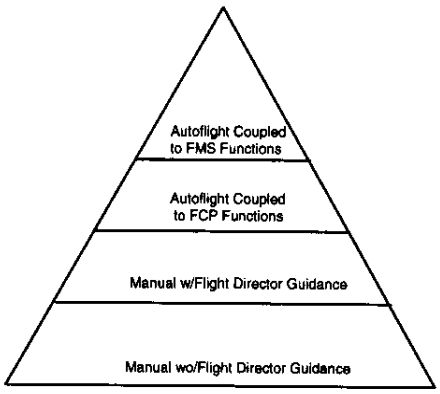
Flight Manual
Automation Philosophy

General (2.1.0)

Pilots will be proficient in operating their aircraft in all levels of automation. However, the level of automation used at any specific time should be the most appropriate to reduce pilot workload during critical phases of flight, increase situational awareness, enhance safety, maintain schedule, and maximize economy. Pilots are authorized to choose what they believe to be an appropriate level of automation.

The hierarchy of automation can be thought of as a pyramid with manual manipulation of flight controls without flight director guidance at the bottom of the pyramid and autoflight coupled to FMS functions at the top of the pyramid, in general, choices among levels can be guided by their functionality and the demands of the situations.

Automation Pyramid



CHOOSING AMONG LEVELS (2.2.0)

Autoflight Coupled to FMS Functions (2.2.1)

Where longer-range strategic planning is needed (i.e. programming accomplished during preflight, en route, or prior to descent) autoflight coupled to FMS functions (i.e. FMS, SPD, NAS and PROF) may be most effective. However, when significant modifications to route and or vertical path are issued by ATC, the pilot should revert, at least temporarily, to lower levels of automation.

Autoflight Coupled to FCP Functions (2.2.2)

Where short range tactical planning is needed (i.e. radar vectors for separation or course intercept, short range speed or climb rate control, etc.) autoflight coupled to the FCP may be most effective.

Manual Manipulation of the Flight Controls with Flight Director Guidance (2.2.3)

Manual manipulation of flight controls with flight director guidance is the primary takeoff and landing mode, except for an autolanding. Additionally, at the discretion of the captain, this level of automation may be used during all phases of flight to maintain proficiency in basic airmanship.

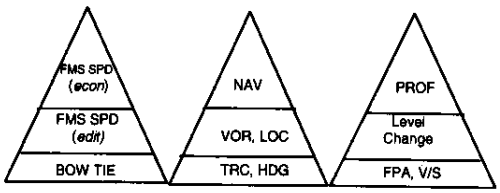
Manual Manipulation of the Flight Controls without Flight Director Guidance (2.2.4)

When immediate control of the aircraft path is necessary (i.e., escape or avoidance maneuvers, aircraft departing its intended lateral or vertical path, etc.), manual manipulation of the flight controls without flight director guidance is necessary. This is an abnormal operation. It should be considered a transitory mode used when the pilot perceives the aircraft is not responding to urgent demands. The pilot should establish a higher level of automation as soon as conditions permit.

Automation/FMA Elements (2.2.6)

The flight guidance system and the FMA have three primary elements – speed, roll and altitude. Each element has its own hierarchy of automation. The dynamic nature of flight often requires a differing level of automation to be used in each element (i.e. a strategic FMS function in speed and a tactical FCP function in heading or altitude).

FMA Elements



Example 2.3.3 Develop an operational philosophy that can be used to specify consistent automation policies and procedures. Guideline 223

2.3.4 Designing Procedures and Crew Workload

Designers should consider the effect of procedures on flight crew workload, being particularly sensitive to procedures that may require crew attention in times of high workload. Procedure design should include an analysis of workload patterns so that procedures may be inserted at times of lower flight crew workload.

Designing procedures with an awareness of flight crew workload will promote safer, more efficient flight deck communication and performance. Communication, whether inter- or intra-flight deck, should be analyzed to ensure that procedures enhance, rather than interfere with, the flow of required information. The designer's goal is not merely to minimize workload, but to distribute it to avoid periods of very high workload. This appears to be particularly important on today's automated flight deck.

Guideline 226

Evaluate the effect of a new procedure on the total workload of the crew at any given time. Careful attention should be given to procedures that may require crew attention in times of high workload, and designers should strive to "manage" workload by moving tasks that are not time-critical to periods of low workload. (D&W-94 and FAA-95)

Guideline 227

Design the duties of each crewmember in order to facilitate optimum crew coordination and distribution of flight deck workload. (D&W-93)

Guideline 228

Protect information transfer during critical and high workload phases of flight by making callouts and communication procedures economical and unambiguous. Callouts and communication procedures should convey only the information needed by the other crewmember(s) without distracting flight crews from their primary task(s). Review callout procedures frequently; as other procedures change, callouts should be reexamined. (D&W-94)

SEE ALSO

Procedures and flight crew workload interact with the coordination of procedures with other flight deck tasks (Subsection 2.3.2).

Crew Briefings and Workload

Crew briefings will be focused at low workload times during the takeoff, approach and landings phases of flight. The content and the location of the ACRM briefings were designed to help crews with their planning and decision making, especially when the workload is high, the crew is fatigued, running late, or behind schedule.

The ACRM Briefing cards were designed to help crews give a more thorough briefing. The specific items on the briefing card should be followed to help make your briefings more efficient and effective, briefing only the relevant information and conditions for that phase of flight. For example, the Takeoff Brief should include relevant airport information, weather, terrain, and/or performance as applicable.

Takeoff Brief:

- Statement of Condition

  Brief relevant airport info, WX, terrain, performance
- Bottom Lines for Takeoff
- Backup Plan for Takeoff

ACRM briefings:

- Take place at lower workload times during the course of a flight
- Are structured to contain information relevant to the specific phase of flight
- Are proceduralized in the checklist

Example 2.3.4 Designing procedures with an awareness of flight crew workload will promote safer, more efficient flight deck communication and performance. Guideline 226

2.4 Usability of Checklists

2.4.1 Sequencing Normal Checklist Items

There is a subset of considerations specific to the design of normal checklists. In a previous study (Degani and Wiener, 1990), sequential deficiencies in the normal checklists of several U.S. operators have been addressed. Because of these deficiencies, the procedural flow becomes intermittent (as opposed to consistent), disrupting the normal motor movement of eyes and hands along flight deck panels.

Sequencing of critical items in a checklist can affect the probability of their being completed without interruption. For example, when an item is at the beginning of a checklist, its chance of completion without interruption is the highest. During busy periods, the probability of accomplishing subsequent checklist items without interruption diminishes. Because of this, critical items should be placed first or early, and not last.

Guideline 229

Sequence checklist items to follow the "geographical" organization of the items on the flight deck, to be performed in a logical flow such as top to bottom and left to right. (D&W-93 & FAA-95) A checklist flow pattern that begins at the top of a panel and progresses downward accommodates most flight crews and can also lead to overall standardization. (FAA-95)

Guideline 230

Sequence the most critical items so they are listed as close as possible to the beginning of the checklist to reduce the likelihood of their interruption. (D&W-93)

Note Guideline 230 may interact with Guideline 229. In normal checklist development, Guideline 229 has priority; but in emergency checklist design, Guideline 230 should be given priority.

Guideline 231

Sequence checklist items in parallel with internal and external activities that require input from the cabin crew, ground crew, fuelers and gate agents. (D&W-93)

Note Guideline 231 may interact with Guideline 229 and is related to Guideline 230. In general, give priority to Guideline 229, sequencing by geographical organization, but when flight crew tasking interacts with external activities, give priority to this guideline.

SEE ALSO

The issue of flight deck interruptions is important to flight deck coordination (Subsection 2.3.2) normal checklists (Subsection 2.4.2) and determining checklist media (Subsection 2.4.4).

Normal Procedures: General Information

Normal Procedures describe actions that are necessary for routine airplane operations:
- The sequence of procedures follows the natural phases of flight.
- The sequence of actions in a procedure follow a standardized scan of panels or equipment except when required by system logic or priority
- For all crew actions, relevant expanded information is provided.

All actions (or steps) of a procedure must be performed, for the following reasons:
- They are required to operate the airplane safely in the related phase of flight.
- To prepare the airplane for the following phase of flight.

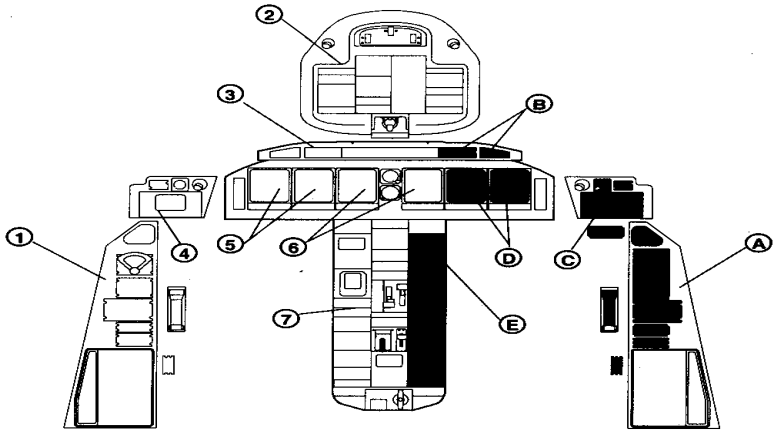
They should be performed by the assigned crewmember to ensure coordinated and safe operation.

NORMAL PROCEDURES
GENERAL INFORMATION

PANEL SCAN SEQUENCE

This figure illustrates the panel scan sequence recommended when accomplishing preflight checks.

SHADED AREA DEFINES COPILOT'S AREA OF RESPONSIBILITY



PILOT'S SIDE

SEAT BELTS, HARNESS AND RUDDER PEDALS

HEADSET/BOOM

1. SIDE CONSOLE
2. OVERHEAD PANEL AND STANDBY COMPASS
3. GLARESHIELD
4. SIDEPANEL
5. EFIS INSTRUMENT PANEL
6. CENTER INSTRUMENT PANEL

COPILOT'S SIDE

SEAT BELTS, HARNESS AND RUDDER PEDALS

HEADSET/BOOM

A. SIDE CONSOLE
B. GLARESHIELD
C. SIDEPANEL
D. EFIS INSTRUMENT PANEL
E. CENTER INSTRUMENT PANEL

Example 2.4.1 Sequence checklist items to follow the “geographical” organization of the items on the flight deck, to be performed in a logical flow such as top to bottom and left to right. Guideline 229

2.4.2 Designing Normal Checklists

A normal checklist is a listing of action items to be verified at a particular point in the flight. Normal checklist items, unlike those in emergency checklists, do not need to represent a procedural step and may specify the completion of an entire procedure. Normal checklist design should take into consideration across-fleet standardization as well as the level of automation of the specific flight deck for which it is designed.

The normal checklist provides a framework to verify that critical internal and external flight deck tasks have been completed. It should be designed to facilitate crew coordination, to distribute the flight crew workload and to ensure that all critical normal procedures have been completed. When well designed, flight crews follow the normal checklist because it is an indispensable cockpit management tool.

Guideline 232

Keep normal checklists as short as possible to minimize interruptions. Two short checklists may reduce the possibility of interruptions that can occur with a longer list that spans a considerable period of time. (FAA-95) A long checklist should be subdivided into smaller task checklists or chunks that can be associated with systems and functions on the flight deck. (D&W-93)

Guideline 233

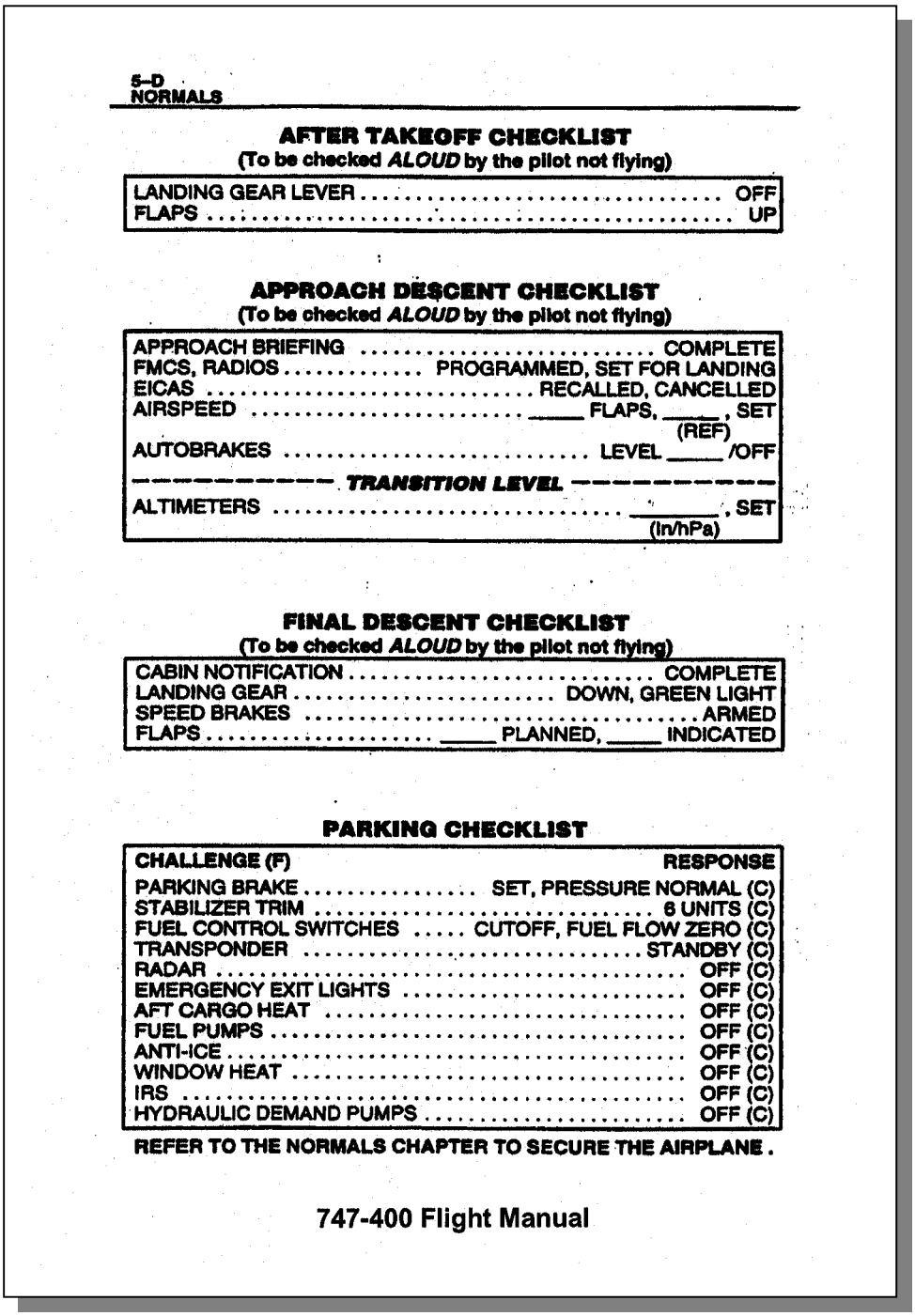
Use procedures that require the use of aural, visual and tactile sensors in order to reduce error and enhance verification during a checklist flow. (FAA-95) The use of hands and fingers to touch or point to appropriate controls, switches and displays while conducting the checklist is recommended. (D&W-93)

Guideline 234

Identify decision points in normal checklists and indicate the correct alternative actions to be taken after each decision point. (FAA-95)

SEE ALSO

The issue of flight deck interruptions is also addressed in flight deck coordination (Subsection 2.3.2), sequencing normal checklists (Subsection 2.4.1) and determining checklist media (Subsection 2.4.4).



5–D
NORMALS

AFTER TAKEOFF CHECKLIST
(To be checked *ALOUD* by the pilot not flying)

LANDING GEAR LEVER	OFF
FLAPS	UP

APPROACH DESCENT CHECKLIST
(To be checked *ALOUD* by the pilot not flying)

APPROACH BRIEFING	COMPLETE
FMCS, RADIOS	PROGRAMMED, SET FOR LANDING
EICAS	RECALLED, CANCELLED
AIRSPEED	_____ FLAPS, _____ (REF), SET
AUTOBRAKES	LEVEL _____ /OFF
---------- *TRANSITION LEVEL* ----------	
ALTIMETERS	_____ (In/hPa), SET

FINAL DESCENT CHECKLIST
(To be checked *ALOUD* by the pilot not flying)

CABIN NOTIFICATION	COMPLETE
LANDING GEAR	DOWN, GREEN LIGHT
SPEED BRAKES	ARMED
FLAPS	_____ PLANNED, _____ INDICATED

PARKING CHECKLIST

CHALLENGE (F)	RESPONSE
PARKING BRAKE	SET, PRESSURE NORMAL (C)
STABILIZER TRIM	6 UNITS (C)
FUEL CONTROL SWITCHES	CUTOFF, FUEL FLOW ZERO (C)
TRANSPONDER	STANDBY (C)
RADAR	OFF (C)
EMERGENCY EXIT LIGHTS	OFF (C)
AFT CARGO HEAT	OFF (C)
FUEL PUMPS	OFF (C)
ANTI-ICE	OFF (C)
WINDOW HEAT	OFF (C)
IRS	OFF (C)
HYDRAULIC DEMAND PUMPS	OFF (C)

REFER TO THE NORMALS CHAPTER TO SECURE THE AIRPLANE .

747-400 Flight Manual

Example 2.4.2 A long checklist should be subdivided into smaller task checklists or chunks that can be associated with systems and functions on the flight deck. Guideline 232

2.4.3 Designing Abnormal and Emergency Checklists

Abnormal and Emergency checklists should be designed with a consistent flow along the flight deck panels. This is particularly critical during the execution of emergency procedures because of time constraints, workload and stress.

Specify the three types of checklists: "NORMAL," "ABNORMAL" and "EMERGENCY," and apply the appropriate guidelines to each type. Emergencies are nonroutine operations requiring actions to protect crew, passengers, or aircraft from hazard. The design of emergency procedures tends to emphasize a response to a failure of an aircraft specific system much more than the operational environment. Because of this emphasis, operators are more likely to adopt the manufacturer's procedures when working on emergency checklists.

Guideline 235

Reduce the possibility that two checklists are in progress simultaneously. In some cases it may be necessary to add normal checklist items to the emergency checklist to keep checklists manageable. (FAA-95)

Guideline 236

Specify each sequential step of a procedure in abnormal and emergency checklists. (FAA-95)

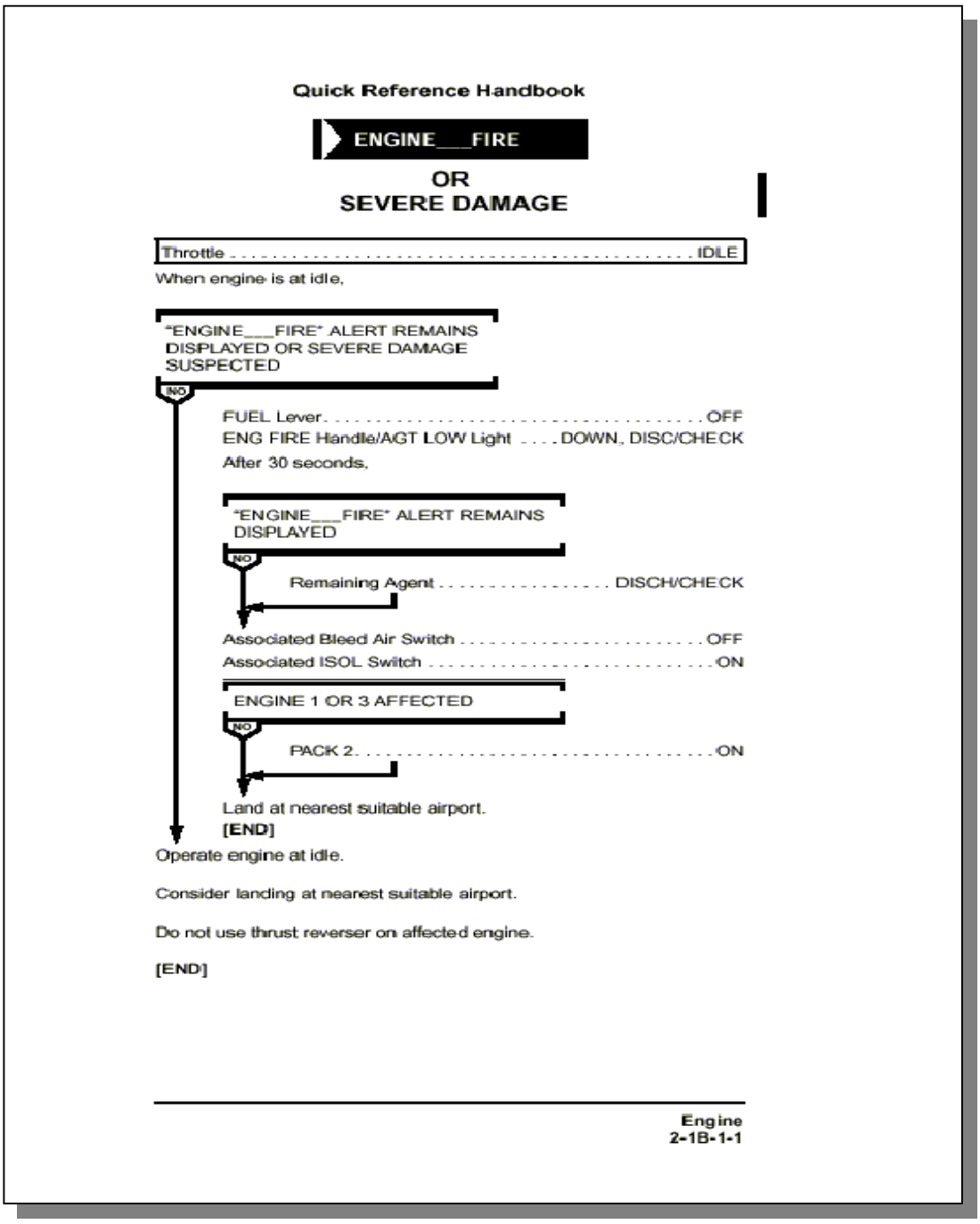
Note Guideline 236 is unique to abnormal and emergency checklists. Normal checklist items do not need to specify each procedural step and may represent the completion of an entire procedure.

Guideline 237

Consider using the Challenge-Do-Verify (CDV) method when designing emergency and abnormal checklists. (FAA-95) Traditionally, operators have preferred the Do-Verify (DV) method for normal checklists and the CDV method for abnormal and emergency checklists. (FAA-95)

SEE ALSO

Planning for indexing and redundant information (Subsection 1.4.7).



Quick Reference Handbook

ENGINE___FIRE

OR

SEVERE DAMAGE

Throttle . . . . . IDLE

When engine is at idle,

"ENGINE___FIRE" ALERT REMAINS DISPLAYED OR SEVERE DAMAGE SUSPECTED

NO

FUEL Lever . . . . . OFF

ENG FIRE Handle/AGT LOW Light . . . . DOWN, DISC/CHECK

After 30 seconds,

"ENGINE___FIRE" ALERT REMAINS DISPLAYED

NO

Remaining Agent . . . . . DISCH/CHECK

Associated Bleed Air Switch . . . . . OFF

Associated ISOL Switch . . . . . ON

ENGINE 1 OR 3 AFFECTED

NO

PACK 2 . . . . . ON

Land at nearest suitable airport.

[END]

Operate engine at idle.

Consider landing at nearest suitable airport.

Do not use thrust reverser on affected engine.

[END]

Engine
2-1B-1-1

Example 2.4.3 Specify each sequential step of a procedure in abnormal and emergency checklists and be sure that branching decisions are clearly delineated. Guideline 236

2.4.4 Determining Checklist Media

The paper checklist has been the most used among all operators, but there are a number of other media types that should be considered. Paper checklists come in several forms including the laminated card and the checklist booklet. In addition, there are electronic checklists (ECL) and mechanical devices. Each media type has its advantages and disadvantages that go beyond considering what is available for a specific aircraft type.

Paper checklists may be issued on card stock, as laminated cards, or as checklist booklets. The laminated card is the most used form of paper checklist, but each form has a particular set of advantages and disadvantages. Working with cardstock is inexpensive to reproduce and update and may be a good media for prototype or preliminary checklists. The disadvantages of cardstock are that it is easily defaced, worn and misplaced. Laminated cards are more rugged, easier to stow and last longer than those on cardstock. The laminated cards are more expensive to reproduce and are bulkier. The booklet checklist helps to group checklists, and when well designed, can help locate the required checklist, but they can be bulkier and more expensive to duplicate. Crews are more likely to lose their place with a card or booklet checklist.

Electronic checklists have the advantage that they cannot be misplaced, can present additional information such as schematics and can include ways to keep track of checklist progress. Care should be taken when implementing an ECL so that it does not displace other electronic information, does not increase heads-down time and does not pose difficulties in finding information or returning to a previous point.

Mechanical devices use slides to cover checklist items as they are accomplished. This media has some of the advantages of the ECL including that the checklists cannot be misplaced. Mechanical devices also allow one to keep track of progress. They do not have the flexibility of the ECL and they do take up critical flight deck display space.

Guideline 238

Consider the advantages and disadvantages, both from the perspective of the user and economics, prior to selecting a checklist media. (G-95)

Guideline 239

Consider that with card or booklet checklists, it can be difficult for the flight crew to keep their place, especially with interruptions. (G-95)

Guideline 240

Implement an ECL so that it does not displace other important electronic information, does not increase heads-down time and does not pose difficulties in finding information or returning to a previous point. (G-95)

Pros and Cons of Different Checklist Media

Paper Pros	**Paper Cons**
• Easy to access and use	• Easily worn and torn
• Easy to stow	• Easily marked and defaced
• Inexpensive to reproduce	• Easily misplaced
• Inexpensive to update	• Easily removed from flight deck
Laminated Card Pros	**Laminated Card Cons**
• Durable and rugged	• More expensive to reproduce
• Difficult to deface or damage	• More expensive to update
• Easily stowed and used	• Bulky an less flexible
Booklet or Handbook Pros	**Booklet or Handbook Cons**
• Groups checklists together	• Bulk makes less easy to store
• If well tabbed, easy to access	• More difficult to organize
• Difficult to deface or damage	• More expensive to change
Electronic Display Pros	**Electronic Display Cons**
• Stays on the flight deck	• Can be more difficult to read
• Can increase use of color coding	• Can increase heads down time
• Can present lots of data	• Can overload pilots
• Easily updated	• Can be difficult to navigate
• Integrated with other displays	• Requires display space

Example 2.4.4 Consider the advantages and disadvantages of checklist media options, both from the perspective of the user and economics. Guideline 238

2.5 Usability of Documents

2.5.1 Structuring Documents

Documents should not only be standardized, as discussed in Section 2.2, but they should also be structured in such a way as to improve overall crew performance. A number of usability design and formatting techniques are presented and illustrated through operational examples.

In the design of longer documents, such as operations manuals, information needs to be structured and sequenced such that it can be accessed quickly by flight crews. The structure should be clearly stated, easy to understand, appropriate for the information documented and clearly identified through headings and other formatting devices. Structuring guidelines address the higher level issues that generally apply at the document level. Format and typography issues can be used at a lower level to facilitate information access, and apply at the page or display level.

Guideline 241

Specify the document structure at its beginning by explaining organizing elements such as headings, main parts of the document, numbering scheme and other sources of coding or grouping. (A&S-97)

Guideline 242

Use a clear heading system to help users access the needed information and navigate through the document. Placement on page, indenting, numbering schemes, upper vs. lower case letters, font style, color or size all may be used to show the heading hierarchy, which should be applied consistently. (A&S-97)

Guideline 243

Sequence information based on the following three criteria: 1) Critical information should be placed early and prominently, 2) Actions should be sequenced chronologically, and 3) Items should be sequenced alphabetically, by quality or by quantity. (A&S-97)

FLIGHT MANUAL

CHAPTER 7-0-1
OPERATIONS, TRAINING AND EVALUATION (1.0.0)

INTRODUCTION (1.1.0)

This chapter describes standard maneuvers, techniques and procedures. It is organized into five (5) sections:

7-0 Operation, Training and Evaluation
7-1 Normal Maneuvers
7-2 Emergency Maneuvers
7-3 Airwork and Demonstrated Maneuvers
7-4 Training and Qualification

Maneuvers within each section are arranged by phase of flight and are described using the following general format:

Description of the Maneuver (1.1.1)
This section is a general discussion of the described maneuver.

Procedures (1.1.2)
This section describes the procedures used to accomplish the maneuver. Compliance with this section is mandatory for all flight crews. To avoid duplication, references are made to procedures described in other chapters of this manual and related documents.

Techniques (1.1.3)
In many cases, different techniques may be used to accomplish the described maneuver. This section explains common techniques that are approved. These techniques are not intended to preclude the use of other techniques that are equally effective. In the description of a technique, many procedures are repeated from the procedure section in order to help describe how the technique works as a whole.

Acceptable Performance (1.1.4)
Acceptable performance guidelines are stated for each maneuver or procedure and describe the minimum performance standards. Continued deviations beyond these tolerances without timely corrections are unacceptable. Performance on the basis of judgment, knowledge, accuracy, CRM and smoothness shall be such that successful and safe completion of any maneuver or procedure is never seriously in doubt. Crewmembers are expected to use good judgment in the execution of procedures, selection of aircraft configuration, and speeds appropriate to existing situations and conditions.

Example 2.5.1 Specify the document structure at its beginning by explaining organizing elements such as headings, main parts of the document, numbering scheme and other sources of coding or grouping. Guideline 241

2.5.2 Formatting Documents

The page of a document should be organized in such a way that the information is immediately accessible. The main page attributes used in the formatting of information on a page are vertical and horizontal spacing. That spacing should be used to communicate how the information is organized and how the user should navigate through the page.

Vertical spacing should be used to specify the areas of information on the page. It may also be used to direct the user to key procedural elements such as warnings or cautions. Horizontal spacing, specifically spacing between blocks of text, defines the critical chunks of information on the page. This helps users group related information while separating out unrelated information.

Guideline 244

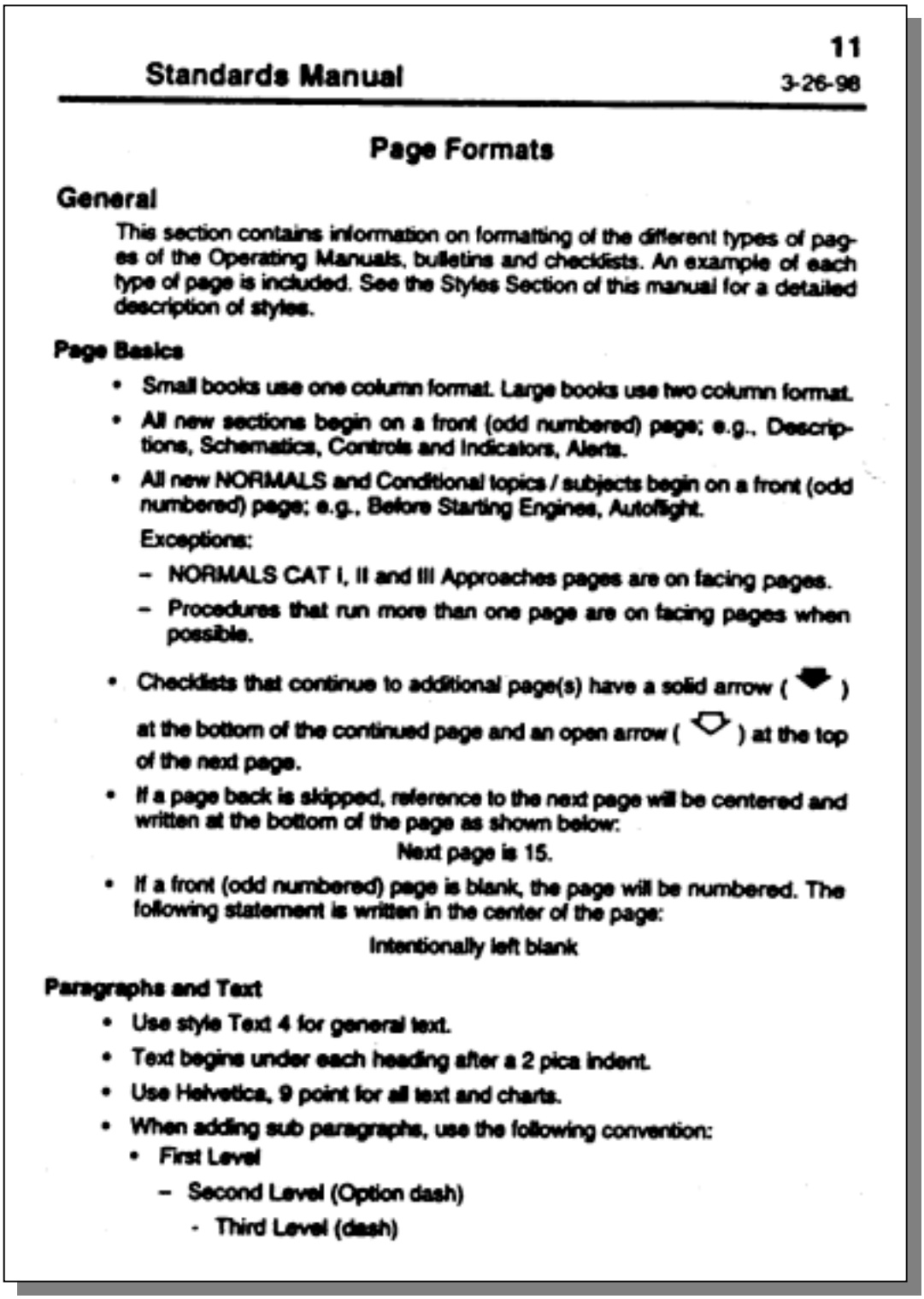
Format the page so that the reader knows how to process the text simply by the look of the page. The page layout is one of the first things the user notices when looking at a page, and its format should immediately guide him or her to the needed information. (A&S-97)

Guideline 245

Use horizontal and vertical spacing to define the basic format. The page is divided spatially in two parts: the outer margins, and the area within the margins containing the text and visuals. Careful use of white space is important to structuring the page effectively. (A&S-97) There are variations in margin design, but once specifications have been determined, they should be used consistently. (A&S-97)

Guideline 246

Design each page based on the actual to-be-published size rather than using a standard letter-size format and later reducing the page size. (A&S-97)



Standards Manual 11
3-26-98

Page Formats

General

This section contains information on formatting of the different types of pages of the Operating Manuals, bulletins and checklists. An example of each type of page is included. See the Styles Section of this manual for a detailed description of styles.

Page Basics

- Small books use one column format. Large books use two column format.
- All new sections begin on a front (odd numbered) page; e.g., Descriptions, Schematics, Controls and Indicators, Alerts.
- All new NORMALS and Conditional topics / subjects begin on a front (odd numbered) page; e.g., Before Starting Engines, Autoflight.

  Exceptions:

  - NORMALS CAT I, II and III Approaches pages are on facing pages.
  - Procedures that run more than one page are on facing pages when possible.

- Checklists that continue to additional page(s) have a solid arrow (▼) at the bottom of the continued page and an open arrow (▽) at the top of the next page.
- If a page back is skipped, reference to the next page will be centered and written at the bottom of the page as shown below:

  Next page is 15.

- If a front (odd numbered) page is blank, the page will be numbered. The following statement is written in the center of the page:

  Intentionally left blank

Paragraphs and Text

- Use style Text 4 for general text.
- Text begins under each heading after a 2 pica indent.
- Use Helvetica, 9 point for all text and charts.
- When adding sub paragraphs, use the following convention:
  - First Level
    - Second Level (Option dash)
      - Third Level (dash)

Example 2.5.2 Format the page so that the reader knows how to process the text simply by the look of the page. Guideline 244

2.5.3 Using Effective Typography

Typography, to include font and line characteristics, influences how easy it is to locate and read information. This is especially important on flight decks where the range of lighting conditions and operational pressures make typography selection critical to flight crew performance. This subsection provides the high level guidelines dealing with font selection, use of upper and lower case, and basic ink and color selection considerations. There are additional guidelines on font height, line spacing and use of multiple fonts. Much of that research-based guidance is summarized in Degani (1992) in the form of design recommendations. In addition, FAA (1995) presents guidelines for font usage, font size, spacing and use of different font styles in the design of checklists.

Extensive research has been conducted on the readability and use of typography, but many of the results are context dependent and may not apply to the flight deck environment. The most important guideline is to test new or different typography combinations to make sure that they are readable to the full range of users in the actual operating environment. The recommendation for usability testing is sound guidance for not only selecting typography, but also for formatting documents and for designing new procedures.

Guideline 247

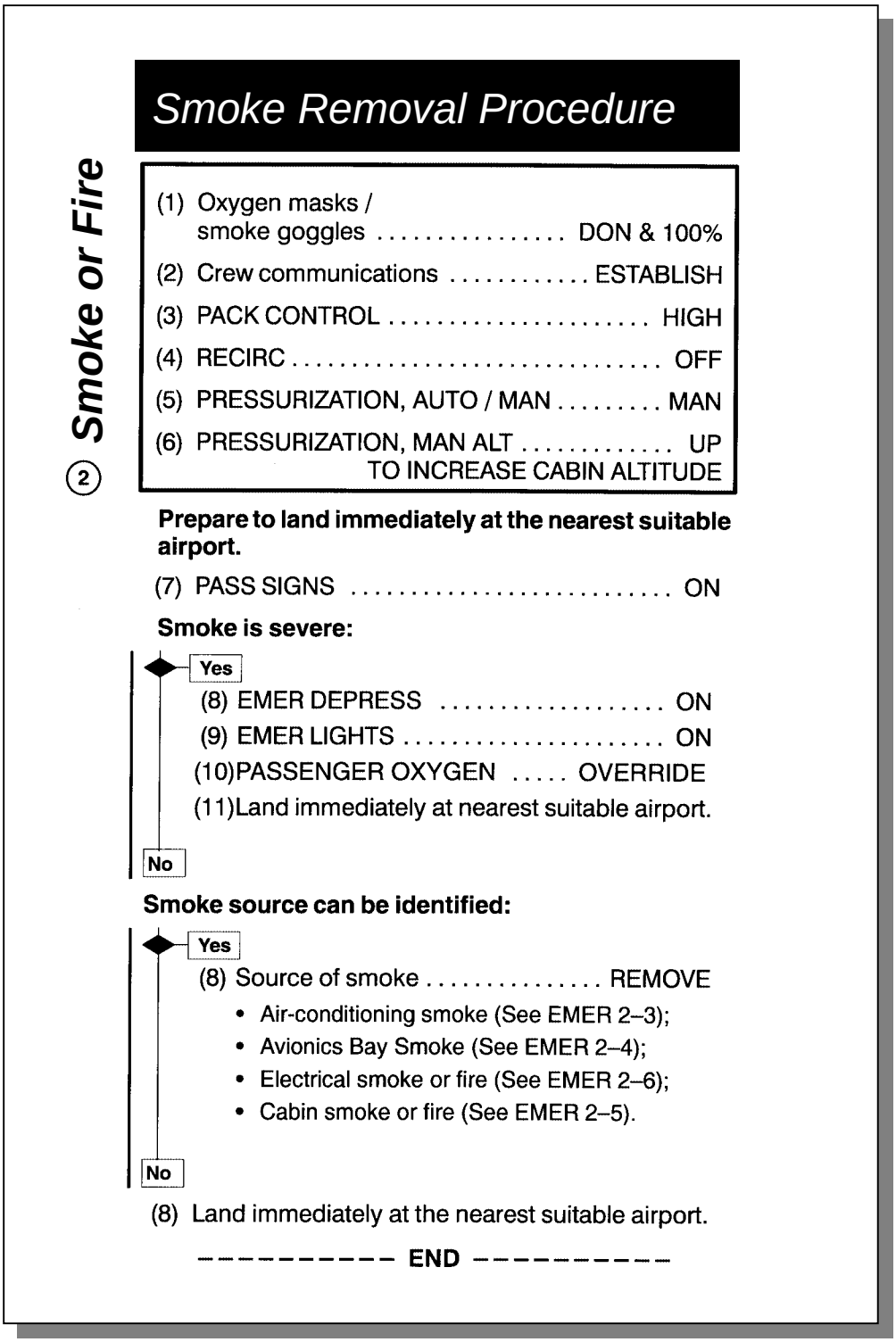
Print the checklist in a style that will accommodate different age groups with different eyesight abilities, providing sufficient contrast that will allow easy reading in low ambient light levels. (FAA-95) Test alternatives or new designs to ensure that they can be easily read by the full range of potential users.

Guideline 248

Use sans-serif fonts in lower case wherever possible (D-92). When upper case is required, the leading letter in each word should be larger to increase legibility.

Guideline 249

Use black ink for letters over white or yellow for flight deck documentation. Avoid using black ink letters over dark blue, dark green or dark red. (D-92)



Smoke Removal Procedure

② Smoke or Fire

(1) Oxygen masks / smoke goggles ..... DON & 100%
(2) Crew communications ..... ESTABLISH
(3) PACK CONTROL ..... HIGH
(4) RECIRC ..... OFF
(5) PRESSURIZATION, AUTO / MAN ..... MAN
(6) PRESSURIZATION, MAN ALT ..... UP
TO INCREASE CABIN ALTITUDE

Prepare to land immediately at the nearest suitable airport.

(7) PASS SIGNS ..... ON

Smoke is severe:

Yes
(8) EMER DEPRESS ..... ON
(9) EMER LIGHTS ..... ON
(10) PASSENGER OXYGEN ..... OVERRIDE
(11) Land immediately at nearest suitable airport.

No

Smoke source can be identified:

Yes
(8) Source of smoke ..... REMOVE
- Air-conditioning smoke (See EMER 2–3);
- Avionics Bay Smoke (See EMER 2–4);
- Electrical smoke or fire (See EMER 2–6);
- Cabin smoke or fire (See EMER 2–5).

No

(8) Land immediately at the nearest suitable airport.

---------- END ----------

Example 2.5.3 Typography, including font and page orientation, influences how easy it is for a user to locate and read information. Guideline 247

2.5.4 Indexing Across and Within Documents

From a usability perspective, indexing should emphasize links within and across documents, both paper and electronic, to provide users with efficient access to needed information. Comprehensive indexing is more than providing a single index for the content of each document. It may include a master index as well as cross-referencing within documents. Thus, indexing should be designed at the document system level, rather than concentrating on the individual document.

Indexing should support other key usability elements such as the structure and format of documents, as well as standardization used to locate specific types of information. In other words, do not use an index in place of good structure and organization, rather, use indexing to further aid in locating lower level information.

Guideline 250

Design indexes as an entire system and not just a collection of independent indexes. Indexing should support the entire operating documents system used on the flight deck. (NASA/FAA - 97)

Guideline 251

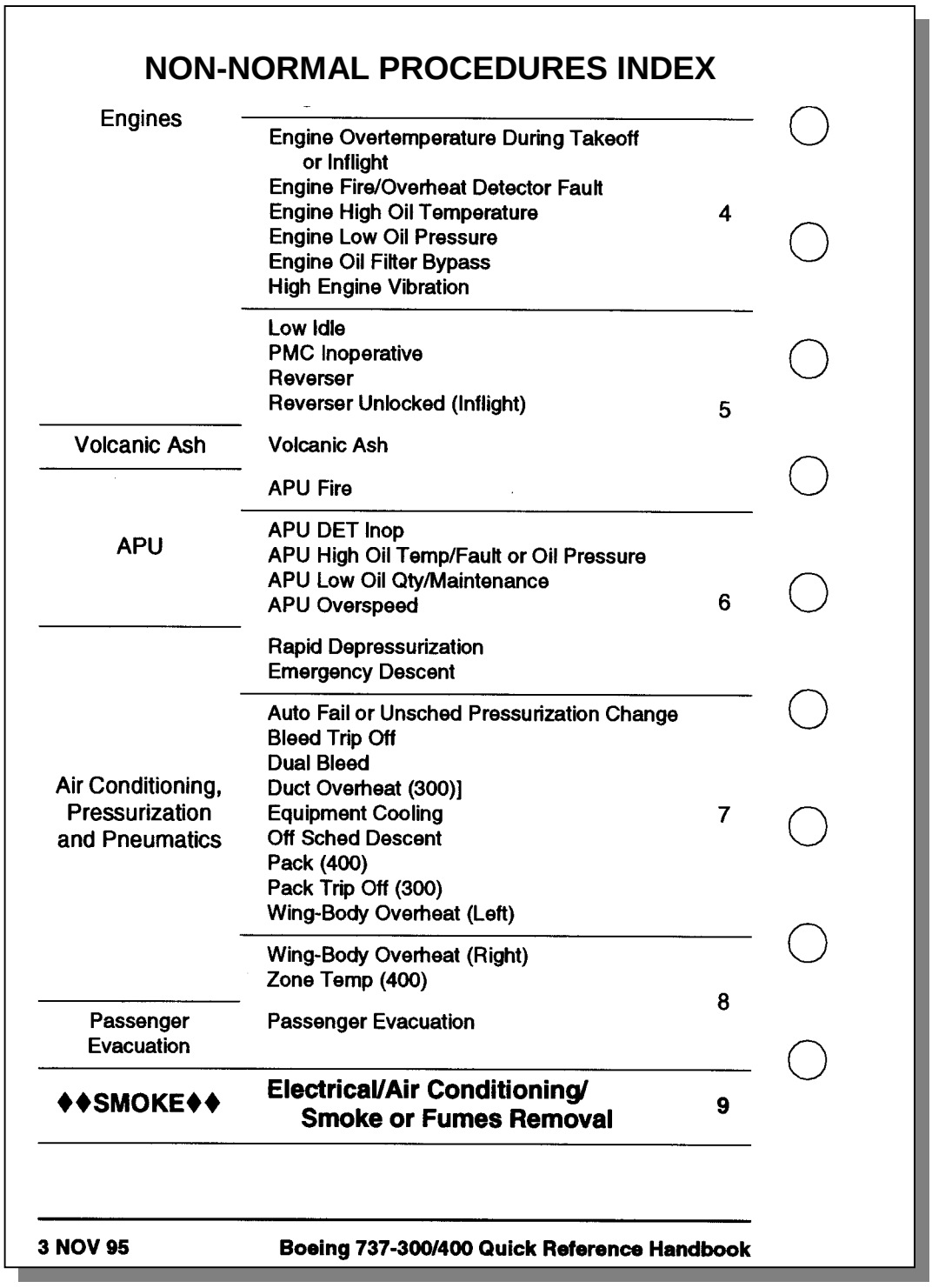
Supply an effective and consistent index in each manual that helps flight crews in finding materials they seek, especially when it is an unfamiliar, obscure or seldom-accessed procedure. (D&W-94)

Guideline 252

Use standard terminology for the main index entries, being sure to support the essential terms used on the flight deck. (NASA/FAA - 97)

SEE ALSO

Indexing is important at the planning or organizational stage in developing a document system (Subsection 1.4.7).



NON-NORMAL PROCEDURES INDEX

Example 2.5.4 Supply an effective and consistent index in each manual that helps flight crews in finding materials they seek. Guideline 251

Part 3 Production and Maintenance of Documents

Operators should develop a system for collecting new information affecting their operating documents on a continuing basis. Such a system can also be used for revising, reviewing and approving new information; and for distributing and tracking the changes.

3.1 Introduction of New Procedures and Information

3.1.1 Working with External Input Sources

Operators should develop an information gathering, review and disposition system to process information obtained from the government, manufacturers and equipment vendors. As the FAA updates and adds new regulations, operators may be required to make changes to their operating documents and flight crew training. Government input sources include Airworthiness Directives (ADs), changes to FARs, revisions to Advisory Circulars (ACs) and Flight Standard Bulletins (FSATs and HBATs).

Operators also receive revisions to information provided by manufacturers and equipment vendors that could affect their documents. They should make every effort to comply with any procedural changes recommended by manufacturers in the context of their operational environment. Because of the liability associated with non-compliance or the use of an alternate means of compliance, operators should obtain letters of "no technical objection" from the manufacturer in cases where deviations are being considered. Manufacturers also make production line changes to aircraft that affect systems and procedures information. The operator must have a means of gathering this information to ensure timely issuance prior to placing the aircraft into service.

It is also helpful to maintain operating manuals of other operators of similar equipment through a manuals exchange program to monitor changes they are making that would be equally applicable to your operation.

Guideline 300

Develop an information gathering, review and disposition system to process information obtained from the government, manufacturers and equipment vendors. (NASA/FAA - 97)

Guideline 301

Establish a means of gathering aircraft production change information to ensure timely issuance prior to placing the aircraft into service. (NASA/FAA - 97)

Guideline 302

Maintain operating manuals of other operators of similar equipment through a manuals interchange program to monitor changes they are making. (NASA/FAA - 97)

SEE ALSO

Review Working with Government Regulations (Subsection 2.1.1), Working with Manufacturer Recommendations (Subsection 2.1.2) and Reviewing Other Operator's Best Practices (Subsection 2.1.3).

WORKING WITH EXTERNAL INPUT SOURCES

- GOVERNMENT
- MANUFACTURERS

INPUT	FOCAL POINT	DISTRIBUTION	DISPOSITION
WHAT IS IT?	WHO SHOULD GET IT?	WHO SHOULD IT BE SENT TO?	WHAT SHOULD THEY DO WITH IT?

GOVERNMENT

FSAT	MGR FAA COORD + COMPLIANCE	MGR FLEET OPS MGR FLT TRNG	DEVELOP A COORDINATED PLAN FOR COMPLIANCE
AD	MGRS MTC + ENGRING	MGR FLEET OPS MGR MTC STRATEGIC PLANNING	DEVELOP A COORDINATED PLAN FOR COMPLIANCE

MANUFACTURERS

AFM FCOM BULL	MGR FLEET OPS SUPPORT	FLEET SUPPORT TEAMS	DEVELOP A COORDINATED PLAN FOR COMPLIANCE

Example 3.1.1 Develop an information gathering, review and disposition system to process information obtained from the government, manufacturers and equipment vendors. Guideline 300

3.1.2 Working with Internal Input Sources

Change also emanates from within an organization. Changes affecting information requirements arise for a variety of reasons including:

- Changes resulting from the installation of new equipment
- Changes in response to operating experience
- Changes in an organization's policies and procedures
- Changes in an operator's Ops Specs
- Changes being implemented by other departments
- Changes for purposes of maintaining cross fleet standardization
- Changes in response to pilot debriefs

Often flight crews are in the best position to detect needed changes. The informed operator values input from crews and provides timely and conscientious feedback to pilots who make such inputs in order to encourage this practice.

Introducing a new aircraft into the current fleet or introducing new fleets as result of mergers and acquisitions will normally require creating a new set of documents in the same format as for existing fleets. In some cases, however, introducing a new fleet may involve new technologies, such as electronic checklists, that might impact document design and organization.

Guideline 303

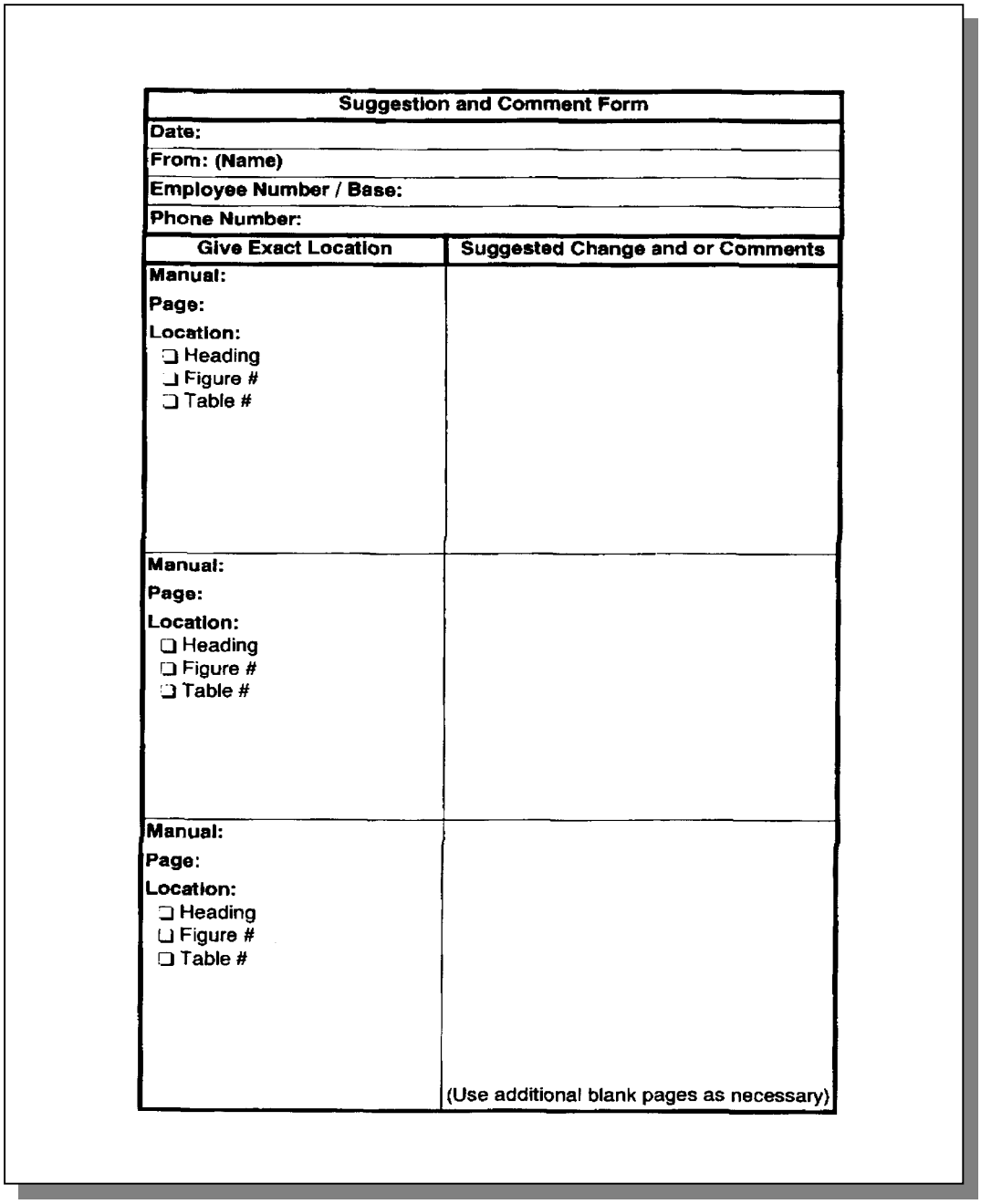
Establish a debrief system for obtaining input from line pilots to flight management. This feedback process should be formalized, maintained as non-punitive with timely, mandatory feedback from management to the initiating pilot about the progress of his/her report and/or suggestion. (D&W-94)

Guideline 304

Evaluate existing procedures and policies in light of the new technology when introducing new technology on the flight deck, and if existing standard operating procedure (SOP) does not support the new technology, develop or modify procedures. (D&W-94)

Guideline 305

Document standardization and usability policies in a clear and accessible way so that those producing and maintaining documents will have consistent guidance. (NASA/FAA - 97)



Suggestion and Comment Form	
Date:	
From: (Name)	
Employee Number / Base:	
Phone Number:	
Give Exact Location	**Suggested Change and or Comments**
Manual: **Page:** **Location:** ❑ Heading ❑ Figure # ❑ Table #	
Manual: **Page:** **Location:** ❑ Heading ❑ Figure # ❑ Table #	
Manual: **Page:** **Location:** ❑ Heading ❑ Figure # ❑ Table #	(Use additional blank pages as necessary)

Example 3.1.2 Establish a formalized, non-punitive debrief system for obtaining input from line pilots to flight management with timely mandatory feedback from management. Guideline 303

3.1.3 Communicating New Information

Whether the changes come from the government, manufacturers or from within an organization, an operator can use different methods to communicate changes. Depending on the urgency of the change and the number of people affected by the change, an operator can use document revisions, bulletins, flight plan special messages, E-mail, et cetera.

Permanent changes are communicated through a formal revision process, but operators also need a mechanism for communicating temporary information or for communicating changes quickly prior to formal revisions. Operators may establish a temporary revision process or a system of bulletins for such purposes. Temporary revisions and bulletins require special tracking and controls to allow users to determine their currency. In addition, operators may use Flight Plan Special Messages and Read Before Fly Messages to communicate information to specific fleets, aircraft, airports or flights.

Having a structure for communicating change in place is desirable, but operators must be careful not to overuse it. Frequent changes, especially in flight deck procedures, even though efficiently communicated, can undermine the stability of SOP and can reduce flight crew compliance. Communicating new information to the end user, typically the pilot group, may also require coordination with other groups who may be affected by such changes such as flight training, aircraft maintenance, flight dispatch and flight service.

Guideline 306

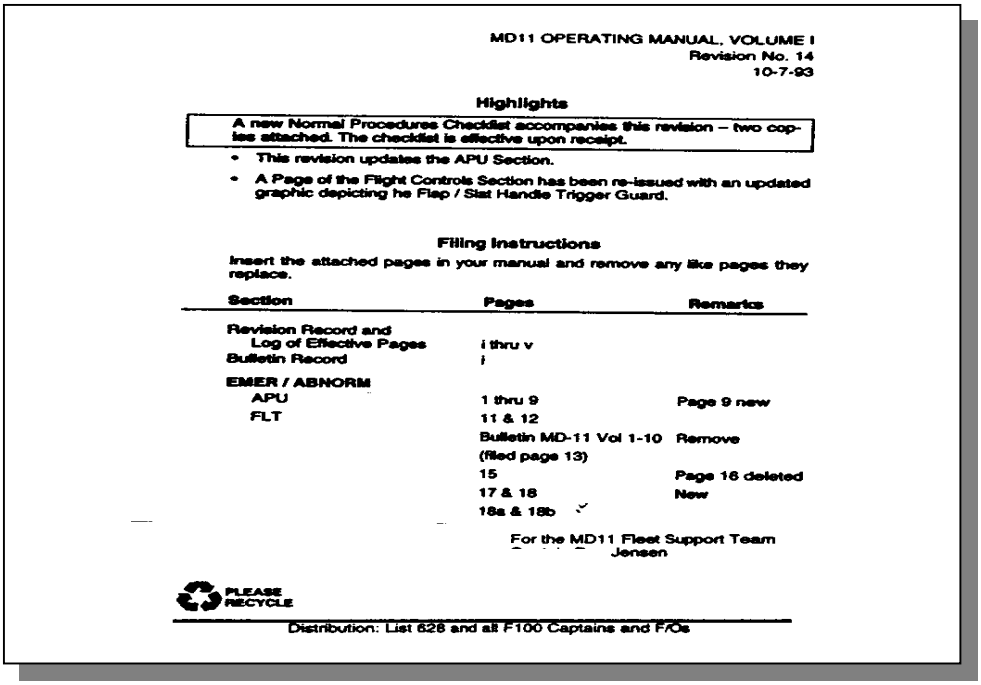
Develop methods of communicating new information to include training, implementation and checking. The specific methods should be responsive to the degree of communication urgency. (D&W-94)

Guideline 307

Ensure that others within the organization that might be affected by changes being made are consulted early in the development process (e.g., controllers, ground crews, cabin attendants). (D&W-94)

Guideline 308

Minimize frequent procedures or checklist changes. Frequent changes lead flight crews to conclude that the system is unstable, diminishing the importance attributed to new and modified procedures. (D&W-94)



MD11 OPERATING MANUAL, VOLUME I
Revision No. 14
10-7-93

Highlights

A new Normal Procedures Checklist accompanies this revision – two copies attached. The checklist is effective upon receipt.

- This revision updates the APU Section.
- A Page of the Flight Controls Section has been re-issued with an updated graphic depicting he Flap / Slat Handle Trigger Guard.

Filing Instructions

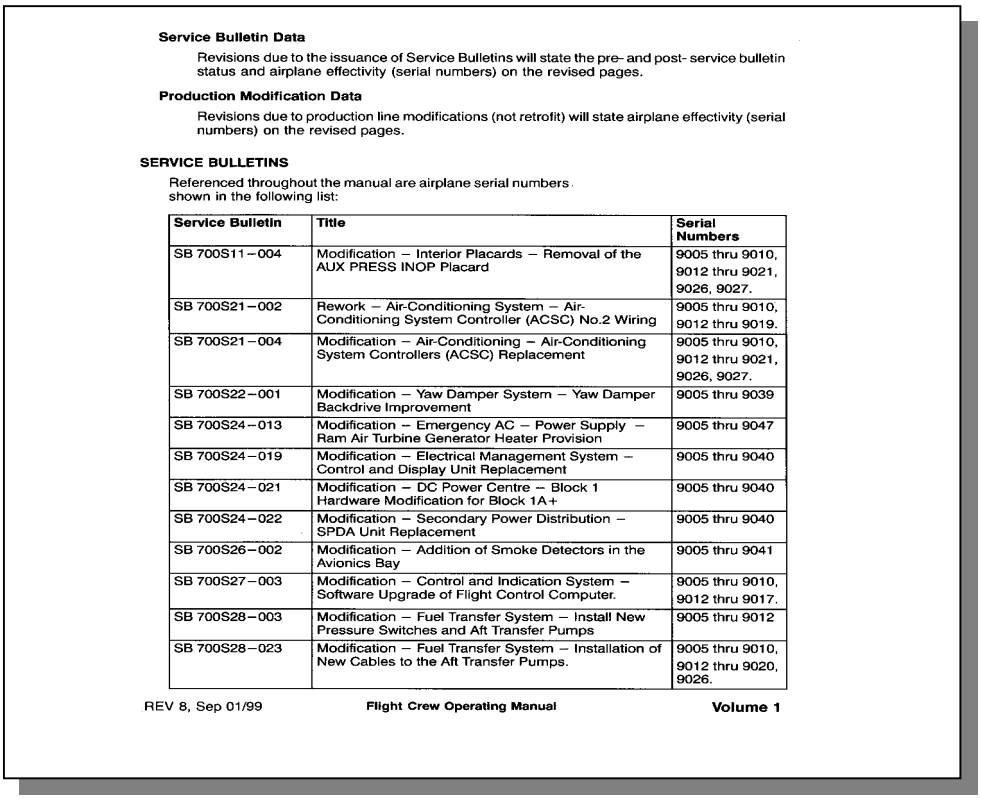
Insert the attached pages in your manual and remove any like pages they replace.

Section	Pages	Remarks
Revision Record and Log of Effective Pages	i thru v	
Bulletin Record	i	
EMER / ABNORM		
APU	1 thru 9	Page 9 new
FLT	11 & 12	
	Bulletin MD-11 Vol 1-10 (filed page 13)	Remove
	15	Page 16 deleted
	17 & 18	New
	18a & 18b	

For the MD11 Fleet Support Team
Jensen

PLEASE RECYCLE

Distribution: List 628 and all F100 Captains and F/Os



Service Bulletin Data

Revisions due to the issuance of Service Bulletins will state the pre- and post- service bulletin status and airplane effectivity (serial numbers) on the revised pages.

Production Modification Data

Revisions due to production line modifications (not retrofit) will state airplane effectivity (serial numbers) on the revised pages.

SERVICE BULLETINS

Referenced throughout the manual are airplane serial numbers shown in the following list:

Service Bulletin	Title	Serial Numbers
SB 700S11–004	Modification – Interior Placards – Removal of the AUX PRESS INOP Placard	9005 thru 9010, 9012 thru 9021, 9026, 9027.
SB 700S21–002	Rework – Air-Conditioning System – Air-Conditioning System Controller (ACSC) No.2 Wiring	9005 thru 9010, 9012 thru 9019.
SB 700S21–004	Modification – Air-Conditioning – Air-Conditioning System Controllers (ACSC) Replacement	9005 thru 9010, 9012 thru 9021, 9026, 9027.
SB 700S22–001	Modification – Yaw Damper System – Yaw Damper Backdrive Improvement	9005 thru 9039
SB 700S24–013	Modification – Emergency AC – Power Supply – Ram Air Turbine Generator Heater Provision	9005 thru 9047
SB 700S24–019	Modification – Electrical Management System – Control and Display Unit Replacement	9005 thru 9040
SB 700S24–021	Modification – DC Power Centre – Block 1 Hardware Modification for Block 1A+	9005 thru 9040
SB 700S24–022	Modification – Secondary Power Distribution – SPDA Unit Replacement	9005 thru 9040
SB 700S26–002	Modification – Addition of Smoke Detectors in the Avionics Bay	9005 thru 9041
SB 700S27–003	Modification – Control and Indication System – Software Upgrade of Flight Control Computer.	9005 thru 9010, 9012 thru 9017.
SB 700S28–003	Modification – Fuel Transfer System – Install New Pressure Switches and Aft Transfer Pumps	9005 thru 9012
SB 700S28–023	Modification – Fuel Transfer System – Installation of New Cables to the Aft Transfer Pumps.	9005 thru 9010, 9012 thru 9020, 9026.

Example 3.1.3 Develop methods of communicating that cover the implementation of new information (e.g., checklist revisions, Service Bulletin revisions) to include training and any others in the organization that might be affected. Guideline 306

3.2 Internal and External Approval Process

3.2.1 Establishing Internal Checks

The internal checks for operating documents should be compatible with the operator's organizational structure with its associated areas of responsibility and accountability. For example, a fleet support team may be established with representatives from: 1) a flight manuals group, represented by a fleet specialist, 2) a flight technical group, represented by a fleet technical pilot, and 3) the flight training group, represented by a fleet manager.

The approval process for changes within a fleet typically involves the members of the fleet support team. Issues affecting all fleets need to be resolved in a forum that involves the collective wisdom of all fleet support teams, with the objective of arriving at consensus and cross-fleet standardization in policies and procedures. Fleet support teams need to keep good records reflecting the coordination and approval process and tracking of proposed changes through the process.

Final approval should ensure compliance with federal regulations, manufacturer recommendations (see Subsection 3.1.1) and the organization's philosophy and policies (see Subsection 1.3.2). It should also ensure that the organization's document standards have been followed (see Sections 2.2 through 2.5).

Guideline 309

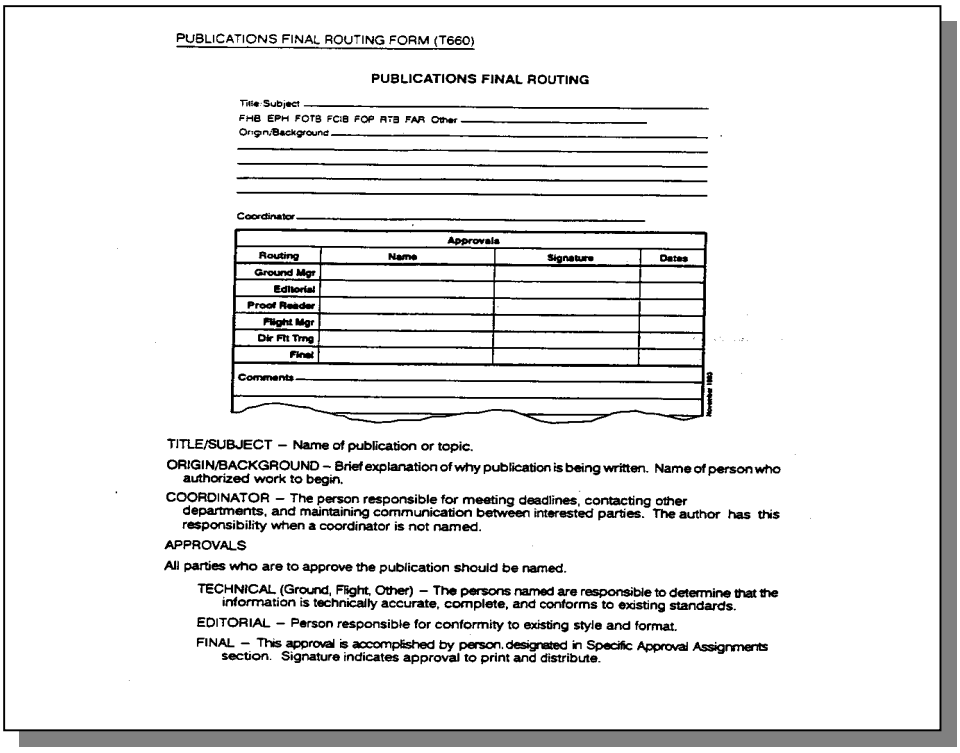
Establish fleet support groups or teams made up of representatives from different departments associated with that fleet to collect and review inputs, develop solutions and then validate and approve results. Key members of each fleet support group should meet periodically to address cross-fleet issues. (NASA/FAA - 97)

Guideline 310

The internal approval process should ensure compliance with federal regulations, manufacturer recommendations, company policy and the organization's document standards. (NASA/FAA - 97)

SEE ALSO

Guidance on external approval (Subsection 3.2.2) and guidance on reviewing and validating (Subsection 3.2.3).



PUBLICATIONS FINAL ROUTING FORM (T660)

PUBLICATIONS FINAL ROUTING

Title/Subject _____

FHB EPH FOTS FCIB FOP RTB FAR Other _____

Origin/Background _____

Coordinator _____

Approvals			
Routing	Name	Signature	Dates
Ground Mgr			
Editorial			
Proof Reader			
Flight Mgr			
Dir Flt Trng			
Final			

Comments _____

November 1993

TITLE/SUBJECT – Name of publication or topic.

ORIGIN/BACKGROUND – Brief explanation of why publication is being written. Name of person who authorized work to begin.

COORDINATOR – The person responsible for meeting deadlines, contacting other departments, and maintaining communication between interested parties. The author has this responsibility when a coordinator is not named.

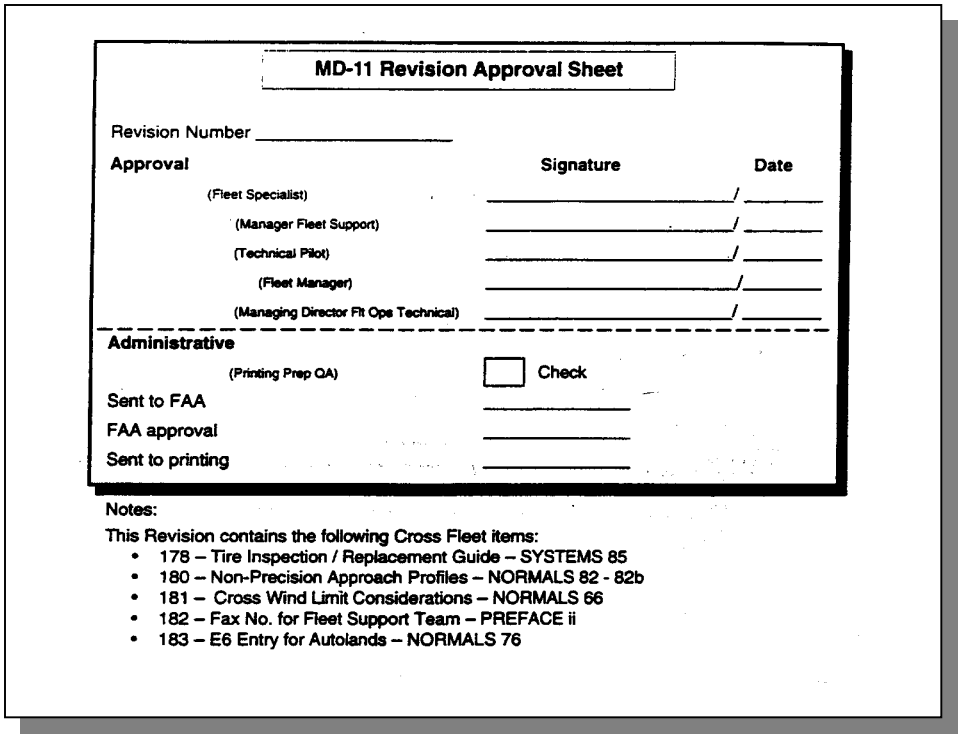
APPROVALS

All parties who are to approve the publication should be named.

TECHNICAL (Ground, Flight, Other) – The persons named are responsible to determine that the information is technically accurate, complete, and conforms to existing standards.

EDITORIAL – Person responsible for conformity to existing style and format.

FINAL – This approval is accomplished by person designated in Specific Approval Assignments section. Signature indicates approval to print and distribute.



MD-11 Revision Approval Sheet

Revision Number _____

Approval	Signature	Date
(Fleet Specialist)	_____ /	_____
(Manager Fleet Support)	_____ /	_____
(Technical Pilot)	_____ /	_____
(Fleet Manager)	_____ /	_____
(Managing Director Flt Ops Technical)	_____ /	_____

Administrative

(Printing Prep QA)	☐ Check	
Sent to FAA	_____	
FAA approval	_____	
Sent to printing	_____	

Notes:

This Revision contains the following Cross Fleet items:

- 178 – Tire Inspection / Replacement Guide – SYSTEMS 85
- 180 – Non-Precision Approach Profiles – NORMALS 82 - 82b
- 181 – Cross Wind Limit Considerations – NORMALS 66
- 182 – Fax No. for Fleet Support Team – PREFACE ii
- 183 – E6 Entry for Autolands – NORMALS 76

Example 3.2.1 The approval process for changes within a fleet typically involves the members of the fleet support team. Guideline 309

3.2.2 Obtaining External Approval

The external approval process is guided by FAA Order 8400.10 with some variation in FAA interpretations at the regional and local level. By involving FAA Aircraft Program Managers early in the change development process, concerns can be worked out prior to formal submission for approval.

The FAA's 'approval' process is reserved for critical documents involving checklists and procedures. Some material only requires that the FAA deem it ‘acceptable’ versus requiring formal approval, with other material requiring neither acceptance nor approval.

There are three conditions when operating documents must undergo approval or acceptance: 1) when the operator applies for certification, 2) when an existing operator proposes a change, and 3) when the Principal Operations Inspector (POI) determines that an operating document is inadequate. When an operator proposes a change to an abnormal or emergency procedure, that operator must establish the safety and effectiveness of the procedure through analysis, documentation, or validation tests. By maintaining accurate records and good communication with the POI, the need for or the scope of validation tests can be minimized.

Guideline 311

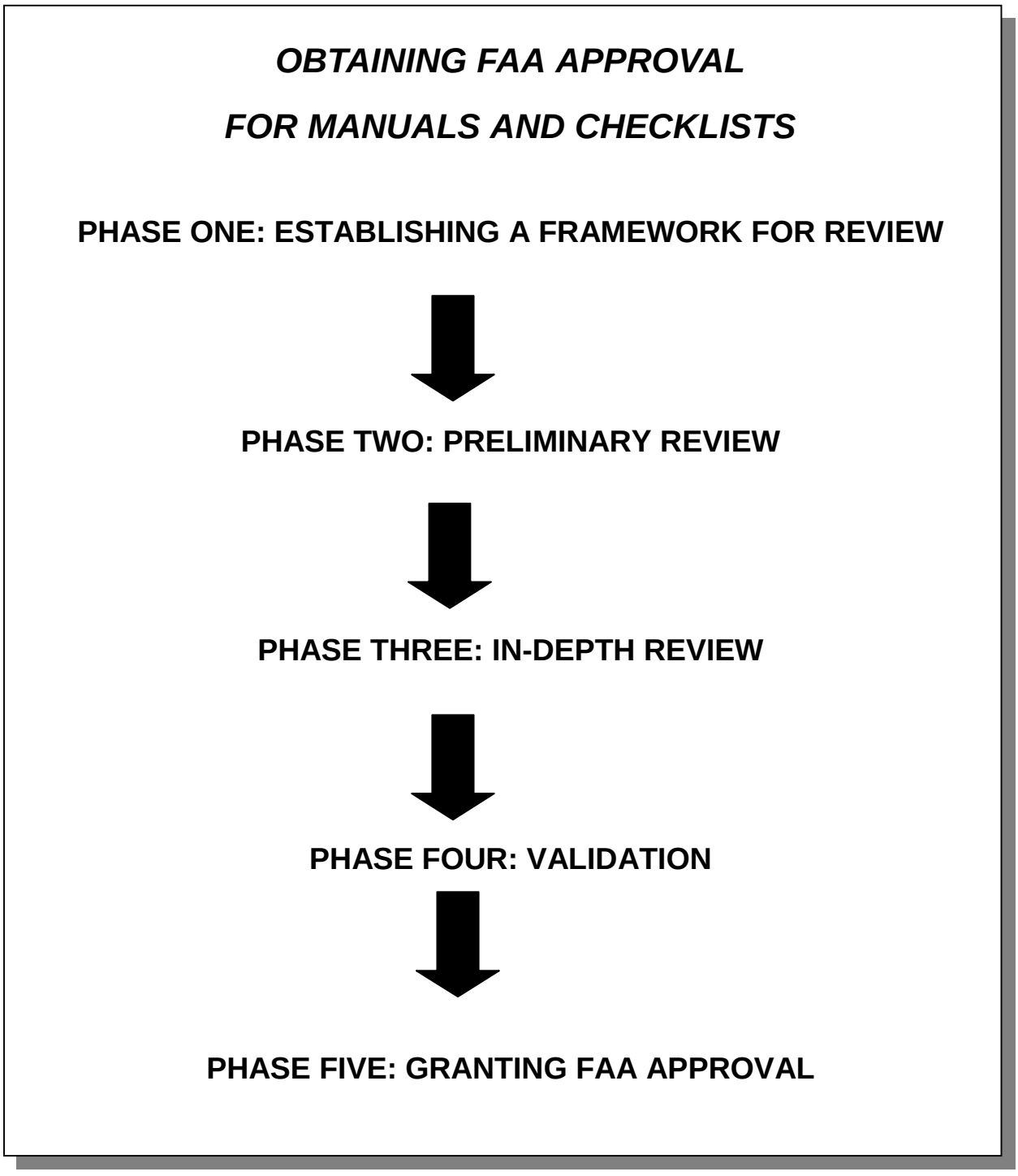
Involve FAA Aircraft Program Managers (APM) early in the coordination and review process before material is formally submitted for approval because there are differences in interpretation of the FAA Order 8400.10. It may also be beneficial for an operator to have a Memorandum of Understanding (MOU) with the POI on how approvals are to be coordinated, submitted and obtained. (NASA/FAA - 97)

Guideline 312

Maintain accurate, detailed records and good communication with the POI in order to better manage the approval process especially when changing abnormal or emergency procedures. (NASA/FAA - 97)

SEE ALSO

8400.10, Volume 3, Chapter 15, Section 2 provides additional detail on the approval and acceptance of documents.



Example 3.2.2 Maintain accurate, detailed records and good communication with the POI in order to better manage the approval process. Guideline 311

3.2.3 Reviewing and Validating

With automated importing of information, it is essential that the new documents be carefully reviewed. That review should look at issues of accuracy as well as examine the document for consistency with operator policies and display, formatting and terminology conventions. Operators should coordinate their internal review process with the required external reviews. The main types of external reviews of manuals include the Initial Review, Review of Changes and Periodic Reviews. Each type of review has specific points of focus that are presented in brief below:

Prior to the FAA required Initial Review, operators should ensure that they have addressed all required topics (see 8400.10, Sections 3 and 4) in a form consistent with their operations and with the appropriate level of detail for the information users, such as pilots. When reviewing manual changes, prior to a Review of Changes to Manuals, the operator should not only consider the actual change, but their effects on the entire operating document system, training and overall operations. In order to be prepared for Periodic Review of Manuals, the operator should make sure that their manuals reflect the changes in equipment, regulations and operating environments. These Periodic Reviews take place on a 3-year cycle, and operators should work within that cycle to ensure their manuals are ready for review.

Validation may refer to an operator's internal validation or to required FAA validation tests. Operators should work with POIs to determine the need for and type of validation. If properly coordinated with the POI, an internal validation test, performed prior to submitting the checklist for approval, may fulfill the FAA validation test requirements. By maintaining accurate records and good communication with their POI, an operator can minimize the need for validation testing. For procedures and checklists, when the operator has deviated significantly from the manufacturer's recommendations, the procedure should be validated in a flight simulator. Repeated validation may be required to exercise all relevant operational scenarios (for example, engine fire checklist on the ground, after takeoff, during approach and in cruise), and to exercise all possible decision alternatives in a checklist. Normal procedures and checklists should additionally be validated on the airplane.

Guideline 313

Coordinate internal review process with the required external FAA reviews making sure to emphasize the main points of focus that the POI will use on such reviews such as the Initial Review, Review of Changes to Manuals and Periodic Reviews. (NASA/FAA - 97)

Guideline 314

Review not only the change, but also its effects on the entire operating document system, training and overall operations when preparing for a Review of Changes to Manuals. (NASA/FAA - 97 and 8400.10)

SEE ALSO

Establishing Internal Checks (Subsection 3.2.1).

PHASE FOUR: VALIDATION TESTS

(Excerpt from 8400.10)

POI's should consider the following guidance concerning validation tests.

A. Aircraft operating procedures and checklists should be tested in realistic real-time scenarios, with a full crew complement.

B. Validation tests of normal procedures may be con-ducted in a flight simulator, in a flight training device, on training flights, or in conjunction with proving tests.

C. Validation tests of non-normal, abnormal, and emergency procedures or checklists should be conducted in a flight simulator or training device. Tests of non-normal and emergency procedures and checklists may be conducted in an aircraft; however, the operator must ensure that the test can be conducted safely. Testing of non-normal and emergency procedures and checklists shall not be conducted during revenue service.

D. Operators may submit evidence that a qualified party (such as the manufacturer or another operator) has already conducted a validation test of a procedure or checklist. When such evidence is available, the POI should not require a validation test unless the operator's circumstances are significantly different from those in which the original tests were conducted.

E. Changes in the wording of a procedure may not actually change the procedure. In such cases, validation tests are not necessary.

F. POI's shall require that operators validate the safety and effectiveness of any addition, deletion, or change of sequence in the steps of a non-normal or emergency checklist, through validation testing.

G. For those operators who intend to convert immediate action items to or from challenge-do-verify items on an emergency checklist, POI's shall require that they test the modified procedure to ensure that it is safe, effective, and has no adverse effects. POI's shall consult with the appropriate Aircraft Evaluation Group (AEG) before approving such changes.

H. The addition or deletion of individual items to a normal phase checklist does not usually need to be validated by a test. If the POI is of the opinion that the change significantly alters crewmember assignments or workload distribution, the POI shall require a validation test.

I. While electronic checklists must comply with the same guidelines discussed here, modification to an existing electronic checklist does not in itself require a validation test if the POI deems the modification to be minor.

Example 3.2.3 Validation may refer to an operator's internal validation or to required FAA validation tests. Operators should work with POIs to determine the need for and type of validation. Guideline 313

3.3 Production Process

3.3.1 Selecting Software

Although there are a number of software applications that can be used for designing and producing operating documents, an operator should consider the decisions previously made by other operators and manufacturers. As more operators manage operating documents as a system rather than individual word processing files, there has been a growing need for comprehensive software that can be used to design, transfer, produce, maintain and reuse operational information. SGML is being used increasingly by manufacturers and operators to manage the production and maintenance of operating documents.

Standard Generalized Markup Language (SGML) allows manufacturers and operators to tag information in such a way that it can be identified and used across a number of different applications. Although the Air Transport Association has established an SGML standard for aircraft documents, that standard has not yet been adopted by operators.

Reviewing some of the characteristics of an operating documents system (see Part 1), the production software should allow operators to produce and manage documents as an entire system rather than individual files. In addition, the production software should have the capability of handling both the design as well as the production needs of the operator allowing the development of prototype documents as well as the finished camera-ready copy (CRC).

Guideline 315

Select a document development software application that provides comprehensive word processing, page design and standardization management, between and within document linking, as well as revision management. (NASA/FAA - 97)

Guideline 316

Ensure that the software you select meets your color display and printing requirements, and that it is able to produce the CRC or electronic file types required by the printing department or outside printer. (NASA/FAA - 97)

SEE ALSO

Guidance on translation from manufacturer to user (Subsection 1.2.3) and working with manufacturer recommendations (Subsection 2.1.2).

SAMPLE Operations Manual System Description	SGML Levels
	Level 1 Top level for documents describing general systems information.
The Air Data Inertial Reference System (ADIRS)	**Level 1** Heading title
The Air Data Inertial Reference System (ADIRS) provides flight data such as position, speed, altitude, and attitude, for the flight displays, flight management computers, flight controls, engine controls, and other systems requiring inertial or air data. The two main components of the ADIRS are the Air Data Inertial Reference Unit (ADIRU) and the Secondary Attitude Air Data Reference Unit (SAARU).	**Level 1** Paragraph
	Level 2 Second level of general systems documents
The Air Data Inertial Reference Unit (ADIRU)	**Level 2** Heading title
Air Data Inertial Reference Unit (ADIRU) replaces the inertial reference units found on some airplanes, or the mechanical gyros and inertial navigation systems on older technology airplanes. The ADIRU contains electronic sensors and non-mechanical laser gyroscopes, which measure airplane movement in all 3 axes.	**Level 2** Paragraph
	Level 3 Lowest level for general systems documents
ADIRU Calculations	**Level 3** Heading title
Before the ADIRU can calculate the airplane's latitude and longitude position, it must accomplish a preflight alignment.	**Level 3** Paragraph

Example 3.3.1 Standard Generalized Markup Language (SGML) allows manufacturers and operators to tag information in such a way that it can be identified and used across a number of different applications.

3.3.2 Creating Formats and Templates

Operators should determine how they want to format their documents and then develop a set of electronic templates, using a software's style features to create such templates. Templates contain the information for providing standardized formats for classes of information within and across documents. Template design should be based on a consideration of how the information will be received and how the information will be displayed. With proper software selection and style/template development, some importing of information can be automated.

A template includes font, paragraph and page characteristics that can be reused when preparing the same type of document helping to establish a standard format. With planning, an operator can establish templates and formats to be used within documents as well as across the entire system of documents. That system of templates will help to achieve the standardization discussed in Part 2 of this Manual.

When designing templates for operating documents, make sure they include specifications for all the types of objects and paragraphs used in the class of document under development. Most operating documents will require the specification of body text, indented text, bullet and numbered listings, headers and footers, labels, multiple headings, tables, cautions, warnings, notes, et cetera. A document template, for example a template for a flight crew operating manual (FCOM), would contain the complete specification of these objects. Such a template could be used not only in preparing the FCOM, but many of its formats could be reused in the preparation of similar types of documents, such as flight policy manuals.

Guideline 317

Design templates in the context of the entire document system so that they can be reused efficiently across documents. Before designing a new format, review existing formats to determine if an existing format can be used more efficiently. (NASA/FAA - 97)

Guideline 318

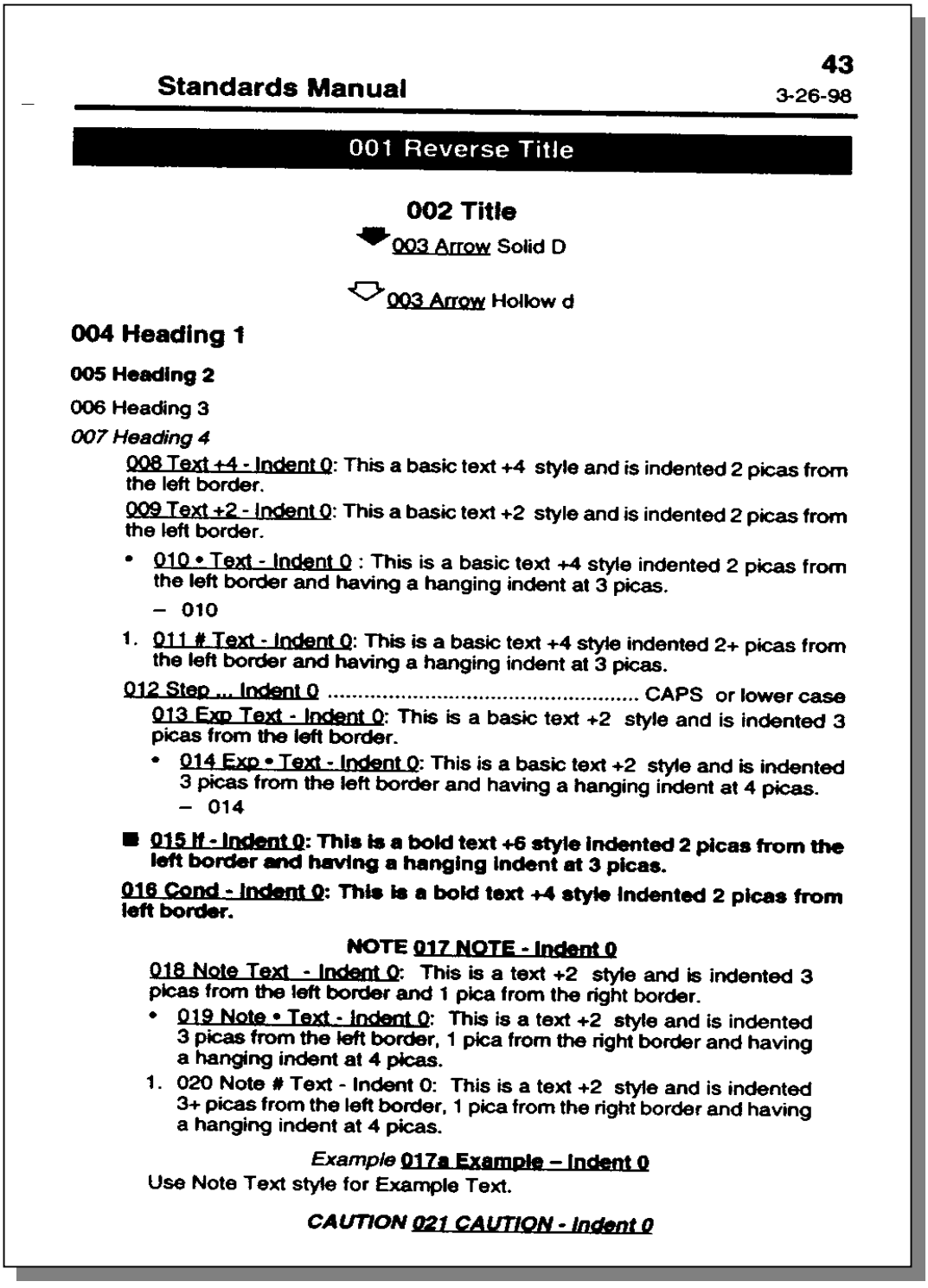
Format pages using the actual to-be-published size rather than using a standard letter-size format and later reducing, enlarging or scaling the page size. (A&S-97)

Guideline 319

Design templates based on a consideration of how the information needs to be displayed, as well as the format of the source information. Whether the information comes from internal documents or manufacturer manuals, review those templates and consider how that information can be most effectively transferred to the new document. (NASA/FAA - 97)

Guideline 320

Provide a clear statement of formats, styles and rules to document developers with guidelines to maintain consistency and discipline in document creation. (NASA/FAA - 97)



Standards Manual 43
3-26-98

001 Reverse Title

002 Title

003 Arrow Solid D

003 Arrow Hollow d

004 Heading 1

005 Heading 2

006 Heading 3

007 Heading 4

008 Text +4 - Indent 0: This a basic text +4 style and is indented 2 picas from the left border.

009 Text +2 - Indent 0: This a basic text +2 style and is indented 2 picas from the left border.

- 010 • Text - Indent 0 : This is a basic text +4 style indented 2 picas from the left border and having a hanging indent at 3 picas.
  - 010

1. 011 # Text - Indent 0: This is a basic text +4 style indented 2+ picas from the left border and having a hanging indent at 3 picas.

012 Step ... Indent 0 ..... CAPS or lower case

013 Exp Text - Indent 0: This is a basic text +2 style and is indented 3 picas from the left border.

- 014 Exp • Text - Indent 0: This is a basic text +2 style and is indented 3 picas from the left border and having a hanging indent at 4 picas.
  - 014

■ **015 If - Indent 0: This is a bold text +6 style indented 2 picas from the left border and having a hanging indent at 3 picas.**

016 Cond - Indent 0: This is a bold text +4 style indented 2 picas from left border.

NOTE 017 NOTE - Indent 0

018 Note Text - Indent 0: This is a text +2 style and is indented 3 picas from the left border and 1 pica from the right border.

- 019 Note • Text - Indent 0: This is a text +2 style and is indented 3 picas from the left border, 1 pica from the right border and having a hanging indent at 4 picas.

1. 020 Note # Text - Indent 0: This is a text +2 style and is indented 3+ picas from the left border, 1 pica from the right border and having a hanging indent at 4 picas.

Example **017a Example – Indent 0**

Use Note Text style for Example Text.

CAUTION 021 CAUTION - Indent 0

Example 3.3.2 Provide a clear statement of formats, styles and rules to document developers with guidelines to maintain consistency and discipline in document creation. Guideline 320

3.3.3 Selecting Media and Materials

The quality of the paper and ink needs to be evaluated in the production of operating documents. Operators have the conflicting objectives of reducing the mass of paper required on the flight deck, while making sure that the actual paper used is sufficiently durable and provides a good background for the printed characters.

When choosing paper or other type of material to print on, the operator must take into consideration the document location, its use and the expected life of that document. In the case of checklists, the material should be durable and of sufficient thickness that print from the other side will not show through when it is help up to the bright sunlight entering flight deck windows. Plasticizing some single sheet documents such as flight deck checklists using a sufficiently adequate gage of laminate should also be considered.

Guideline 321

Ensure that thickness of the paper or material is adequate for the specific document type. Print checklists on thick opaque paper that prevents the print on the other side from showing through even when held up by flight deck windows. Ensure that the material will withstand the substantial handling it will receive. (D-92 & FAA-95)

Guideline 322

Ensure that the quality of the print and the paper is well above normal standards. Poor print quality will effect legibility, readability and usability of the document. (D-92 & FAA-95)

Guideline 323

Establish good legibility of operating documents by using black print on a white background. The print should be clear and the boundaries between the strokes and spaces should be sharp and distinguishable. In special cases, such as emergency checklists, improved readability may be attained by the use of black print on a bright lemon yellow background. (FAA-95 & T&H-91)

Guideline 324

Avoid using white characters over a black background for body text (it may be okay for use in headers or titles). If white characters over black are required, use minimum amount of characters and a large sans-serif font. (D-92)

SEE ALSO

Determining Checklist Media (Subsection 2.4.4).

USEFUL TERMS IN SELECTING TYPE OF PAPER

Actual Weight	The true weight of any volume of paper. The actual weight of paper is used to determine both purchase price and shipping costs. see also basic size, basis weight, weight.
Bonding Strength	The internal strength of a paper; the ability of the fibers within a paper to hold to one another.
Card Stock	A stiff or rigid paper stock. Card (also referred to as Cover) stock is often used for post cards, catalog covers and other items which require rigidity.
Coated Paper	Paper with an outer layer of coating applied to one of both sides. The coating may be added while the paper is still moving through the papermaking machine, or after it comes off the machine.
Finish	The surface characteristics of a paper. Finishes may be created on-machine or off-machine.
M weight	The weight in pounds of 1,000 sheets (or two standard 500- sheet reams) or paper.
Ream	A package containing 500 sheets of printing paper.
Ream Weight	The actual weight in pounds of a ream (500 sheets) of paper. see also actual weight, basis weight, weight
Whiteness	The measure of the amount of light reflected from a sheet of paper.

Example 3.3.3 Operators have the conflicting objectives of reducing the mass of paper required on the flight deck, while making sure that the actual paper used is sufficiently durable and provides good background for the printed characters. Guideline 322

3.4 Revision, Distribution and Tracking

3.4.1 Planning and Distributing Revisions

Operators need a distribution method tailored to the type of document, frequency of distribution and location of the distributed documents. A comprehensive distribution process should include some form of audit trail to ensure that the distribution is complete. Revision distribution is part of the communication mechanism discussed in Subsection 3.1.3, and is affected by issues of revision frequency, time sensitivity, document location and overall organization of documents. The organization, design and production of documents should take distribution into consideration, and the Documents Database (DDB) can be used to structure and manage the process.

Distribution may be directed to the information user, such as flight crews, or to the aircraft or ship's library. When distributing directly to flight crews, the documents may be shipped in bulk to domiciles and then placed in flight crew mailboxes. The advantage of direct flight crew distribution is that each individual is assured of getting the revisions. The disadvantage of this approach is that large operators will need to print large quantities and will have to maintain an accurate mailing list.

Distribution to the ship's library can reduce print quantity as well as reduce the weight of flight bags. Even though the flight crew may have to receive a copy of the revision for their personal study copy of the manual or procedure, the distribution process may be more efficient. Potential problems with this form of distribution include the need for more durable materials and chasing aircraft. Both approaches will require some form of audit to ensure that a complete distribution has been achieved (see Subsection 3.4.2).

Guideline 325

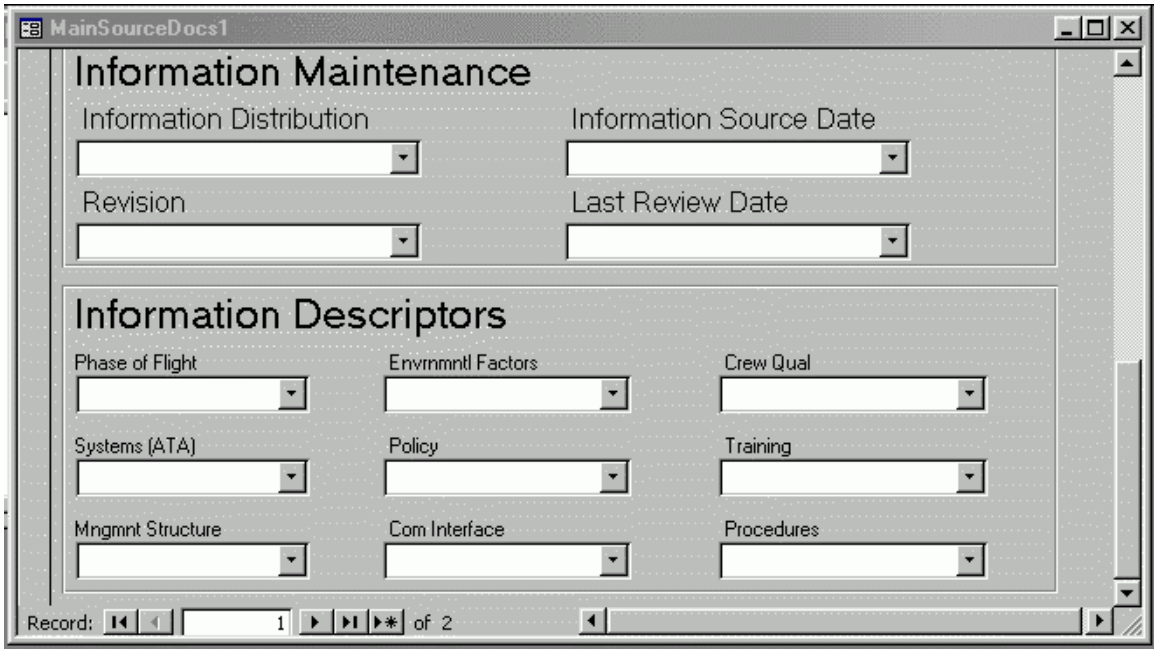
Organize, design and revise document systems so that they have efficient distribution. Distribution should be part of the DDB and should be considered when organizing the document system. (NASA/FAA - 97)

Guideline 326

Consider the revision process when designing documents. Single-column format is easier to work with, especially with frequent revisions. The main problem with single columns is excessive line length, which can be avoided by making the text column narrower and allowing more margin space. (A&S-97)

SEE ALSO

Establishing a Documents Database (Subsection 1.1.2) and Revision considerations as they affect document location (Subsection 1.4.5).



Information Maintenance Portion of the DDB Includes:

Information Distribution	The method of document or information distribution such as directly to the crew or to the ship's library. Method of information distribution may be tracked through a DDB.
Information Source Date	A DDB field to record the most recent update of the information.
Revision	DDB field used to track the revision status of a document or information topic.
Last Review Date	DDB field that records the most recent review date of a document or information topic.

Example 3.4.1 Organize, design and revise document systems so that they can be efficiently distributed. Distribution should be considered when organizing the document system and can be a useful element in the DDB. Guideline 325

3.4.2 Tracking Revisions

An operator's method of distribution is complemented by a tracking system to ensure currency throughout the organization. The tracking system usually includes some form of a log combined with a procedure to verify that individual flight crews have the most recent updates.

There are two mechanisms that may be used to help manage the revision tracking process, the first helping the operator and the second helping the information users keep current. The first is the DDB that can be used during the organization and design of documents, as well as during the tracking of revisions. The DDB should contain information about frequency of revisions, revision control numbers and tracking data. In addition, the operator may include tracking issues and difficulties that can be addressed during document system changes or future revisions. By maintaining a history of these issues, operators can capitalize on lessons learned and avoid repeating mistakes that may have been made at an earlier point in time.

In addition to the DDB, operators should maintain Revision Logs and Bulletin Logs to provide the user with current information. These logs help individual users keep track of what has been inserted and what should have been removed, along with date information. These logs require some form of verification where flight crews can check to make sure that they are up to date. Some operators provide periodic checks of flight crew manuals during training events or line checks.

Guideline 327

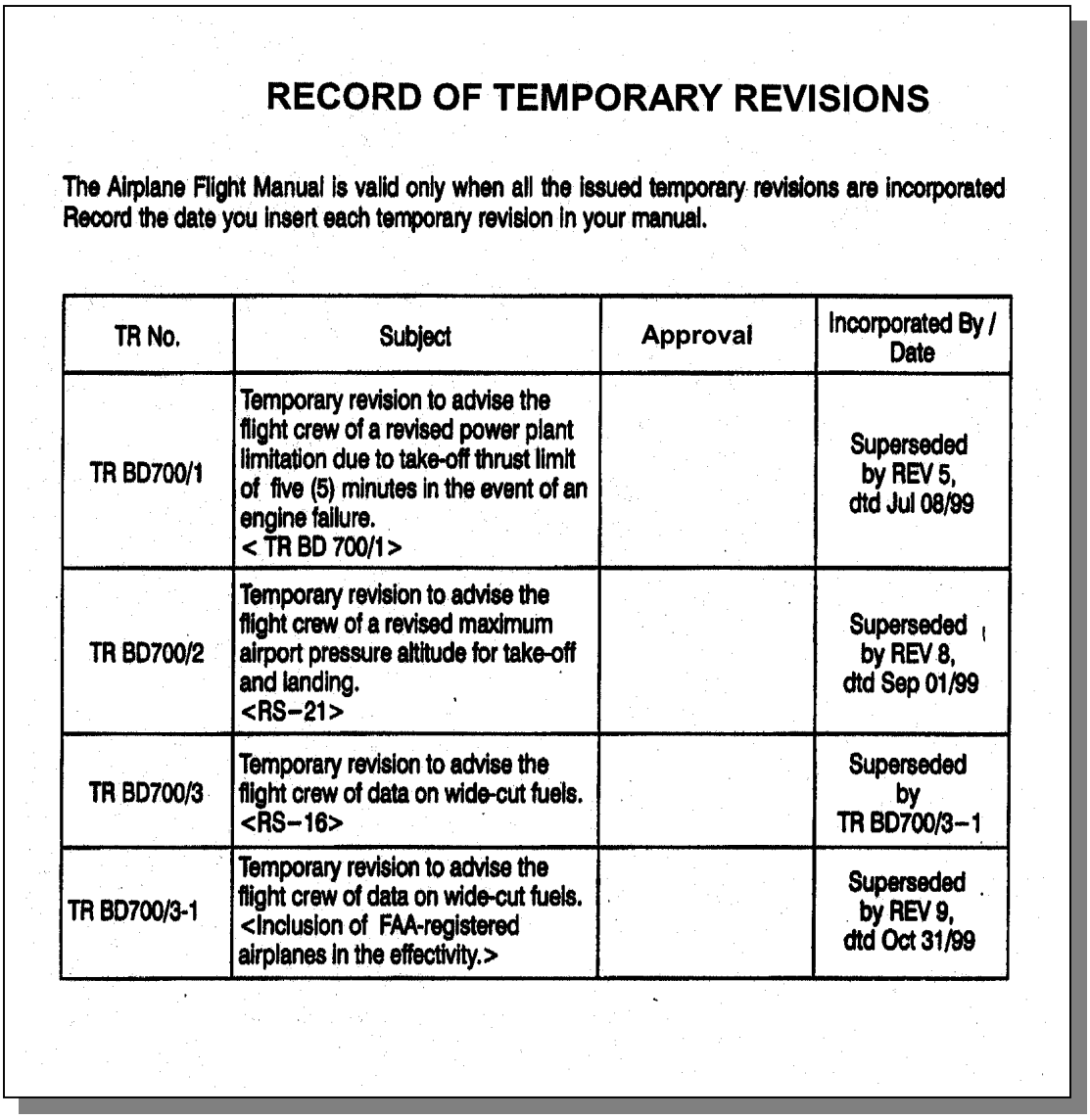
Consider using the DDB to help manage the tracking of operating document revisions. The DDB can contain information about frequency of revisions, revision control numbers, tracking data, as well as tracking issues and difficulties that can be addressed during later revisions. (NASA/FAA - 97)

Guideline 328

Implement a Revision and Bulletin Log system to help individuals maintain current operating documents. These logs should be backed up with a systematic verification that all crews are current. (NASA/FAA - 97)

SEE ALSO

Establishing a Documents Database (Subsection 1.1.2) and considerations related to the tracking of cards, guides and checklists (Subsection 1.4.6).



RECORD OF TEMPORARY REVISIONS

The Airplane Flight Manual is valid only when all the issued temporary revisions are incorporated Record the date you insert each temporary revision in your manual.

TR No.	Subject	Approval	Incorporated By / Date
TR BD700/1	Temporary revision to advise the flight crew of a revised power plant limitation due to take-off thrust limit of five (5) minutes in the event of an engine failure. < TR BD 700/1 >		Superseded by REV 5, dtd Jul 08/99
TR BD700/2	Temporary revision to advise the flight crew of a revised maximum airport pressure altitude for take-off and landing. <RS−21>		Superseded by REV 8, dtd Sep 01/99
TR BD700/3	Temporary revision to advise the flight crew of data on wide-cut fuels. <RS−16>		Superseded by TR BD700/3−1
TR BD700/3-1	Temporary revision to advise the flight crew of data on wide-cut fuels. <Inclusion of FAA-registered airplanes in the effectivity.>		Superseded by REV 9, dtd Oct 31/99

Example 3.4.2 Revision logs should be maintained in order to provide the information user with current information. Guideline 328

Part 4 Electronic Documents

This section contains general considerations along with examples and guidelines for converting a paper-based flight deck information management system to a system based on linked electronic documents. It includes general design and architecture considerations, and discusses broad regulatory issues. It is not an exhaustive examination of all design and regulatory issues surrounding conversion to and use of electronic documents for the flight deck.

4.1 General Considerations

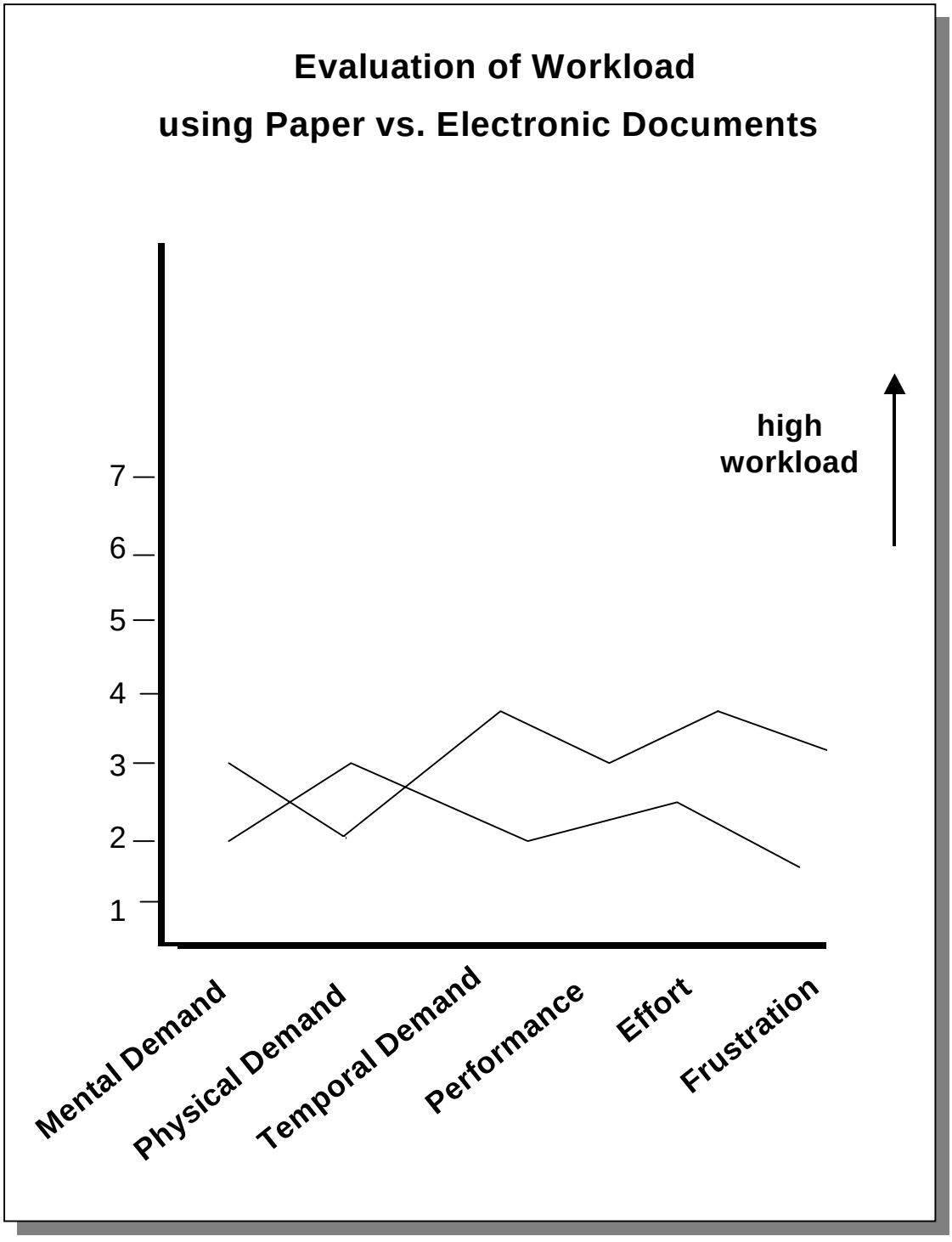
4.1.1 Change Indicators

The first step in determining whether to transition to an information system based on electronic documents is to evaluate deficiencies and costs associated with the current paper-based system. If existing deficiencies are not significant or can be resolved within the paper system, or a transition would not produce significant operational or safety benefits, then transition is probably not warranted. Consider also whether a partial transition to an electronic format would be beneficial. It might be advantageous to leave some documents in paper formats (e.g., Quick Reference Handbooks and Checklists), and convert other to the electronic format (e.g., policy and procedure manuals, operating manuals). Indicators that might point toward transition to electronic media include:

- **Frequently changing documents** - Dynamic documents increase publishing and information costs, which frequently include republishing non-revised material that has simply been repaginated. Revision costs also include packaging, shipping, personnel and warehousing costs.
- **Timely distribution** - Large numbers of users, user locations and the frequency of document changes, increase the probability of non-standard policy, procedures and practices within user groups. Non-standard documents can lead to confusion, operational inefficiencies and non-compliance within the regulatory environment; each instance can have significant cost impacts. A process that includes remotely distributed electronic documents and document revisions can address these issues.
- **Responsiveness to user needs** - Does the current system simply meet users' minimum information requirements, or does it provide targeted information and guidance to allow users to make accurate, timely decisions with respect to safety and efficiency, and allow users to take full advantage of opportunities.
- **Paper Induced Errors** - Are there errors associated with the current paper documents that could be eliminated using an electronic system?

Guideline 400

Evaluate problems with current paper-based system, and determine whether solutions exist using electronic media. (NASA/FAA – 97)



Example 4.1.1 Evaluate whether problems induced by a paper-based system are alleviated by the use of electronic media. Guideline 400

4.1.2 Architecture Decisions

If change to electronic media is indicated, there are decisions to make regarding basic architecture. These decisions impact on scope of the transition, as well as the cost benefit analysis. Specific decisions include:

- **Complete Paper Replacement**. This means no paper backup aboard the aircraft; the electronic system will stand-alone. This system will likely require higher levels of certification and cost more to develop and deploy. It also means the electronic system would be required for dispatch, potentially decreasing dispatch reliability by adding these systems to the Minimum Equipment List (MEL).
- **Selected Paper Replacement.** Certain documents may be maintained in the paper format (e.g., Quick Reference Handbook). Lengthy, frequently revised documents such as Policy/Procedure Manuals would be transitioned to electronic media. This may reduce certification requirements and consequently reduce development/implementation costs. However, paper documents would continue to be distributed, revised, warehoused, et cetera.
- **Paper Supplement**. This process requires complete paper backup of electronic flight deck documents. Certification/approval might be greatly simplified, but there would be significant costs associated with maintaining two systems including increased training costs (train and evaluate two systems). The advantage is, aircraft could dispatch with the electronic system inoperative, increasing dispatch reliability. The possible disadvantage is, human factors problems when switching between the two systems during flight. Human factors issues would have to be addressed by close synchronization between procedural flows in paper and electronic systems, as well as specific training and evaluation processes.
- **Printing Electronic Documents.** Will the system allow the crew to print out a copy of pertinent documents on the flight deck (e.g., ACARS or other third party manufactured and FAA-approved printer)?
- **Document Access Outside Aircraft.** How will crews access the information outside the flight deck for reference or study? Will the company provide other display devices (e.g., laptops) along with associated software and documents for personal use and study of manuals, or will crews continue to receive paper media?

The level of replacement of paper documents by electronic media relates directly to cost and lead time for implementation, as well as basic issues of functionality. Lower replacement levels (e.g., paper backup or limited transition) reduce initial acquisition costs, maintenance costs and certification levels, but may impact training costs and raise human factors issues. Conversely, the more complete the paperless transition and tightly integrated with aircraft systems, the more costly the startup, but a greater return-on-investment (ROI) over the same time period may be possible.

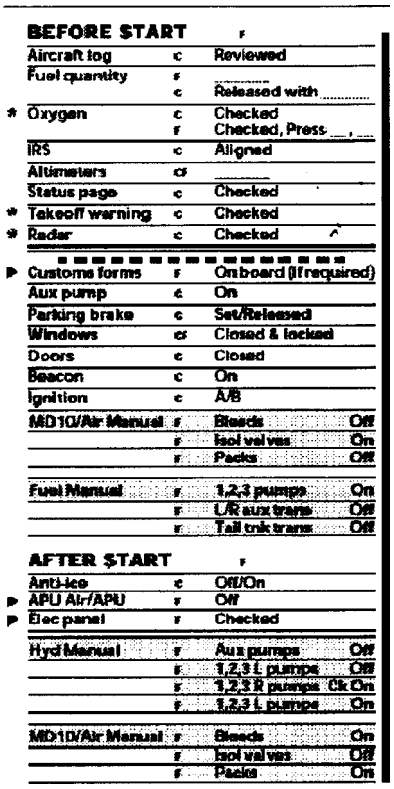
Guideline 401

Examine basic architecture and decide to what extent the electronic documents will replace paper. (NASA/FAA – 97)

Deciding Level of Replacement:

Paper vs. Electronic Documents

- Cost
- Access
- Training
- ROI
- Certification
- Human Factors
- Distribution
- Revision
- Time
- Approval



BEFORE START		
Aircraft log	c	Reviewed
Fuel quantity	s	
	c	Released with .....
* Oxygen	c	Checked
	s	Checked, Press __, __
IRS	c	Aligned
Altimeters	cs	
Status page	c	Checked
* Takeoff warning	c	Checked
* Radar	c	Checked
▶ Customs forms	s	On board (if required)
Aux pump	c	On
Parking brake	c	Set/Released
Windows	cs	Closed & locked
Doors	c	Closed
Beacon	c	On
Ignition	c	A/B
MD10/Air Manual	s	Bleeds Off
	s	Isol valves On
	s	Packs Off
Fuel Manual	s	1,2,3 pumps On
	s	L/R aux trans Off
	s	Tail tnk trans Off

AFTER START		
Anti-ice	c	Off/On
▶ APU Air/APU	s	Off
▶ Elec panel	s	Checked
Hyd Manual	s	Aux pumps Off
	s	1,2,3 L pumps Off
	s	1,2,3 R pumps Ck On
	s	1,2,3 L pumps On
MD10/Air Manual	s	Bleeds On
	s	Isol valves Off
	s	Packs On

Example 4.1.2 Examine basic architecture and decide to what extent the electronic documents will replace paper. Guideline 401

4.1.3 Organizational Commitment

There are several key considerations relating to organizational commitment.

Project Champion. Organizational commitment is critical to successfully replacing paper-based information management systems with electronic documents. In most cases, a detailed study of required products and processes, as well as cost/benefit analyses are not sufficient to break the paper paradigm; there must be a "Champion" at a high level, willing to pursue and support the project. For example, it is likely there will not be a standard 18-month return on investment (ROI); it may stretch over several years, and without high-level organizational support, the probability of taking the conversion to completion and realizing savings is unlikely.

Information as the Asset. The organization's critical operating information, not the medium used to display it (e.g., paper or electronic) is the principal asset. Consider the long-term effect of destroyed master document files as opposed to the impact of a fatal crash of an individual workstation. In this instance, hardware can be replaced in an afternoon; lost master files however might require months of effort to recapture. The medium facilitates the use or reuse of critical information, however the technology involved in creating, revising, distributing or viewing information only provides a window to this asset.

Information assets consist of content and structure. A key question is whether the current content and structure are compatible with the users' requirements, and applies regardless of the medium. Before considering transitioning to another media, first ensure current information structure and content meet the needs of the end user; if not, work first on the documents.

A common style used by several major carriers is an approach called Information Mapping for creation of technical documentation (see Example 4.1.3). Many organizational and presentation methods transfer well to electronic documents.

Guideline 402

Identify conversion requirements and paybacks, then find a product "Champion" high within the organizational structure. (NASA/FAA – 97)

Guideline 403

Determine whether current information content and structure are compatible with users' needs. Consider using the Information Mapping style of organizing and writing. (NASA/FAA – 97)

INFORMATION MAPPING*

Sample Intranet Guidelines and Development Steps

Information Mapping* may be used to help organize and standardize documents as well as web sites. The following guidelines may be used in the design of Intranet pages:

Intranet Guideline 1	Web pages are organized into information chunks that are accurately labeled and consistently placed.
Intranet Guideline 2	Advance Organizers may be placed toward the top of the web page with links to the appropriate section of the page.
Intranet Guideline 3	Graphics should be used to promote quick comprehension of ideas that may otherwise require a lengthy explanation.
Intranet Guideline 4	A Next-Page link may be placed at the bottom of web pages to help users navigate though the document.

Information Mapping* may be used in the design or redesign of an Intranet based on the following steps:

Step 1	Develop a plan that includes a schedule, resource requirements, budget, implementation plan, and criteria for measuring the success of your Intranet.
Step 2	Design an information architecture for your Intranet based on audience needs and performance objectives to ensure information will be organized to efficiently and effectively answer user questions.
Step 3	Establish standards, models, and a prototype to use as a guide for developing your content, structure, and navigation.
Step 4	Test and validate your solution to be sure that it will provide the results you require.
Step 5	Train your content providers to create results-driven content

*Information Mapping is the property of Information Mapping, Inc.

Example 4.1.3 Information mapping is a commonly used style of organizing and standardizing document systems which transfers well to electronic documents. Guideline 403

4.1.4 Document Repository

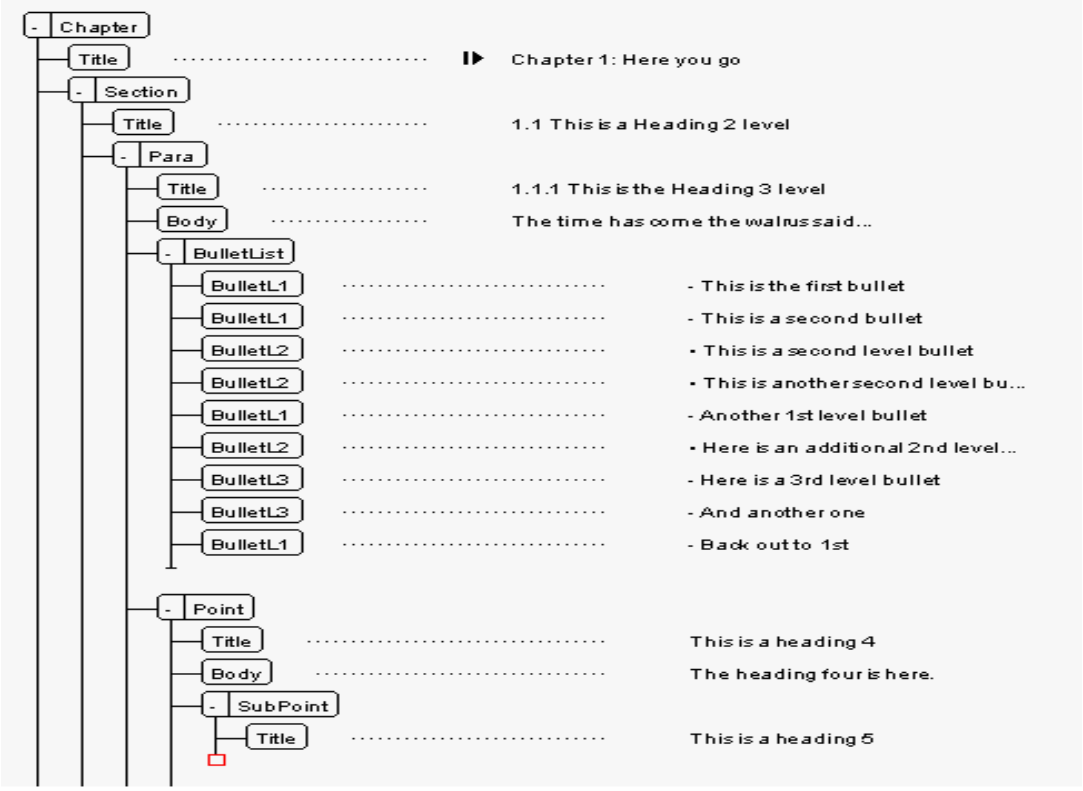
A document repository is the vehicle by which an organization's documents are warehoused (stored for use). Document repositories span the spectrum of paper warehousing, from standard word processing files (where format alone determines structure), to fully linked, structured document files such as in SGML (Standard Generalized Markup Language).

Paper documents are the least reusable, while many word processing and SGML documents can be used in a variety of ways (e.g., HTML, XML, PDF, etc.). Structured documents such as SGML are the most reusable. Before converting to an electronic medium however, an organization may have to do extensive work on the information repository in order to yield an electronic product that exploits that media's strengths. The preparation process alone might take a huge commitment of work-hours to complete, and is seldom considered in the conversion to electronic media; the cost, however, may be as significant as the hardware/software acquisition and networking issues.

Guideline 404

Consider all tradeoffs in planning the document repository. Fully linked, structured documents such as SGML are more reusable than standard word processing or paper documents; however, its strengths may not be exploited until extensive work on the information repository is completed. (NASA/FAA – 97)

SGML Document Structure



Term	Name	Definition
CHAPTER	Chapter	A CHAPTER specifies a major division of a document.
COLNUM	Column Number	The number of the displayed column counted from the left.
COLS	Columns	The number of columns that are defined for that table.
FCOM	Flight Crew Operating Manual	The Flight issue Crew Operating Manual (original, re-issue, set of partial revisions, temporary revisions, of bulletins).
PARA	Paragraph	This tag identifies a piece of text, composed of a set of sentences which are to be presented as a block separated in some way from its neighbor. This element is he basic one which is found almost every time when creating instances.
SECTION	Section	A section within an ATA allocated Chapter. For non-ATA documents, the section is a set of data units which are related and stored together.
TITLE	Title	A TITLE summarizes the content of an element.

Example 4.1.4 Fully linked, structured documents using SGML terms can link attributes such as chapter, column number, paragraphs and sections within and across documents. Guideline 404

4.2 Regulatory Standards

4.2.1 Existing Standards

Primary Regulatory Documents. Four primary regulatory documents impact creation and use of electronic documents for flight deck operations. FAA Order 8400.10 dictates the content, approval processes and requirements of Company Operating Manuals. 8400.10 pertains primarily to paper documents, but does contain guidance on limited electronic systems such as electronic checklists. Hardware and software used on the flight deck typically come under the auspices of aircraft equipment certification guidance contained in DO-178 and DO-160 (see Example 4.2.1). These documents describe certification requirements for hardware and software used in aircraft systems, and may result in a type certification or subtype certification depending on the particular system or component. Finally, advisory circular, AC 120-64 addresses electronic checklists as part of aircraft equipment.

Certification issues arise with respect to the scope of specific electronic document systems. Electronic document system functionality ranges from a standalone system (no physical connection to aircraft), which only replaces some or all of its paper counterpart, to a fully integrated electronic library which interfaces with, and may control some components or functionality of actual aircraft systems. In the first instance, hardware and software could be considered independent of the aircraft and outside current DO-160D/178B guidelines, while the latter system is definitely an aircraft system component subject to certification standards.

AC 120-64 addresses a very narrow spectrum of an electronic document system, primarily an "in-dash" electronic checklist, as used on the Boeing 777 series aircraft. Advisory Circulars can be ordered through the FAA website at http://www.faa.gov/abc/ac-chklst/actoc.htm.

Personal Electronic Device (PED). Several carriers now use certain interactive technical electronic documents on the flight deck through standard laptop computers. DO-199 describes requirements for PEDs, and FAR Part 91.21 regulates usage aboard aircraft.

Guideline 405

Review DO-178B, "Software Considerations in Airborne Systems and Certification," DO-160D, "Environmental Conditions and Test Procedures for Airborne Equipment," and DO-199, "Potential Interference to Aircraft Electronic Equipment from Devices Carried Aboard" (Available from http://www.rtca.org/). Become familiar with hardware and software certification requirements and procedures. (NASA/FAA – 97)

DO-160D, ENVIRONMENTAL CONDITIONS AND TEST PROCEDURES FOR AIRBORNE EQUIPMENT

Issued 7-29-97
Superseded DO-160C, Changes 1, 2 & 3
Prepared by SC-135

Standard procedures and environmental test criteria for testing airborne equipment for the entire spectrum of aircraft from light general aviation aircraft and helicopters through the "Jumbo Jets" and SST categories of aircraft. The document includes 25 Sections and three Appendices. Examples of tests covered include vibration, power input, radio frequency susceptibility, lightning and electrostatic discharge. Coordinated with EUROCAE, RTCA/DO-160D and EUROCAE/ED-14D are identically worded. DO-160D is recognized by the International Organization for Standardization (ISO) as de facto international standard ISO-7137.

DO-178B, SOFTWARE CONSIDERATIONS IN AIRBORNE SYSTEMS AND EQUIPMENT CERTIFICATION

Issued 12-1-92
Advisory Circular
Superseded DO-178A
Prepared by SC-167

Provides revised guidelines for the production of airborne systems equipment software.

DO-199, POTENTIAL INTERFERENCE TO AIRCRAFT ELECTRONIC EQUIPMENT FROM DEVICES CARRIED ABOARD

Issued 9-16-88
Superseded DO-119
Prepared by SC-156

Reports on the investigation to determine potential interference effects to aircraft electronic systems due to emissions from self-powered portable electronic and electrical devices operated aboard aircraft. Recommends regulatory actions relating to operation and identification of passenger-operated devices to assure control of possible sources of interference, and recommends standardized procedures for reporting suspected interference. Volume I is the basic report and includes background, data collection, data analysis, conclusions and recommendations. Volume II provides amplification or background material for some of the summary data included in the basic report.

Example 4.2.1 These documents, available from the RTCA website, http://www.rtca.org/, describe certification requirements for hardware and software used in aircraft systems, and may result in a type certification or subtype certification depending on a particular system or component. Guideline 405

4.2.2 Emerging Standards

Digital Display Working Group. In March 1996, the Air Transport Association (ATA) Chart and Data Display Committee formed the Digital Display Working Group (DDWG) to study ways to display chart and navigation information digitally. The DDWG's effort evolved to include ways and guidelines for converting existing paper-based flight deck information systems to digital documents. The Group is working to facilitate issues between the FAA, NASA, ATA members and Industry vendors.

FAA. AFS 400 (Flight Standards) announced work on a new Advisory Circular in the spring of 1999. The initial thrust of this Circular was informational in nature. In addition, in June 1999, AHM 100 (Certification) formed a group to study certification issues for an "Electronic Flight Bag," or "EFB." The Group's charter is to examine, and if necessary, develop new certification standards for the EFB.

Other Initiatives and Documents. Several other industry initiatives include an ATA Flight Operations Working Group (FOWG) standard for SGML (part of ATA Spec 2100), standardized digital symbology (SAE G10), and standardized instrument approach display information (SAE G10).

Guideline 406

Obtain a copy of Advisory Circular 120-64. Understand type certificates (TC) and supplemental type certificates (STC) requirements with respect to a fixed position electronic checklist. (NASA/FAA – 97)

Guideline 407

Review ATA Specification 2100, "Digital Data Standards for Aircraft Support," available through the Air Transport Association, at http://www.air-transport.org/public/publications/62.asp (NASA/FAA – 97)

SUMMARY INFORMATION
AC No. 120-64
Operational Use and Modification of Electronic Checklists

PURPOSE: This advisory circular (AC) provides an acceptable means, but not the only means, to address the processes for approval, operational use, and modification of electronic checklists (ECL) and ECL data by air carriers.

FOCUS: This AC applies to air carriers using installed ECL systems under Federal Aviation Regulations (FAR) parts 121 or 135. Operators under FAR parts 91 or 125 may also use the criteria of this AC to the extent that provisions of this AC are pertinent to their aircraft and operations. This AC is primarily intended for ECL systems that have checklist items or procedures that may be modified by the operator. Portions of this AC may be applicable to the use of ECL systems that are fixed by their type design (for example, when necessary to ensure use of compatible paper checklists). This AC does not apply to hand-held independent ECL devices, devices otherwise temporarily attached to a flight deck surface, or devices incidental to flight deck function added by the aircraft operator.

BACKGROUND: Simple forms of ECL's have been used in various types of aircraft. In the past, these systems typically were not modifiable by the operator, and use of these ECL's often required crew action to “check off” the completion of an action item. These ECL systems have been integrated into some other flight deck display (for example, weather radar or Electronic Centralized Aircraft Monitoring (ECAM)), have been installed by an operator as an incidental flight deck aid, or have been independently displayed on a hand-held device. Recently, ECL's have become more versatile as they address more complex logic and may include closed loop responses. For example, the completion of an action item may be sensed by the ECL system, and a non-normal (abnormal or emergency) checklist may be displayed automatically upon detection of the related fault. As such, ECL's provide a means to accomplish checklists with a reduction of “head-down” time and a reduction in the possibility of crew error. ECL checklist data has also become modifiable by the operator. The information in this AC is intended to facilitate the development and modification of these operator-modifiable ECL's and to provide guidance for the operational use of ECL's to assist operators in integrating ECL's into their crew resource management (CRM) and training programs.

Example 4.2.2 Limited guidance is provided for electronic checklists (AC 120-64), thus the standards being developed through industry and regulatory initiatives are greatly needed. Advisory Circulars can be ordered through the FAA website at http://www.faa.gov/abc/ac-chklst/actoc.htm. Guideline 406

4.3 Considerations for Electronic Document and Display Systems

4.3.1 Aircraft and System Connectivity

Mobility. As mentioned earlier, a critical determination is whether the display device will be physically handled by the pilot much like a book or other non-rigid-mounted piece of equipment, or the device will be physically mounted on the flight deck and if so, where? Does the device pull power from the aircraft or operate solely on batteries, or a combination of both?

Another critical consideration is how the pilot accesses information off the aircraft, such as for study or flight preparation. If the display remains with the aircraft, the organization must provide an alternative (paper or electronic) means of achieving that capability.

Integrated or External to Aircraft Systems. Determine whether the display device will use aircraft-supplied information as part of the electronic display. For example, when the "electronic checklist" calls for flaps, would the display system "sense" that flaps were in the correct position based on information received from aircraft systems? The more tightly integrated the display system is with the aircraft, the higher the design, development and certification costs. Isolation of the display and software from aircraft systems, however, may reduce functionality of the electronic media.

Standalone or Networked. Are the display devices self-contained, requiring no input other than power from either the aircraft or other device? Devices that operate independently would simplify design, development and implementation costs, but might suffer from the inability to receive remotely distributed information, such as the status of the other pilot's checklist. Networked devices however may require additional aircraft cabling or special modifications to support other network architectures (e.g., infrared), but might provide greatly increased functionality for the price differential.

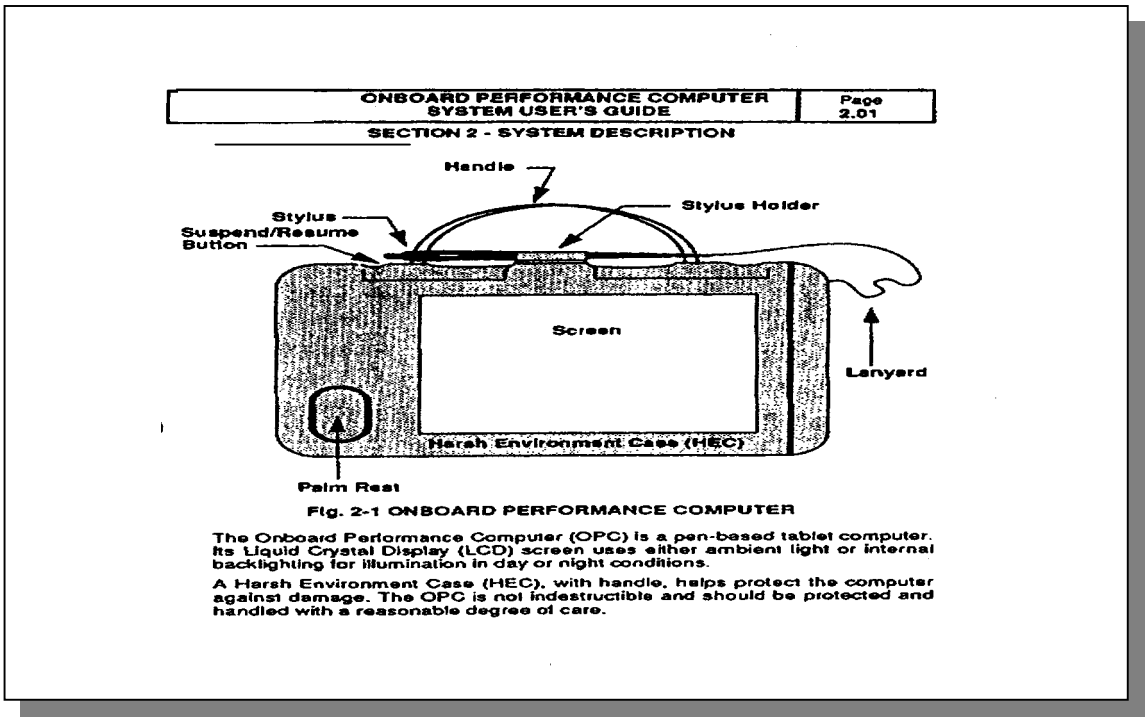
Another network consideration is whether the display devices use an on-board server to provide information, updates, or added functionality to the display device. A network based on client-server architecture would provide significantly more information storage than a peer-to-peer network, as well as a centralized location to update display devices.

Guideline 408

Evaluate system architecture options. The greater the functionality and integration with aircraft systems, the higher the certification level and cost. (NASA/FAA – 97)

SEE ALSO

ARINC 763 File Server Standard http://www.arinc.com/characteristics/arinc700.html



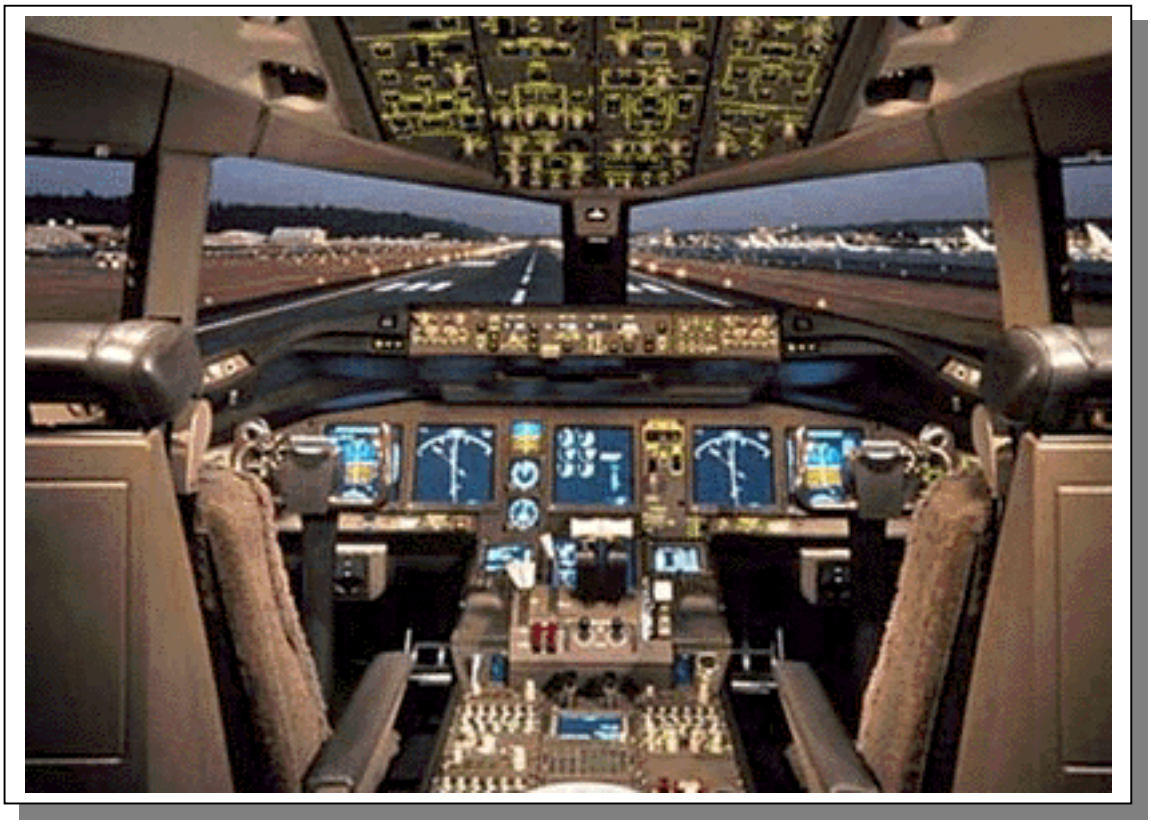
ONBOARD PERFORMANCE COMPUTER
SYSTEM USER'S GUIDE
Page 2.01

SECTION 2 - SYSTEM DESCRIPTION

Fig. 2-1 ONBOARD PERFORMANCE COMPUTER

The Onboard Performance Computer (OPC) is a pen-based tablet computer. Its Liquid Crystal Display (LCD) screen uses either ambient light or internal backlighting for illumination in day or night conditions.

A Harsh Environment Case (HEC), with handle, helps protect the computer against damage. The OPC is not indestructible and should be protected and handled with a reasonable degree of care.



Example 4.3.1 Evaluate system architecture options. The greater the functionality and integration with aircraft systems, the higher the certification level and cost. Guideline 408

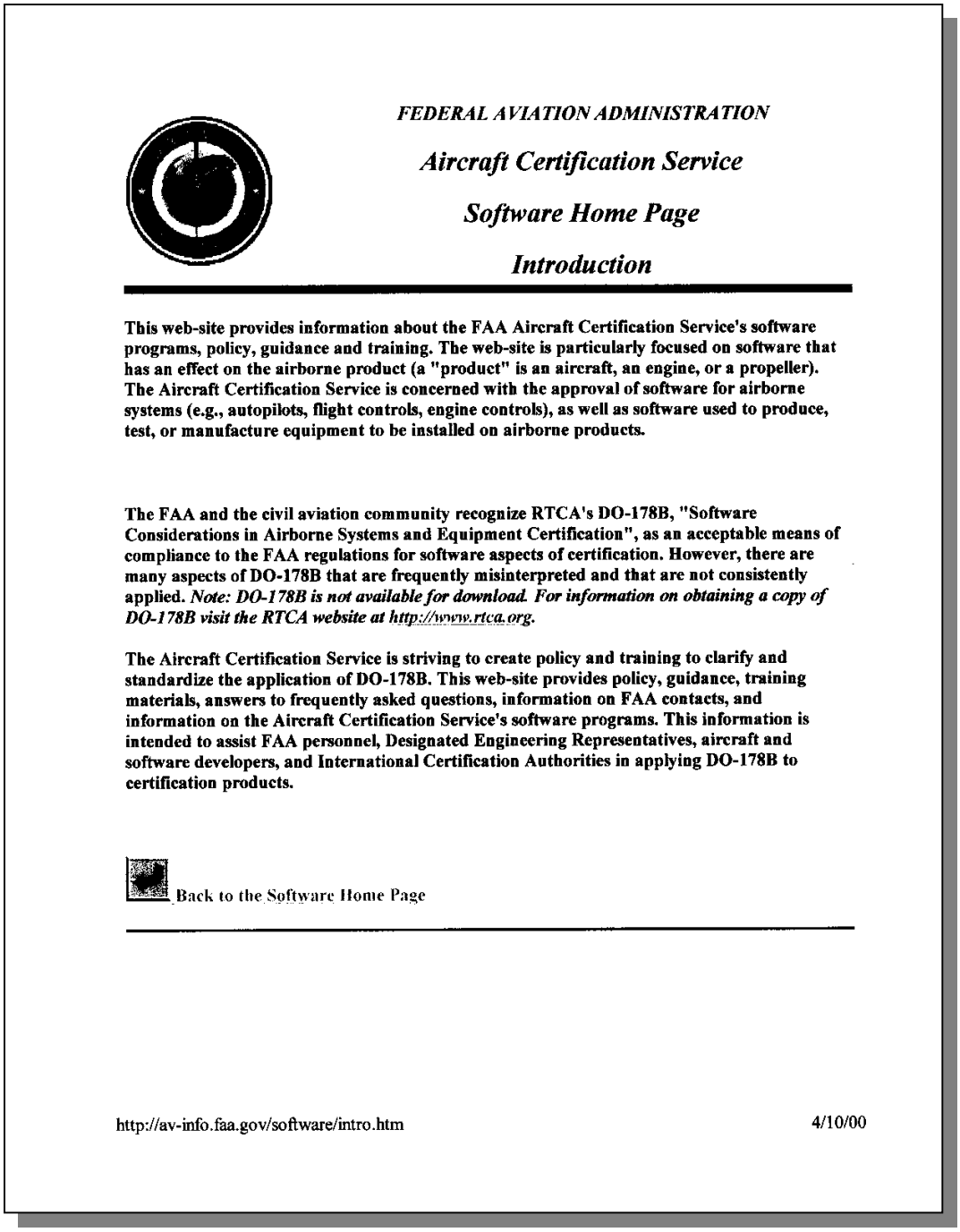
4.3.2 COTS or Custom Software

Commercial-Off-The-Shelf (COTS). The use of COTS or custom-designed hardware/software is a difficult decision, and must be made following a detailed examination of advantages and disadvantages. COTS software and hardware offer rapid and relatively inexpensive solutions to a broad range of electronic document and display needs.

However, most COTS products are not designed for the rigorous flight deck environment (e.g., effects of rapid decompression on a standard laptop), or for the high levels of reliability and redundancy required due to the critical nature of flight operations. As a consequence, it might be difficult and expensive to complete modifications and testing required for the certification process, or certification might require backup paper documents in addition to the electronic display.

Custom. Custom designed and built equipment may pass certification easily, but development and deployment of relatively few devices will be costly. In either case, COTS or custom, companies must also consider follow-on requirements for increased functionality. It would be difficult to justify buying a COTS system when future plans call for capabilities which require greater certification levels.

DO-178B considerations for software documentation, available from the RTCA website, http://www.rtca.org/, generally require an FAA review of source code in order to establish and prove the integrity level of the software. Commercial software source code, particularly the operating systems (e.g., Windows 95/98/NT), is not available from all manufacturers. This may severely limit the ability to qualify the software to the integrity level required for the application.



FEDERAL AVIATION ADMINISTRATION

Aircraft Certification Service

Software Home Page

Introduction

This web-site provides information about the FAA Aircraft Certification Service's software programs, policy, guidance and training. The web-site is particularly focused on software that has an effect on the airborne product (a "product" is an aircraft, an engine, or a propeller). The Aircraft Certification Service is concerned with the approval of software for airborne systems (e.g., autopilots, flight controls, engine controls), as well as software used to produce, test, or manufacture equipment to be installed on airborne products.

The FAA and the civil aviation community recognize RTCA's DO-178B, "Software Considerations in Airborne Systems and Equipment Certification", as an acceptable means of compliance to the FAA regulations for software aspects of certification. However, there are many aspects of DO-178B that are frequently misinterpreted and that are not consistently applied. *Note: DO-178B is not available for download. For information on obtaining a copy of DO-178B visit the RTCA website at http://www.rtca.org.*

The Aircraft Certification Service is striving to create policy and training to clarify and standardize the application of DO-178B. This web-site provides policy, guidance, training materials, answers to frequently asked questions, information on FAA contacts, and information on the Aircraft Certification Service's software programs. This information is intended to assist FAA personnel, Designated Engineering Representatives, aircraft and software developers, and International Certification Authorities in applying DO-178B to certification products.

Back to the Software Home Page

http://av-info.faa.gov/software/intro.htm 4/10/00

Example 4.3.2 RTCA's DO-178B, available from the RTCA website, http://www.rtca.org/, is part of the effort to develop standards and approval processes for the software aspects of airborne systems.

4.3.3 Document Conversion, Control and Distribution

Document Conversion. A critical element in the electronic document transfer process is converting current documents into a usable form for electronic media, as well setting up processes and safeguards for warehousing the information. If the information is efficiently stored, it can be used for a variety of purposes, not simply for the electronic display (e.g., CBT).

The ATA adopted SGML (Standard Generalized Markup Language) as a standard for both aircraft maintenance and operations. Only the maintenance standard, ATA Spec 2100, however, is complete. The key benefit to this method is that information is reusable for multiple purposes, is independent of specific computer operating systems, and is readable by any software that is "SGML aware."

Another advantage of SGML is the ability to store "metadata," which is "information about information." For example, hidden within an SGML document one might find information about the author, revision number, approval date or other information.

The disadvantage to SGML is complexity. Creating SGML data removes all document formatting information (e.g., fonts, text sizes, paragraph indents, etc.). Then, each paragraph or sentence receives a "tag" with information about that piece of data. The tag may indicate what airplane system it applies to, or that it is a checklist item, systems information, performance data and much more. If an operator chooses to use SGML data, a system must be developed that "de-codes" the SGML data and puts it into a document or database that is available to the intended user. The expertise and time associated with this task can be considerable, especially for a smaller operator with a limited technical staff.

Document Control and Distribution. A key issue is how information is revised and distributed for electronic media. For distribution, there are a variety of methods, few of which require extensive modification. Current examples include:

- Serial or similar connection from a client workstation capable of downloading information (e.g., net-worked workstation in Operations)
- Storage media (e.g., CD ROM, PCMCIA card, magneto-optical disk)
- Modem-type transfer (e.g., RF modem (gate link), connection through external aircraft power cable)
- High speed/bandwidth radio transmission (e.g. SATCOM)

Regardless of method chosen to deliver and update documents, there must be specific procedural, as well as hardware and software, safeguards in place to ensure data integrity of the documents and user compliance with the process requirements to complete loads and updates.

Guideline 409

Enable specific procedural as well as hardware and software safeguards to ensure data integrity of the documents and user compliance with the process requirements to complete loads and updates. (NASA/FAA – 97)

SEE ALSO

Review "Introduction to the Standard Generalized Markup Language (SGML)," by Martin Bryan of the SGML Centre (http://www.sgml.u-net.com).

POSSIBLE SGML STANDARD

The data model for the exchange of data between aircraft manufacturers and operators will contain a number of essential entities along with the specification of their interrelationships. Entities under consideration include the following:

	Action
	Aerodynamic Configuration
	Air Transport Association System
	Airworthiness Aircraft Dispatchability
	Annunciation
	External Condition
	Flight Phase
	Limitation
	Malfunction
	Performance
	Planning Information
	Procedure
	Task (maintenance task - external reference)

PRELIMINARY METADATA ELEMENTS

Metadata is structured information about flight operations data that addresses requirements not covered by the data model. Metadata objects will provide the necessary dynamic information and functions to achieve improved use of the content objects in the data model.

	Authority
	Crew Qualification
	Data Provider
	Regulation
	Responsibility

Example 4.3.3 A data model for the exchange of data between manufacturers and operators can be facilitated by standards such as SGML entities; additional information may be stored through “metadata” elements.

4.3.4 Display Device Considerations

In addition to architecture and functionality questions reviewed earlier, consider the physical display characteristics of the device used to present the documents. Is the device handheld, or in a fixed location on the instrument panel or other location? Does the user interface through a mouse or other input mechanism, hard buttons, touch screen, or a computer "pen?"

If the electronic document display is integrated into the aircraft, may of the guidelines for usability are similar to those pertaining to other aircraft instruments. As one more piece of the instrument array, basic perceptual principles relating to multiple display layout may come into play; for instance, scan pattern, top-down processing, and visual discriminability. In addition, document characteristics such as font size, weight, color, as well as graphics, icons, et cetera, will vary based on distance from display to the user's eye. The flight environment will impact use of input devices, display brightness, screen colors, et cetera.

When the electronic document display is a standalone device, there are other physical attributes to consider including some of the location and usability issues discussed in Subsection 1.4.4, such as volume/weight, wear & tear, and level of information required in flight.

In addition to usability related to physical durability, the standardization and usability issues discussed in Part 2, while identical at a generic level, require special consideration for electronic documents. In a "page-less" environment, navigating within and across documents takes on new meaning and requires different information management skills and training. Because electronic documents are provided relatively little regulatory or industry guidance, pilot feedback, realistic simulator testing, and media training gain in importance (Appendix A).

SEE ALSO

Document location requirements and usability considerations (Subsection 1.4.4). Pros and cons of different checklist media (Subsection 2.4.4).

Key issues related to developing electronic documents (Appendix A).

See C.D. Wickens, S.E. Gordon, & Y. Liu, "An Introduction to Human Factors Engineering", 1998, Addison-Wesley Educational Publishers Inc. New York, NY.

Example 4.3.4 When the electronic document display is integrated into the aircraft, basic perceptual principles relating to multiple display layout may come into play, as well as font size, color, and the use of graphics, icons, et cetera.

4.3.5 Document Design Considerations

Electronic documents are not constrained to the same physical partitioning or layout as paper documents. This principal design paradigm is both the strength and challenge of electronic documents. The concept of "pages" is radically different and the user navigates logically through electronic documents via electronic links.

Pages. Well-designed electronic documents break information into chunks by logical division rather than conventional page layout methods; a method made possible as the electronic document is not constrained by number or size of pages. Consequently, the author designs an electronic "page" to optimize the targeted display characteristics, as opposed to a paper book's physical size. This is an important consideration that relates directly to training costs.

Another important aspect is the concept of "page numbering." Page numbering is essential in paper manuals to help the user find the location of required information. Through use of electronic links, as well as logical organization, page numbers become meaningless. One caution, however, is that current FAA approval processes outlined in FAA Order 8400-10 stipulate approval based on page number, and the same physical page must also contain the applicable revision number. As the FAA moves towards considering alternate information approval practices, page-numbering importance will decrease. Use of metadata (See SGML in Subsection 4.3.3) in electronic documents presents a promising method of storing approval and revision data.

Navigation Logic. Navigation through a well-designed electronic document is accomplished by electronic links. These links may be specially presented text (e.g., blue-underlined), icons, dropdown menus, input device movement, et cetera. Electronic indexes replace conventional "back-of-the-book" paper indexes, and feature the same electronic linking.

Documents must be designed, however, so the user is not required to "drill down" through numerous levels to find important information. Organization and prioritization will assist the user to find critical information quickly via electronic links, while less important information may be several "clicks" away. Another consideration for navigation logic as well as symbology, use of colors and formatting is to ensure the methods used are compatible with the specific flight deck.

Guideline 410

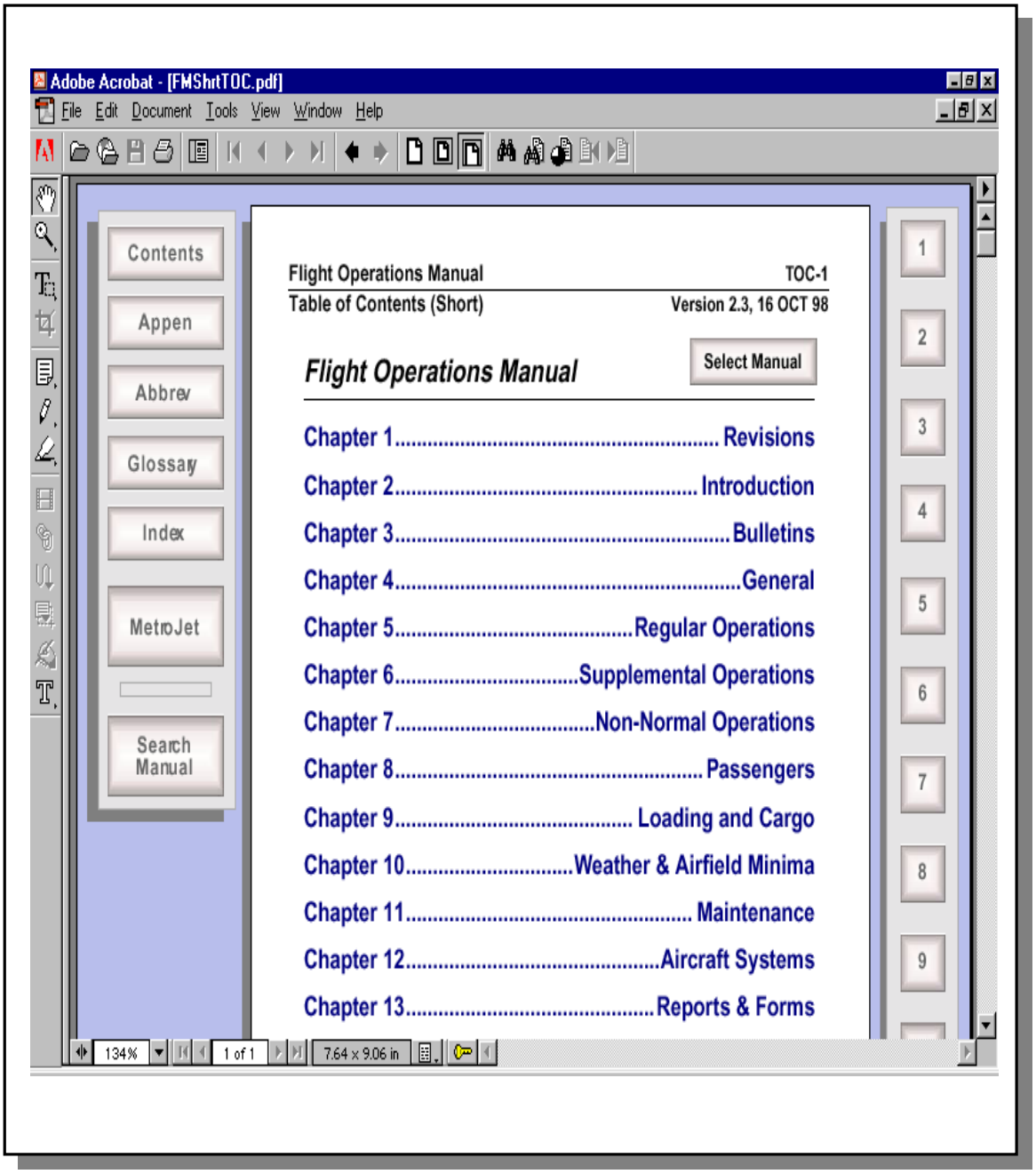
Review web design instructional material to help determine an organizational architecture for electronic documents. (NASA/FAA – 97)

Guideline 411

Review FAA Order 8400.10 for operating manual content requirements and approval processes. (NASA/FAA – 97)

SEE ALSO

See Louis Rosenfeld & Peter Morville's book, "Information Architecture for the World Wide Web," 1998, O'Reilly & Associates, Sebastopol, CA.



Example 4.3.5 Review web design instructional material to help determine an organizational architecture for electronic documents. Guideline 410

4.4 Planning for Internet/Intranet

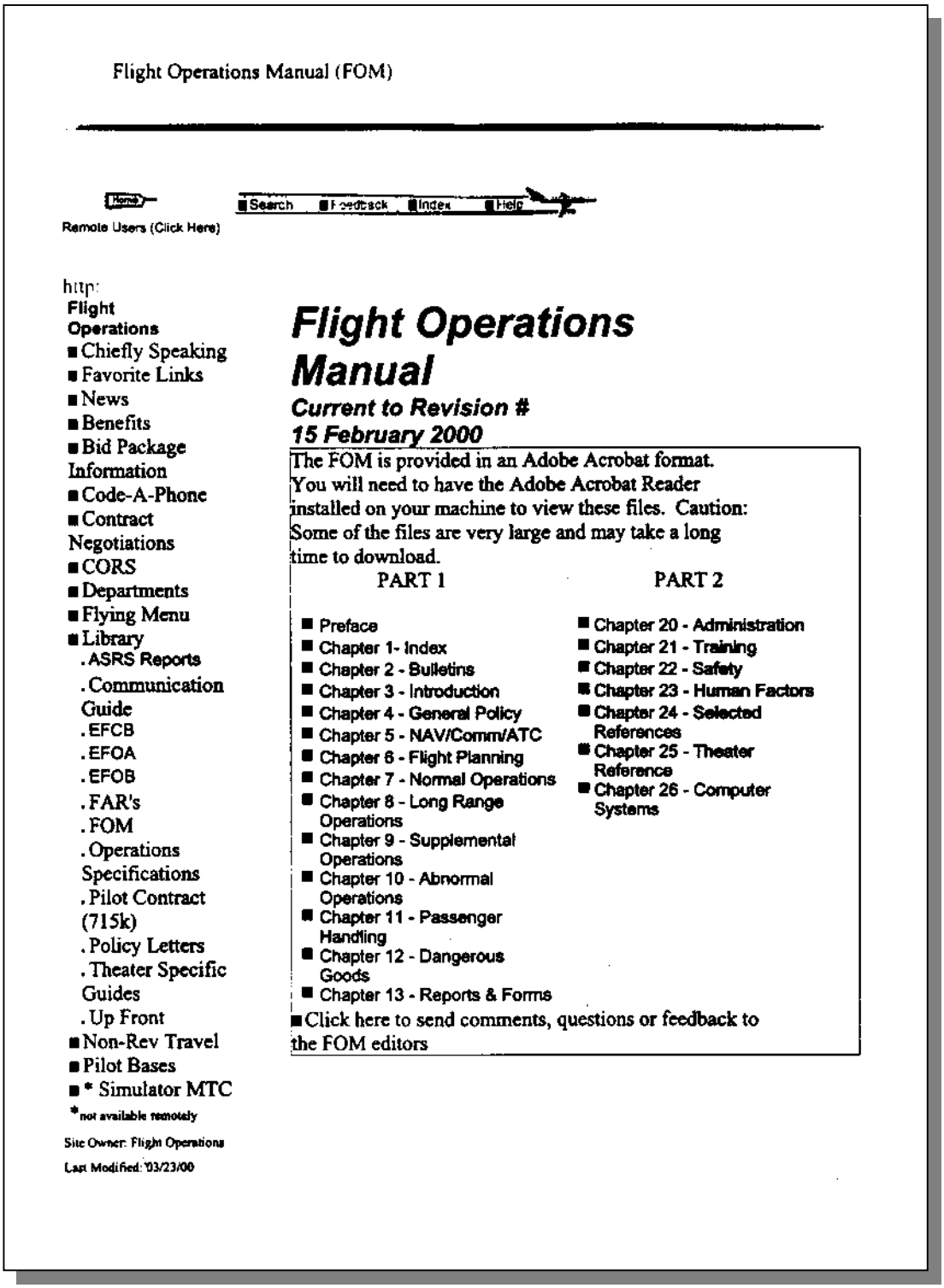
4.4.1 Electronically Distributed Flight Documents

Electronic Flight Documents for Pilots. The proliferation of inter/intranet capability provides real-time, remote access to critical information by pilots. If the flight deck display device (or pilot's personal electronic display device) is remotely located from standard company data sources, the pilot can connect through the inter/ intranet and update electronic documents. Depending on the device's level of functionality, the pilot may also retrieve information for an upcoming flight, schedule a trip, et cetera. This is a design consideration, however, that must be made during initial phases.

Intranets provide significant capability to update electronic documents anywhere a company network exists. With an added link from networked workstations to portable devices or the aircraft, the company may achieve seamless and extremely rapid dissemination of new or revised documents.

Electronic Flight Documents for Non-Pilots. This Manual focuses on flight deck applications. However, there are significant and relatively inexpensive means of deploying information to non-pilot users who have need for the same information (e.g., dispatchers, decision-makers, etc.). This information can be made available via company inter/intranets, creating significant savings and tremendous improvements in communication across departments.

An important consideration is that this capability requires no regulatory certification/approval, and can be quickly deployed. In addition, users are not required to post frequent revisions or store the manuals.



Flight Operations Manual (FOM)

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Flight Operations Manual

Current to Revision #

15 February 2000

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Example 4.4.1 Intranets provide significant capability to update electronic documents anywhere a company network exists.

4.4.2 Security

Security of company information is vital regardless of medium. Security should be based on the value of a resource and the risk of its alteration, loss or misuse. Valuable information should be exposed to low risk based on a cost benefit analysis and a good security policy that is fully supported by the organization. Security has traditionally centered on technical solutions such as firewalls, content security software, and security probes. Analysis of actual security incidents shows that many are due to deficiencies in the security policy or in its enforcement. The human element of security is often the weakest part of the process and should be addressed in the design of policies and procedures.

A good security policy details the steps of the approach taken, and it should be clearly stated in procedural manuals used at all levels of the organization. A security policy should state who does what, when, where and how. With ongoing threats to internal security, Intranet security should be an important part of an organization's security policy. A major challenge in this area is increasing security awareness across the organization. For example, a significant threat to security is poorly chosen passwords. Many security incidents start with password guessing and gaining access to the system. Common password problems include no password, password as username, password as company name, or a password as dictionary word.

Regular evaluation is crucial to keep security up to par with evolving technology. Part of the evaluation can be automated by a scanner software program that will attempt known attacks against your information system. The security audit is also essential. It is an in-depth examination of the system by a security expert using available tools and techniques to penetrate the system. The audit includes a detailed report providing corrective actions that an organization should take to protect its information assets. Both approaches should be used in an ongoing schedule by combining a daily automated scan with a regular expert audit.

Guideline 412

Evaluate current company inter/intranet security policies and procedures against the physical security of the information within the organization. Security should be based on the value of specific resources and the risk of their alteration, loss or misuse. (NASA/FAA – 97)

Guideline 413

Ensure that intranet security is an important part of an organization's security policy and maintain a high level of internal security by raising the organization's awareness. (NASA/FAA – 97)

Guideline 414

Enforce good password practices by not allowing them to contain proper nouns or dictionary words. Each password should differ from the user's login name as well as from standard variations of that login name. New passwords should differ from the old one by at least three characters. (NASA/FAA – 97)

USEFUL SECURITY TERMS

Audit	A security audit involves having a security expert try to use available techniques to penetrate your system and then specify corrective actions to improve security.
Content Security	The screening of information that is pulled from an insecure source for viruses or hostile code fragments. This function is complimentary to firewalls or security probes.
Firewall	A network element with multiple interfaces to screen and inspect traffic for specific characteristics that match the firewall policy.
Internal attacks	Inside attacks by current members of the organization, former members, or other attackers that have gained access to the internal network.
Log Analysis	Review of records of activities of exposed components, such as firewalls, routers or web servers.
Scanner	A software program that will try predefined, well known attacks against your infrastructure.
Security Policy	An overall approach to security with respect to the available resources, the responsibilities involved and guidelines and standards considered "good practice" in the organization.
Security Probe	A probe is a device that constantly monitors traffic as it flows through the network. When a suspicious traffic signature is detected, the probe will perform a predefined activity.

Example 4.4.2 Security of company information is vital regardless of medium. Security should be based on the value of a resource and the risk of its alteration, loss or misuse. Guideline 412

4.5 Cost/Benefits of Electronic Media

An analysis of cost versus benefits occurs in the initial steps when considering a conversion to electronic media. A general guideline is that ROI should occur within 18 months of deployment. However, the initial cost of selecting and acquiring a system, document conversion, approval, certification and infrastructure adjustments, make the 18 month ROI unlikely, but significant ROIs may be possible over somewhat longer periods.

4.5.1 Cost/Benefit Areas

To fully capture all significant areas of the cost benefit analysis, discard standard paradigms and look beyond simple cost/benefit analysis models. Areas to explore include:

- Publishing Costs. Cost of reproducing paper documents.
- Warehousing Costs and Office Budget. Cost to warehouse manuals/documents inventory, replacement pages, et cetera. Consider office budget separately as well.
- Distribution Personnel Costs. Cost of personnel to distribute paper documents.
- Other Personnel Costs. Consider time and materials spent coordinating paper documents with various decision-makers and regulatory agencies.
- Distribution Costs. Cost to distribute documents increases with the number of hubs and shipment locations. The cost of electronically distributed changes however would be near zero once associated equipment and network capability was installed.
- Training Costs. Training costs decrease as the complexity of the task decreases. Well-designed electronic manuals decrease task complexity, thereby decreasing training time.
- Fuel Costs. Certain onboard aircraft performance and airfield analysis software packages can save significant dollars by allowing crews to take advantage of shorter runway lengths, “pop-up” takeoff/landing opportunities, et cetera. Additional estimated fuel savings by not carrying flight bags (two at up to 35 pounds each) is significant given numbers and length of daily flights for large carriers.
- Workman's Compensation Claims. There are several types of common injuries resulting from carrying heavy flight bags. A significant decrease in Workman’s Comp claims might occur.
- Safety Enhancement. Although safety costs are difficult to capture, they can become very real when incidents and accidents occur. If an electronic medium substantially reduces crew errors during a flight critical activity, (e.g., accomplishing normal and nonnormal checklists), the safety enhancement may be used as one of the criteria for decision making.
- Cost Benefit Calculations. Alternative methods to straight-line ROI can demonstrate early benefits. Consider using an internal rate of return and net present value to support your proposal.

Guideline 415

Conduct detailed analysis of current paper-based costs; include costs of materials, services, personnel and process costs. Evaluate proposal through different cost analysis methods. (NASA/FAA – 97)

ELECTRONIC MEDIA COST/BENEFIT
Areas to Consider for Savings

MAIN AREAS OF SAVINGS

When conducting a cost/benefit analysis review possible savings in production, printing, warehousing, and distribution of traditional checklists, handbooks, and manuals. Consider which manuals will be available electronically, and how many copies, such as flight operations copies, can be reduced or eliminated when available on line. Also consider possible saving in personnel and materials as you move to digital data.

Production Savings	Electronic production can save you personnel hours and material especially when done across the organization.
Printing Savings	When moving documents on line, the number of printed copies can be reduced especially for "office" and review copies.
Warehousing Savings	There may be a space and personnel savings as an organization's warehousing needs are reduced.
Distribution Savings	Costs of handing out, mailing, and "chasing" aircraft should be reviewed for possible savings.

ADDITIONAL CONSIDERATIONS

There are additional advantages to electronic media, but these are more difficult to quantify in terms of cost savings.

Quicker Updates	Electronic media can speed up the review process as well as production and distribution.
Less Paper Bulk	Whether in storage, on the aircraft, or in flight bags, less paper can lead to savings in weight and/or volume.
Efficient Access to Data	The entire operation can benefit from more efficient access to data that is also more accurate because it is more up to date.
Improved Safety	Getting updates and revisions on the line and throughout the operations improves safety.

Example 4.5.1 Beyond simple cost/benefit analysis models, consider possible savings in personnel and materials as they relate to production, printing, warehousing and distribution. Guideline 415

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Web References

The following references to the World Wide Web are cited in this Manual and are current as of October 2000. Please be aware that website addresses change frequently and you may need to update them. Links to the related Subsection where the citation first appears are shown in parentheses.

Aeronautical Information Manual (AIM) (Subsection 1.3.1)
http://www.faa.gov/atpubs/aim

Air Traffic Control (ATC) Handbook (Subsection 1.3.1)
http://www.faa.gov/atpubs/ATC/INDEX.htm

Air Transport Association (Subsection 4.2.2)
Specification 2100, "Digital Data Standards for Aircraft Support,"
http://www.air-transport.org/public/publications/62.asp

Air Transportation Operations Inspector's Handbook (8400.10) (Subsection 1.2.2)
http://www.faa.gov/avr/afs/faa/8400/8400.html

Aeronautical Radio, Inc. (ARINC) 763 File Server Standard (Subsection 4.3.1)
http://www.arinc.com/characteristics/arinc700.html

Air Transportation Oversight System (ATOS) (Subsection 1.1.1)
http://www.faa.gov/avr/afs/atos/

FAA Advisory Circulars (Subsection 4.2.1)
http://www.faa.gov/abc/ac-chklst/actoc.htm

FAA Regulations (Subsection 2.1.1)
http://www.faa.gov/aviation.htm

Radio Technical Commission for Aeronautics (RTCA), Inc. (Subsection 4.2.1)
http://www.rtca.org/

The SGML Centre (Subsection 4.3.3)
(http://www.sgml.u-net.com)

Definitions

Acronyms and terms defined below are used consistently throughout this document as follows:

8400.10	FAA (1994). *8400.10 Air Transportation Operations Inspector's Handbook*, Volume 3, Chapter 15. Manual, Procedures, and Checklists. Washington, DC: Federal Aviation Administration.
A&S-97	Adamski, A. J. & Stahl, A. F. (1997). Principles of Design and Display for Aviation Technical Messages. *Flight Safety Digest*, Volume 16: 1-29.
Abnormal	A nonroutine operation requiring certain actions or procedures to maintain an acceptable level of system integrity or airworthiness.
AC	Advisory Circular
Accepted	Describes a document that must be submitted to the FAA for review but does not require FAA approval.
AFM	Airplane Flight Manual
AIM	Aeronautical Information Manual
Aircraft	An airplane used for passenger or cargo operations.
AOM	Aircraft Operating Manual
APM	FAA Aircraft Program Manager
Approved	Describes a document that requires FAA approval indicating the FAA has evaluated and approved it.
AQP	*Advanced Qualification Program* - An alternative training and assessment program based on proficiency-based training where the Proficiency Objectives are systematically developed, maintained and validated.
ASRS	*Aviation Safety Reporting System* - A NASA sponsored reporting system where reports are submitted voluntarily, deidentified and entered into a database.
ATA	Air Transport Association
ATC	Air Traffic Control
Brief	A specific briefing such as the Takeoff Briefing or the Approach Briefing.
Cabin Crew	Those crewmembers, such as flight attendants, whose primary duty position is in the aircraft cabin.

Camera-Ready Copy	See CRC
Category	A grouping of data values along a dimension defined for operational purposes. For example, an air traffic controller might wish to implement the same procedures for all aircraft with speeds in the category of 600 to 800 knots. See also value.
Caution	An instruction about a hazard, that if ignored, could result in damage to the aircraft or its systems.
CFM	*Company Flight Manual* - An approved aircraft flight manual developed by or for an operator for a specific aircraft type.
Checklist	A formal list used to compare, identify or verify a group of actions or items.
COM	Cockpit Operating Manual
Command Language	A type of dialogue in which a user composes control entries, possibly with prompting by the computer.
Communication Interface	DDB field used to record the communications, such as to passengers or to ground, affected by the information topic.
CQP	*Continuing Qualification Program* - The ongoing program during which the proficiency objectives are trained and evaluated. A continuing qualification cycle may last two years and be made up of two evaluations taking place at 12-month intervals.
CRC	*Camera-Ready Copy* - The final version of the procedure, QRH, QRC or guide that is sent to the printers for reproduction.
Crew Qualification	DDB field used to record the flight crew qualifications, such as pilot restrictions, associated with the information topic.
Crew	All crewmembers on board the aircraft to include flight crew and cabin crew.
Crewmember	An individual member of the crew, either from the flight crew or the cabin crew.
CRM	*Crew Resource Management* - The effective use of all resources to include human and other aviation system resources.
Cross Reference	A reference or notation to another section, page or part of the same or another document.
Cross Referencing	The act of making one or more references to other sections, pages or parts of documents.

Cursor	A marker on the display screen that indicates the current position for attention, which may designate a displayed item. A cursor might be positioned under computer control or by the user.
D&W-91	Degani, A., & Wiener, E. L. (1991). Philosophy, policies, and procedures: The three P's of flight-deck operations. *Proceedings of the Sixth International Symposium on Aviation Psychology* (pp. 184-191). Columbus, OH: The Ohio State University.
D&W-93	Degani, A., & Wiener, E. L. (1993). Cockpit checklists: Concepts, design, and use. *Human Factors*, *35*, 345-359.
D&W-94	Degani, A., & Wiener, E. L. (1994). *On the design of flight-deck procedures*. (NASA Contractor Report 177642). Moffett Field, CA: NASA Ames Research Center.
D-92	Degani, A. (1992). *On the typography of flight-deck documentation* (NASA Contractor Report 177605). Moffett Field, CA: NASA Ames Research Center.
Data Display	Output of data from a computer to its users. Generally, this phrase denotes visual output, but it may be qualified to indicate a different modality, such as an auditory display.
Data Entry	User input of data for computer processing, and computer responses to such inputs.
Data Field	An area of the display screen reserved for user entry of a data item.
Database	A collection of data that is stored in the computer.
DDB	*Documents Database* - A structured listing or database of the information topics, requirements, users, approval, distribution, and related data essential to the management of an operating documents system.
Default Value	A predetermined, frequently used value for a data or control entry that is intended to reduce required user entry actions.
Diagram	A special form of a picture in which details are only shown if they are necessary for the performance of a task.
Dialogue	A structured series of interchanges between a user and a computer. A dialogue can be initiated by a computer (e.g., question and answer) or by a user (e.g., command language).
Display Format	The organization of different types of data in a display, including information about the data such as labels and other user guidance such as prompts, error messages, etc.
Document	A written description of a method, procedure or system.
Documents Database	See DDB

Document System	The entire collection of operating documents and manuals organized to be used to specify and direct flight operations.
DOT	Department of Transportation
EFB	Electronic Flight Bag
Emergency	A nonroutine operation requiring certain actions or procedures to protect crew and passengers or the aircraft from serious or potential hazard.
Environmental Factors	DDB field used to record the environmental factors, such as cold weather or windshear, related to the document or information topic.
Example	A part of a document or document system used to exemplify an operator's solution to an issue.
FAA	Federal Aviation Administration
FAA-95	FAA (1995). *Human performance considerations in the use and design of aircraft checklists*. Associate Administrator for Aviation Safety, Human Factors Analysis Division. Washington, DC: Federal Aviation Administration.
FAR	Federal Aviation Regulation
FCOM	Flight Crew Operating Manual
Flight Crew	Those crewmembers whose primary duty position is in the flight deck.
Flight Deck	The forward part of the fuselage containing all the instruments needed to fly the aircraft.
Flow	A panel scan philosophy used to accomplish flight deck required non-safety related tasks or actions.
FOM	Flight Operations Manual
Font	The characteristics of a typeface to include its design, size, and style.
FSM	Flight Standards Manual
FTM	Flight Training Manual
G-95	Gross, M. S. (1995). Studies suggest methods for optimizing checklist design and crew performance. *Flight Safety Digest*, Volume 14:5, 1-10.
Graphic Element	A component part of a graphic display, such as a line, a circle or a scale.
Guideline	A recommendation, not a regulation, based on operator experience, research findings, or human factors principles.

Hard Copy	A printed paper display such as computer output.
Help	A capability that displays information upon user request for on-line guidance. HELP may inform a user generally about system capabilities, or may provide more specific guidance in information handling transactions.
ICAO	International Civil Aviation Organization
Immediate Action	An action that must be taken in response to a nonroutine event so quickly that reference to a checklist is not practical.
Information Date	A DDB field to record the most recent update of the information.
Information Distribution	The method of document or information distribution such as directly to the crew or to the ship's library. Method of information distribution may be tracked through a DDB.
Information Importance	A critical documents organizing criteria based on how quickly the information needs to be accessed. This should be a primary DDB field.
Information Location	The place or places where a document or information is stored. Primary locations may be tracked through a DDB and include the flight deck, flight bag and on the ground.
Information Requirement	The regulation that governs the specific information topic. For US operators, this will often be a section under FAR 121 that should be included in a DDB.
Information Responsibility	The office of primary responsibility (OPR) for the information. A record of the OPR may be tracked through a DDB.
Information Source	The origin of the information in its written of electronic form. In most cases, the source will be a published document which may be tracked in a DDB.
Information Topic	A unit of information used to manage flight information. Information topics may be specified at different levels of detail depending on how they are used within a DDB.
Information Type	A categorization of information used to organize an operating documents system that may include such DDB categories as general, aircraft-specific, and route/geographical information.
Information Users	DDB field label that identifies the end users of the specific information topic.
Issue	A subject under one or more of the topics addressed by this Manual.
Label	A title or descriptor that helps a user identify displayed data. See data field label

Last Review Date	DDB field that records the most recent review date of a document or information topic.
Management Structure	DDB field that records the management element linked to the document or information topic.
MEL	Minimum Equipment List
Menu Selection	A type of dialogue in which a user selects one item out of a list of displayed alternatives, whether the selection is by pointing, by entry of an associated option code, or by activation of an adjacent function key.
MOU	Memorandum of Understanding
NASA	National Aeronautics and Space Administration
NASA/FAA - 97	NASA/FAA - 97 (1997). *Proceedings of the NASA/FAA - 97 Operating Documents Workshops I & II*. 1997. Moffett Field, CA: NASA Ames Research Center.
NASIP	National Air Safety Inspection Program
Nonnormal	Term used to refer to procedures or documents used in nonroutine operations where actions must be taken to maintain system integrity or to protect aircraft, crew, or passengers from hazard.
Normal Checklist	A checklist used in routine or normal flight operations.
Normal	Term used to refer to procedures or documents used in routine operations.
NOTAMS	Notices to Airmen
Note	Provides amplified information, instruction or emphasis.
NTO	No Technical Objection
NTSB	National Transportation Safety Board
Operating Document	The specific flight document or documents where an information topic is placed. By tracking operating document information in a DDB, information redundancy can be reduced or eliminate.
Operating Documents	Cards, checklists, guides, handbooks, and manuals generally prepared by the operator and used in performing operational duties.
Operator	Air carrier or airline engaged in domestic or overseas air transportation. This refers to major, regional and cargo operators.
Page	The data appearing at one time on a single display screen or single side of a piece of paper.

PF	*Pilot Flying* - The pilot flying the aircraft, either PIC or SIC.
Phase of Flight	The standard stages that occur in most operational flights to include preflight, taxi, takeoff, climb, cruise, descent, approach, landing and after-landing.
Phases of Flight (ATA)	DDB field that records the ATA standard phase or phases of flight related to the document or information topic.
Philosophy	High level view of how an operator conducts their business and all operations.
PIC	Pilot In Command
PNF	*Pilot Not Flying* - The pilot on the flight deck not controlling the aircraft.
POI	Principal Operations Inspector
Policy	A written requirement established by an operator's management to be complied with by specified personnel.
Policies	DDB field used to track the operator's policy related to or affected by the information topic.
Procedure	A written sequence of actions and/or decisions prescribed by an operator.
Procedures	DDB field that records the flight deck procedures affected by the information topic.
QRC	*Quick Reference Card* - Brief set of guidelines and procedures, often taking the place of memory items, used during abnormals and emergencies.
QRH	*Quick Reference Handbook* - A document designed to be used in the flight deck that specifies emergency and abnormal procedures.
Regulatory Approval	DDB field used to track whether a document or information topic requires FAA or approval from another agency.
Revision	DDB field used to track the revision status of a document or information topic.
S&M-86	Smith, S. L. & Mosier, J. N. (1986). *Guidelines for Designing User Interface Software*. MTR 10090. Bedford, MA. The MITRE Corporation.
Scrolling	An orientation for display framing in which a user conceives of data as moving behind a fixed display frame. The opposite of panning.
Selecting	A user's action of identifying display elements to the computer in order to manipulate those elements in some way; e.g., to move them, or change their attribute(s), or delete them.

SGML	Standard Generalized Markup Language
SIC	Second In Command
SME	Subject Matter Expert
SOP	Standard Operating Procedure
Standardization	The mandate for or the actions of achieving a level of consistency across fleets or within a document system.
Style Manual	A guide that establishes formatting and writing standards to ensure standard writing style, terminology, use of graphics, and formatting across documents.
Systems (ATA)	DDB field that records the ATA system or systems related to the document or information topic.
T&H-91	Turner, J. W., & Huntley, M. S. (1991). *The use and design of flight crew checklists and manuals*. (DOT/FAA/AM-91/7). Cambridge, MA: National Transportation Systems Center.
Task Analysis	A method to develop a detailed listing of tasks, subtasks and elements belonging to a job such as that of a flight crewmember.
Task Listing	The listing of tasks, subtasks and elements identified through a task analysis.
Technique	A method to accomplish a procedure, maneuver or policy.
Topic	The higher-level subjects, such as “Document Location,” or “Indexing,” used to organize this Manual.
Training	DDB field that records the training area affected by (or that addresses) the information topic.
Typography	Characteristics of printed or displayed information including font specifications and line characteristics.
Usability	The effect of document design, structure and functionality on learning and using the document or system.
User Interface	All aspects of information system design that affect a user’s participation in information handling transactions.
User	Any person who uses an information system in performing his/her job.
Value	Specific data for a particular dimension or variable. For example, values for an aircraft's speed might be 800 knots during one observation and 500 knots during another.
Warning	An instruction about a hazard, if ignored, could result in injury, loss of aircraft control or loss of life.

Index

Appendix A
History of Operating Documents Project

Design and Use of Operating Documents

Presented at the Tenth International Symposium on Aviation Psychology
May 3-6, 1999

Ohio State University
Columbus, Ohio

DESIGN AND USE OF OPERATING DOCUMENTS

Barbara G. Kanki
NASA Ames Research Center
Moffett Field, California

Thomas L. Seamster
Cognitive & Human Factors
Santa Fe, New Mexico

Mark Lopez
Delta Air Lines
Atlanta, Georgia

Ronald J. Thomas and William W. LeRoy
US Airways
Pittsburgh, Pennsylvania

ABSTRACT

Operating documents, especially those used by crews in the cockpit, need to be compatible with regulations, aircraft systems, and, most importantly, the operational environment. In addition, operating documents must be internally consistent with the entire system of documents. There are many guidelines covering most aspects of document development. It is difficult for operators to use these guidelines in their current form which is distributed across a number of reports and other publications. To correct this situation, representatives from many of the US operators have been involved in two workshops to identify their most important document development issues and to organize those issues in a way that is operationally meaningful. Results from the workshops are being used to assess existing guidelines and reorganize them into a manual for operators. One group of results indicates differences in priorities among the three different types of operations involved in these workshops: 1) Majors, 2) Regionals, and 3) Cargo. A second set of results identifies the most important guideline issues. These results provide a detailed outline for organizing operating document guidelines according to five primary issues: 1) organization of documents, 2) standardization of documents, 3) usability of documents, 4) document development process, and 5) transition to electronic media. Additional results from these workshops have shown the importance of using examples to illustrate issues and to demonstrate the application of specific guidelines. Collectively, the results highlight the main document development issues and show how guidelines should be organized and presented in order to help carriers address those issues.

INTRODUCTION

This NASA/FAA project grew from two independent efforts to integrate CRM principles into flightcrew procedures. The original research projects focused on enhancing crew performance, addressing standardization and compliance issues, and improving the link between procedures and operational reality. Specifically, guidelines for across-fleet standardization of normal checklists and the development of a quick reference handbook (QRH) for abnormal and emergency procedures were researched. In each of these cases, many aspects of design were called into play: procedure content, structure, logic, format, terminology, roles and usage. In addition to these features, it became obvious that the design process also required a consideration of the overall information system.

One of the two research projects (see Seamster, Boehm-Davis, Holt, & Schultz, 1998) has documented the need to consider operational constraints and problems when designing new procedures and documentation. In addition, all re-design efforts should consider consistencies across departments (e.g., training, evaluation, safety, maintenance), and consistencies across other documents (aircraft operating manuals, training documents, checklists, company policies, etc.). To invoke Degani and Wiener's 4 P's (1994), operating documents should be internally consistent with the organization's philosophies, policies, procedures and practices. In addition, external consistency must be maintained with regulations, manufacturer requirements, and with human factors principles and guidelines, with usability testing the foundation of the design and development effort.

The current project is called the NASA/FAA Flight Operating Documents project, funded by FAA AAR-100, Air Carrier Training Research and supported by NASA Ames Research Center. Industry participation includes operators, and manufacturers with America West, American Airlines, American Eagle, Delta Air Lines, TWA, and US Airways playing a major role in the effort.

Research Goals and Approach

There are numerous guidelines applicable to procedure and document development grouped by checklist (Degani & Wiener, 1993; FAA, 1995; Turner & Huntley, 1991), procedure (Degani & Wiener, 1994), and display/typography (Adamski & Stahl, 1997; Degani, 1992) considerations. It can be difficult for operators to make the best use of these guidelines in their current form distributed across a number of reports and publications.

The goals of this project are threefold: 1) Identify the key issues in the development of operating documents 2) Assemble guidelines that address those issues in a way that will help operators develop operating document systems, and 3) Incorporate examples of current approaches to resolving key issues. Detailed descriptions of current approaches including both potential pitfalls and successful solutions are useful lessons learned. In addition to information sharing through workshops and focus groups, the product for this project will be an Operating Documents Manual. It is important for this Manual to be based on participation and input from as many operators as possible so that it will have a high degree of operational relevance.

METHODS

Two workshops were held to identify key issues in the development of operating documents and lessons learned. From 35 participants in Workshop I to over 70 in Workshop II, 20 organizations represented a cross section of major, regional, and cargo operations, and manufacturers. The workshops provided a dynamic environment in which operators could present, discuss, and ultimately rate the importance of operating document topics and issues.

Workshop I: Key Topics

Participants provided three sets of survey results in Workshop I, and those results have guided the direction of this project. The first set of results, based on the responses of 35 participants, identified the most important guideline topics. These results provided a detailed outline for organizing operating document guidelines according to five primary topics: 1) organization of documents, 2) standardization of documents, 3) usability of documents, 4) document development process, and 5) transition to electronic media. Topic areas 1-4 are applicable to nearly all operating documents projects although existing guidelines do not address all issues equally well. Topic 5, transition to electronic media is a special topic of growing importance among the major carriers and cargo operators.

The second group of survey results based on a total of 24 participants underscored the differences in priorities among the three categories of operators: 1) Majors, 2) Regionals, and 3) Cargo (see Table 1). Major carriers tended to focus on one or two topics within topic areas (e.g., CRM policies and procedures, Training new procedures). Regionals, on the other hand, found numerous topics to be of equally high importance within almost all topic areas. A few topics (e.g., Reducing number of documents, Human factors of checklist design) showed similar rating patterns across all three types of operations. Another emergent pattern showed that cargo operators placed greater importance on topics related to Use and Transition to Electronic Media compared with majors and regionals. These ratings reflect current and perhaps transitory interests, but the patterns indicate variations in interests and concerns, presumably due to operational differences as well as organizational commitment and economic factors.

The third survey based on input from 24 organizations indicated that operating documents are organized in very different ways. Although there are standard requirements for what information must be carried in flight (e.g., Subparts G and K of FAA Part 121 operating requirements), operators coordinate with their local FAA Principal Operations Inspector (POI), combining and distributing information in a variety of ways. The location of that information (e.g., flightbag, aircraft, base/home) creates further operator differences in responsibility and maintenance of documents.

Workshop II: Key Issues

Workshop II was organized around the following five focus groups: 1) Organization of Documents, 2) Standardization of Documents, 3) Usability of Documents, 4) Development and Maintenance of Documents, and 5) Transition to Electronic Media. Within these focus groups, participants identified and discussed the issues of greatest importance to them. During the first day, participants shared current approaches and future plans, pointed out potential problems and tradeoffs, and discussed regulatory constraints and operational benefits. Similar to Workshop I, the description of approaches, discussion points and the application of specific guidelines were

greatly enhanced through illustration with actual examples from the operators. On the second day, each focus group presented the results of their discussion and participants again rated specific issues on importance. Although organizations were engaged in a wide range of document re-design projects, they collectively identified the issues in Table 2 as most important.

Table 1: Topic Ratings by Operator Type

		Ratings by Operator Type*		
Topic Areas	**Topics**	**Major**	**Regional**	**Cargo**
ORGANIZATION OF DOCUMENTS	Cockpit-based vs. flight bag vs. at home	2.89	3.14	**4.25**
	Merging/consolidation of manuals	**4.00**	4.00	3.25
	Consolidation of checklists	3.11	**4.00**	3.25
	Reorganizing documents	3.67	**4.57**	3.00
	Reducing number of documents	**4.44**	**4.14**	**4.25**
	Redundant information issues	3.78	**4.14**	3.75
	Index across documents (system index)	4.22	**4.29**	3.00
PHILOSOPHY & POLICIES	Flow-driven procedures & checklists	4.22	4.14	**4.00**
	CRM procedures & policy	**4.22**	**4.00**	3.50
	Manual revision policy	3.78	**4.00**	**4.25**
STANDARDIZA-TION	Standardization across fleets	4.33	3.71	**4.50**
	Standardized flows	**4.22**	3.57	3.75
	Standardization across documents	3.78	**4.29**	**4.25**
	Standardization of terminology	3.89	**4.43**	**4.50**
DEVELOPMENT PROCESS	Integration with Regulations & Manufacturers	3.78	**4.00**	3.50
	Involvement of POI's	3.89	**4.14**	**4.25**
	Integration of vendor documents	3.11	3.71	**4.00**
	Training of new procedures	**4.11**	**4.00**	3.75
	Revision and updating document content	3.44	**4.29**	3.50
USABILITY & INDEXING	**Human factors of checklist design & format**	**4.22**	**4.71**	**4.50**
	Techniques vs. procedures	3.89	**4.14**	3.00
	Memory Items / Immediate action items	3.44	**4.57**	**4.00**
	Managing the accomplishment of checklists	3.78	**4.43**	3.50
	Navigating within documents	4.22	**4.00**	3.25
	Navigating within procedure	**4.00**	3.57	3.25
	Navigating from one checklist to another	3.89	**4.14**	3.75
ELECTRONIC MEDIA	Integrate electronic media with FAA standards	3.89	4.00	**4.50**
	Design guidelines for electronic documentation	4.11	3.86	**4.00**
	Onboard computer systems	3.44	2.43	**4.50**
	Use of intra/internet	3.89	3.00	**4.50**
	Total Number of Highly Rated Topics	**7**	**19**	**14**

* 5-point scale with 5=Most Important

*Note: Topic with Means ≥ 4 are **BOLD** in Shaded Area. A few means ≥ 4 are unmarked due to inter-rater variability*

Table 2. Top Ten Issues (lower ratings indicate higher importance)

Issues	Focus Group Topic	Importance Rating*
ORGANIZATION OF DOCUMENTS		
Required for flight	Document Location	1.67
Develop for Time Critical Information	Guides / Cards / Checklists	1.80
Get feedback from flight crews and others involved in operation	Reorganizing Documents	1.85
Test organization logic in simulator under real time operation	Reorganizing Documents	1.91
Non-normal** indexing is very time critical and important	Indexing	2.00
STANDARDIZATION & USABILITY		
Maintaining consistency	Standardization of Procedures and Flows	1.87
Style manuals	Standardization Across Fleets	1.87
Style guide and master templates	Document Design, Format, and Typography	1.87
Abnormal** procedure flow (associated system abnormals)	Managing the Accomplishment of Procedures	1.97
DEVELOPMENT AND MAINTENANCE OF DOCUMENTS		
Communicating Mechanisms	Introduction of New Procedures / Information	1.97

* 5-point scale with 1=Most Important

** Note: Operators use the terms abnomal, emergency, and non-normal in different ways. In reporting survey results, we are not imposing one particular definition over another

Top Ten Issues

The top issues in Table 2 do not exclusively represent one topic area. Rather, they extend across different aspects of document and procedure design, ranging from high level organizational issues (e.g., implementing communication mechanisms for introducing new information), to specific formatting and typography decisions (development of style guides and master templates). Further, these importance ratings probably represent more than one dimension of "importance" (e.g., highest risk consequence, greatest impact on user performance and acceptance, most in need of improvement). For whatever the underlying reasons, there is consensus that information requirements for time critical procedures in flight are of unique importance within the overall information system. Highlighted is the importance of determining abnormal procedure flows from one procedure or document to another with an effective indexing system. It is recommended that the organization logic be tested in the simulator under realistic conditions. Additionally, key issues in the document development process emphasize the need for communication to and feedback from the crew members involved. Finally, key issues are identified for maintaining consistency across the entire document system through standardization at both procedure and document design levels.

Transition to Electronic Media

The issues discussed above are relevant to documents of any media type. However, the transition from paper to electronic media alters critical aspects of the design and use of operating documents. Specific guidelines for standardization and usability may no longer apply in the same way which means new guidelines must be written for FAA approval. To illustrate some of the differences between paper and electronic documents, let us re-consider the issues described above.

Top Issues Applied to Developing Paper Documents

The organization of the document system defines the structure of how information is distributed across documents and locations to satisfy information requirements. Organizing criteria focus on how often the information is used, when it is needed, what level of accessibility is required and a number of other time and location requirements. An example of time critical, abnormal/emergency procedures required in flight is the information contained in a Quick Reference Handbook (QRH), a paper document usually located and maintained on the aircraft.

Using QRH development as an example, feedback from pilots would be solicited throughout the development or re-design process. Communication mechanisms for introducing the QRH to pilots would be made in a timely way with appropriate guidance for use.

At the procedure level, the QRH would necessarily contain aircraft specific procedures, such as how to shut down an engine. But standardization of procedures should be applied when appropriate. As an example, an operator may decide that at the first indication of an engine fire all aircraft types will proceed to the nearest suitable airport for landing. In addition to standardization, abnormal/emergency procedure flows that maximize usability would also be determined.

At the document formatting level, both standardization and usability could be enhanced through the development of style guides and templates. A key design issue to be resolved would be an indexing system that promotes accurate and efficient navigation from one procedure to another. While satisfying usability requirements, the indexing system would also help to ensure standardization across other documents in the information system.

The development process requires numerous design decisions and tradeoffs to be made for which there are no absolute guidelines. In spite of some regulatory, manufacturer and human factors guidance, many decisions would be tailored to the specific operations, resources, fleet characteristics, and existing information system of the operator. Therefore, when possible, it is important to test the organizational logic of one's documents and procedures in the simulator under real time conditions. Testing the logic of a QRH would focus on time critical abnormal/emergency procedures used in flight. It would specifically evaluate the usability of the document and whether the information needed can be correctly accessed and used in the time allowed. Effective testing would answer questions such as: Does the procedure flow correspond to how pilots are trained and how they must perform under realistic conditions? Can the pilot navigate within the QRH from one procedure to another or back to normal operations? Test results would feed back into the design process as well as highlight potential issues for training.

Top Issues Applied to Developing Electronic Documents

Following the example above, developing an electronic document would again start with a focus on information requirements. Can an electronic document provide the information needed when it is needed? Obviously, issues of information access are dramatically different comparing paper to electronics, since the concepts of a page, and of "page-turning" are no longer relevant. Although it is possible to design a display to look like a page and to make button pushes or touchscreens equivalent to turning pages, such constraints are unnecessary and inefficient especially when information needs are time critical. In addition, the concept of standalone manuals loses significance, as electronic documents are not constrained by size or location in the same way as paper. In sum, the chief benefit of electronic media from a users standpoint is ease of navigation through use of electronic linking for rapid access to time-sensitive information. However, pilot feedback and realistic simulator helps to validate whether organization logic and media access satisfy the information requirements.

At a generic level, the issues of standardization and usability for onboard documents are the same regardless of media. For instance, it is always important to determine procedure flow, and maintain standardization across fleets and documents. However, at the procedure level, there are subtle differences. Consider a specific procedure that requires the pilot to refer to and accomplish one or more additional partial or complete procedures, in order to complete the original procedure. Because the electronic document is not page-constrained, it would incorporate all relevant steps into a single procedure. This difference effectively reduces the number of unique procedures that must be trained and used.

At the document level, differences are numerous. Paper documents have the advantage of some external guidance from industry, research and experience. Electronic documents have few standards to follow, and research often falls outside the unique requirements of in-flight usage. Probably most difficult is the concept of standardization of documents when parts of the information system are paper-based and other parts are electronic. The document development process for electronic media has similarities to that of the paper document but not without major changes. For instance, the introduction of a new electronic document may require media training in addition to procedure training, thus re-emphasizing the need for effective communication mechanisms.

There are many areas in which the information system can be enhanced through electronic media. In the organization of the entire information system, electronic media can help to resolve issues of redundant information and cross-referencing, indexing and navigation within and across documents. With proper implementation and training, this has the potential for reducing "heads down" time in the cockpit environment. In the areas of standardization and usability, the use of style guides and templates acquire

great power in maintaining consistency across fleets, across documents, and across departments. Consistency can be checked and maintained with respect to format, terminology, and indexing, as well as conventions pertaining to the actual accomplishment of the procedure (e.g., use of conditionals, decision trees). The document development process for electronic media requires greatly revised methods and standards (e.g., internal and external approval process, production process, communication mechanisms), but an effectively revised document development process can take advantage of its improved capabilities for distributing and tracking revisions, checking and ensuring consistency within the entire information system.

Summary

This paper discusses the approach and results of the Flight Operating Documents project in which an industry team was formed to 1) identify key issues in the development of operating documents, 2) assemble guidelines that help operators address those issues in the development of operating documents and 3) incorporate examples of different approaches to resolving key issues. Operators have specific needs and concerns whether they are developing a single manual or an entire document system. They are particularly interested in the best way to organize and present information required for flight, with an emphasis on time critical elements. This chief area of concern is not limited to checklists, but also includes manuals and handbooks; it is not limited to abnormal and emergency procedures, but also includes time critical normal procedures.

Although this project evolved from research efforts to integrate CRM into operations, it is interesting to note how our initial approach to document development grew to include a broader view of the document system, an appreciation for regulatory and manufacturer requirements, as well as the production and maintenance process for developing and distributing essential flight information. It was rewarding to see that all participants involved in this project consider usability testing and collection of user feedback important aspects of the design and development process.

The culmination of this effort will result in the production of an Operating Documents Manual based on participation and input from major, regional and cargo operators. The manual will address the most important operator issues and provide current examples of different approaches. This collaborative effort between researchers and operators has helped to focus the development issues and highlight the need to support guidelines with specific examples and approaches that operators have taken in applying these guidelines.

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Appendix B
Guidelines List & Matrix

Guideline Number	Guideline Text	Primary Source
100	Develop an organizing system based on the entire development process including the planning, design, review, production and distribution of documents. Each part of the process should be considered when developing the overall organization.	NASA/FAA - 97
101	Develop a user-centered organizing system with the primary objective of meeting user needs.	NASA/FAA - 97
102	Treat each new effort or reorganization as an opportunity to introduce positive innovations by coordinating with the local POIs.	NASA/FAA - 97
103	Consider developing some form of a database, such as a DDB, when starting to develop or when reorganizing your operating documents system. This form of database may be used to manage the organization, design, review, revision and distribution of documents.	NASA/FAA - 97
104	Develop initial listings based on company and FAA/regulatory sources to include topics in 8400.10 and FAR 121.135.	NASA/FAA - 97
105	Establish an iterative and flexible process where the DDB in general and specifically the Information Topics can be reorganized, subdivided and updated on an ongoing basis.	NASA/FAA - 97
106	Ensure that manufacturer information taken from the AFM is amplified and translated into a form suitable for flight crews.	NASA/FAA - 97
107	Ensure that crew coordination procedures, policies and philosophy unique to their operation are included in the appropriate parts of manuals translated from manufacturers.	NASA/FAA - 97
108	Develop philosophy and policies based on the operational environment, and then use them to guide the design of procedures to make them both operationally relevant and beneficial to users such as flight crews.	D&W-91
109	Identify or develop a consistent, high level philosophy stating how the operation is to function. A statement of philosophy should highlight the unique and most positive aspects of the operations mission. Policies then flow from that philosophy with policies consistent with the philosophy and other policies.	D&W-91
110	Start the standardization process with a clearly articulated philosophy and consistent, written policies. Develop the standardization process so it includes not only the development of procedures, but also flight crew training and checking.	D&W-91

Guideline Number	Guideline Text	Primary Source
111	Guide the organization of a document system by criteria such as information types. The way information is characterized in terms of its requirement in flight, whether it is aircraft specific or company generic, and by the size of its content, helps to determine where the information should fall within the entire document system.	NASA/FAA - 97
112	Grouping criteria pertaining to importance and use of information are critical determinants for the organization of your document system. In addition, these criteria are the key index of criticality that must be accommodated in all aspects of the document design, production and maintenance process.	NASA/FAA - 97
113	The DDB should include a means to match information to actual documents in the system. This will enable an assessment of user accessibility to information and point out issues in consistency and redundancy of information. In addition, this information will be useful in editing and indexing.	NASA/FAA - 97
114	It may be helpful to create a mock up of each document in order to make decisions regarding size of document and quantity of information. This information impacts the ease with which users can navigate a single document vs. accessibility of information distributed across multiple documents.	NASA/FAA - 97
115	Determine document location by considering multiple criteria including flight crew requirements, FAA requirements and maintenance and revision issues.	NASA/FAA - 97
116	Document location decisions are aided by considering usability issues as well as cost associated with document production. This information should be included in a Location of Documents table. In some cases, it may be possible to split some types information across different locations.	NASA/FAA - 97
117	The decision to develop supplemental cards, guides and checklists can be aided by organizing criteria related to information importance and use. However, the decision involves a tradeoff since too many supplemental information sources can decrease use accessibility and increase the complexity of the document control and maintenance process.	NASA/FAA - 97
118	Use redundancy of information for safety and reliability reasons taking into consideration tradeoffs pertaining to information accessibility, user convenience, complexity and cost of document maintenance.	NASA/FAA - 97
119	The designer of flight deck documentation should search for situations where procedures are tightly coupled, and exploit the opportunity to decouple them	D&W-94

Guideline Number	Guideline Text	Primary Source
120	Care must be taken that not only the principal participants of a system (e.g., flight crews in this case), but also others that are affected (e.g., controllers, ground crews, cabin attendants) be involved and informed in the design and modifications of a system procedure.	D&W-94
121	When introducing new technology into the cockpit, the procedure designer should reevaluate all of the existing procedures and policies in light of the new technology and support the new technology via new procedures.	D&W-94
200	Ensure that manufacturers and component suppliers are familiar with general operator procedures and that they use that knowledge in the design of systems and their interfaces. In cases where flight deck design does not support an operator's procedures, the operator should tailor the accompanying procedures to conform to their procedures.	D&W-94
201	Ensure that any operator or developer's procedure is compatible with the engineering of the aircraft and its subsystems. Care must be taken when there are subtle differences between aircraft (especially if these differences are invisible or difficult to detect). Operators should address such incompatibilities in the appropriate procedures.	D&W-94
202	Review other operators' best practices to gather the higher-level concepts that can be adapted to your operational environment and requirements. When starting a new fleet, review the operator's complete set of fleet documents to gather general approaches and identify additional documentation that may be required by the new aircraft type.	NASA/FAA - 97
203	Use multiple approaches to establish across-fleet standardization including: (1) Developing a cross-fleet philosophy, (2) Creating an across-fleet standardization forum, and (3) Obtaining input for procedural design from personnel that design, certify, teach, use and check procedures.	D&W-94
204	Use a standard sequence for checklist items across fleets to the degree possible.	FAA-95
205	Identify areas where across-fleet standardization is not appropriate and where standardization may not lead to optimal procedures when procedures that are suitable for one type of flight deck operation are superimposed on another.	D&W-94

Guideline Number	Guideline Text	Primary Source
206	Establish a feedback loop from flight crews to flight management and procedure designers. This feedback loop should be a formal process, maintained as a non-punitive, reactive system, with mandatory feedback from management to the initiating flight crewmember about the progress of his or her report and/or suggestion.	D&W-94
207	Include intra-flight deck communication in procedure design. Required communication should be specified, trained and subject to standardization like any other procedure.	D&W-94
208	Standardize terminology in operating documents whenever practical. For example, since the terms "throttles" and "thrust levers" refer to the same item, the operator should choose one term and use it consistently throughout operating documents.	FAA 8400.10
209	Evaluate all items that require variable responses. Such items may not actually be required on the checklist, or may be more appropriately included in the system management portion of a checklist.	FAA-95
210	Define all significant terms used in manuals. Further, define all acronyms and abbreviations.	FAA 8400.10
211	Avoid ambiguous and excess verbiage on checklists. Require responses that specify the desired status or the value of the item being considered not just "checked" or "set."	D&W-93
212	Promote strict use of the terms presented on the checklist to reduce the chance for misunderstanding of the task to be performed and its status. Any attempt on the part of the flight crew to personalize the checklist erodes the safety margin established by the procedure.	FAA-95
213	Evaluate the feasibility of placing common items on checklists with standard titles for all aircraft.	FAA-95
214	Display information consistently using standards and conventions familiar to the users. This includes a consistent location of specific types of information, using consistent units of measurement and codes.	S&M-86
215	Define significant terms used in operating documents, ensuring consistent meaning across documents. All acronyms or abbreviations should be defined and included within a document's glossary.	FAA 8400.10
216	Establish standard meanings for graphic symbols and use them consistently across documents.	S&M-86

Guideline Number	Guideline Text	Primary Source
217	Involve not only the principal users of a system (e.g., flight crews), but also others that are affected (e.g., controllers, ground crews, cabin crews) in the design and modification of procedures.	D&W-94
218	Consider the limitations and capabilities of the device for which the procedure is being designed. Devices that are well designed from a human user perspective require minimal use of procedures. Devices that are not well designed will require more thought on the part of the user, and may require more detailed procedures.	D&W-94
219	Evaluate existing procedures and policies in light of the new technology and procedures when introducing new technology on the flight deck.	D&W-94
220	Develop checklists after a careful task analysis and ensure they are consistent with the procedures section of the operator's flight manual.	FAA-95
221	Tailor procedures that recognize the characteristics of the operation. Ignoring these characteristics will result in low procedural compliance.	D&W-94
222	Identify situations where procedures are tightly linked with other flight deck tasks, and determine whether the procedures and/or checklists can be unlinked, altered in another way or eliminated.	D&W-94
223	Develop an operational philosophy that can be used to specify consistent automation policies and procedures.	D&W-94
224	Recognize that tasks involving the use of automation may be too complex and interactive to require a fixed set of procedures.	D&W-94
225	Use briefings as a critical crew coordination tool to reduce the level of ambiguity in the management of automated flight decks. The more one allows for technique, the more one has to stress briefings and crew coordination.	D&W-94
226	Evaluate the effect of a new procedure on the total workload of the crew at any given time. Careful attention should be given to procedures that may require crew attention in times of high workload, and designers should strive to "manage" workload by moving tasks that are not time-critical to periods of low workload.	FAA-95
227	Design the duties of each crewmember in order to facilitate optimum crew coordination and distribution of flight deck workload.	D&W-93

Guideline Number	Guideline Text	Primary Source
228	Protect information transfer during critical and high workload phases of flight by making callouts and communication procedures economical and unambiguous. Callouts and communication procedures should convey only the information needed by the other crewmember(s) without distracting flight crews from their primary task(s). Review callout procedures frequently; as other procedures change, callouts should be reexamined.	D&W-94
229	Sequence checklist items to follow the "geographical" organization of the items on the flight deck, to be performed in a logical flow such as top to bottom and left to right. A checklist flow pattern that begins at the top of a panel and progresses downward accommodates most flight crews and can also lead to overall standardization.	FAA-95
230	Sequence the most critical items so they are listed as close as possible to the beginning of the checklist to reduce the likelihood of their interruption.	D&W-93
231	Sequence checklist items in parallel with internal and external activities that require input from the cabin crew, ground crew, fuelers and gate agents.	D&W-93
232	Keep normal checklists as short as possible to minimize interruptions. Two short checklists may reduce the possibility of interruptions that can occur with a longer list that spans a considerable period of time. A long checklist should be subdivided into smaller task checklists or chunks that can be associated with systems and functions on the flight deck.	D&W-93
233	Use procedures that require the use of aural, visual and tactile sensors in order to reduce error and enhance verification during a checklist flow. The use of hands and fingers to touch or point to appropriate controls, switches and displays while conducting the checklist is recommended.	D&W-93
234	Identify decision points in normal checklists and indicate the correct alternative actions to be taken after each decision point.	FAA-95
235	Reduce the possibility that two checklists are in progress simultaneously. In some cases it may be necessary to add normal checklist items to the emergency checklist to keep checklists manageable.	FAA-95
236	Specify each sequential step of a procedure in abnormal and emergency checklists.	FAA-95

Guideline Number	Guideline Text	Primary Source
237	Consider using the Challenge-Do-Verify (CDV) method when designing emergency and abnormal checklists. Traditionally, operators have preferred the Do-Verify (DV) method for normal checklists and the CDV method for abnormal and emergency checklists.	FAA-95
238	Consider the advantages and disadvantages, both from the perspective of the user and economics, prior to selecting a checklist media.	G-95
239	Consider that with card or booklet checklists, it can be difficult for the flight crew to keep their place, especially with interruptions.	G-95
240	Implement an ECL so that it does not displace other important electronic information, does not increase heads-down time and does not pose difficulties in finding information or returning to a previous point.	G-95
241	Specify the document structure at its beginning by explaining organizing elements such as headings, main parts of the document, numbering scheme and other sources of coding or grouping.	A&S-97
242	Use a clear heading system to help users access the needed information and navigate through the document. Placement on page, indenting, numbering schemes, upper vs. lower case letters, font style, color or size all may be used to show the heading hierarchy, which should be applied consistently.	A&S-97
243	Sequence information based on the following three criteria: 1) Critical information should be placed early and prominently, 2) Actions should be sequenced chronologically, and 3) Items should be sequenced alphabetically, by quality or by quantity.	A&S-97
244	Format the page so that the reader knows how to process the text simply by the look of the page. The page layout is one of the first things the user notices when looking at a page, and its format should immediately guide him or her to the needed information.	A&S-97
245	Use horizontal and vertical spacing to define the basic format. The page is divided spatially in two parts: the outer margins, and the area within the margins containing the text and visuals. Careful use of white space is important to structuring the page effectively. There are variations in margin design, but once specifications have been determined, they should be used consistently.	A&S-97
246	Design each page based on the actual to-be-published size rather than using a standard letter-size format and later reducing the page size.	A&S-97

Guideline Number	Guideline Text	Primary Source
247	Print the checklist in a style that will accommodate different age groups with different eyesight abilities, providing sufficient contrast that will allow easy reading in low ambient light levels. Test alternatives or new designs to ensure that they can be easily read by the full range of potential users.	FAA-95
248	Use sans-serif fonts in lower case wherever possible. When upper case is required, the leading letter in each word should be larger to increase legibility.	D-92
249	Use black ink for letters over white or yellow for flight deck documentation. Avoid using black ink letters over dark blue, dark green or dark red.	D-92
250	Design indexes as an entire system and not just a collection of independent indexes. Indexing should support the entire operating documents system used on the flight deck.	NASA/FAA - 97
251	Supply an effective and consistent index in each manual that helps flight crews in finding materials they seek, especially when it is an unfamiliar, obscure or seldom-accessed procedure.	D&W-94
252	Use standard terminology for the main index entries, being sure to support the essential terms used on the flight deck.	NASA/FAA - 97
300	Develop an information gathering, review and disposition system to process information obtained from the government, manufacturers and equipment vendors.	NASA/FAA - 97
301	Establish a means of gathering aircraft production change information to ensure timely issuance prior to placing the aircraft into service.	NASA/FAA - 97
302	Maintain operating manuals of other operators of similar equipment through a manuals interchange program to monitor changes they are making.	NASA/FAA - 97
303	Establish a debrief system for obtaining input from line pilots to flight management. This feedback process should be formalized, maintained as non-punitive with timely, mandatory feedback from management to the initiating pilot about the progress of his/her report and/or suggestion.	D&W-94
304	Evaluate existing procedures and policies in light of the new technology when introducing new technology on the flight deck, and if existing standard operating procedure (SOP) does not support the new technology, develop or modify procedures.	D&W-94

Guideline Number	Guideline Text	Primary Source
305	Document standardization and usability policies in a clear and accessible way so that those producing and maintaining documents will have consistent guidance.	NASA/FAA - 97
306	Develop methods of communicating new information to include training, implementation and checking. The specific methods should be responsive to the degree of communication urgency.	D&W-94
307	Ensure that others within the organization that might be affected by changes being made are consulted early in development (e.g., controllers, ground crews, cabin attendants).	D&W-94
308	Minimize frequent procedures or checklist changes. Frequent changes lead flight crews to conclude that the system is unstable, diminishing the importance attributed to new and modified procedures.	D&W-94
309	Establish fleet support groups or teams made up of representatives from different departments associated with that fleet to collect and review inputs, develop solutions and then validate and approve results. Key members of each fleet support group should meet periodically to address cross-fleet issues.	NASA/FAA - 97
310	The internal approval process should ensure compliance with federal regulations, manufacturer recommendations, company policy and the organization's document standards.	NASA/FAA - 97
311	Involve FAA Aircraft Program Managers (APM) early in the coordination and review process before material is formally submitted for approval because there are differences in interpretation of the FAA Order 8400.10. It may also be beneficial for an operator to have a Memorandum of Understanding (MOU) with the POI on how approvals are to be coordinated, submitted and obtained.	NASA/FAA - 97
312	Maintain accurate, detailed records and good communication with the POI in order to better manage the approval process especially when changing abnormal or emergency procedures.	NASA/FAA - 97
313	Coordinate internal review process with the required external FAA reviews making sure to emphasize the main points of focus that the POI will use on such reviews such as the Initial Review, Review of Changes to manuals and Periodic Reviews.	NASA/FAA - 97
314	Review not only the change, but also its effects on the entire operating document system, training and overall operations when preparing for a Review of Changes to manuals.	FAA 8400.10

Guideline Number	Guideline Text	Primary Source
315	Select a document development software application that provides comprehensive word processing, page design and standardization management, between and within document linking, as well as revision management.	NASA/FAA - 97
316	Ensure that the software you select meets your color display and printing requirements, and that it is able to produce the CRC or electronic file types required by the printing department or outside printer.	NASA/FAA - 97
317	Design templates in the context of the entire document system so that they can be reused efficiently across documents. Before designing a new format, review existing formats to determine if an existing format can be used more efficiently.	NASA/FAA - 97
318	Format pages using the actual to-be-published size rather than using a standard letter-size format and later reducing, enlarging or scaling the page size.	A&S-97
319	Design templates based on a consideration of how the information needs to be displayed, as well as the format of the source information. Whether the information comes from internal documents or manufacturer manuals, review those templates and consider how that information can be most effectively transferred to the new document.	NASA/FAA - 97
320	Provide a clear statement of formats, styles and rules to document developers with guidelines to maintain consistency and discipline in document creation.	NASA/FAA - 97
321	Ensure that thickness of the paper or material is adequate for the specific document type. Print checklists on thick opaque paper that prevents the print on the other side from showing through even when held up by flight deck windows. Ensure that the material will withstand the substantial handling it will receive.	FAA-95
322	Ensure that the quality of the print and the paper is well above normal standards. Poor print quality will effect legibility, readability and usability of the document.	D-92
323	Establish good legibility of operating documents by using black print on a white background. The print should be clear and the boundaries between the strokes and spaces should be sharp and distinguishable. In special cases, such as emergency checklists, improved readability may be attained by the use of black print on a bright lemon yellow background.	FAA-95 T&H-91

Guideline Number	Guideline Text	Primary Source
324	Avoid using white characters over a black background for body text (it may be okay for use in headers or titles). If white characters over black are required, use minimum amount of characters and a large sans-serif font.	D-92
325	Organize, design and revise document systems so that they have efficient distribution. Distribution should be part of the DDB and should be considered when organizing the document system.	NASA/FAA - 97
326	Consider the revision process when designing documents. Single-column format is easier to work with, especially with frequent revisions. The main problem with single columns is excessive line length, which can be avoided by making the text column narrower and allowing more margin space.	A&S– 97
327	Consider using the DDB to help manage the tracking of operating document revisions. The DDB can contain information about frequency of revisions, revision control numbers, tracking data, as well as tracking issues and difficulties that can be addressed during later revisions.	NASA/FAA - 97
328	Implement a Revision and Bulletin Log system to help individuals maintain current operating documents. These logs should be backed up with a systematic verification that all crews are current.	NASA/FAA - 97
400	Evaluate problems with current paper-based system, and determine whether solutions exist using electronic media.	NASA/FAA - 97
401	Examine basic architecture and decide to what extent the electronic documents will replace paper.	NASA/FAA - 97
402	Identify conversion requirements and paybacks, then find a product “Champion” high within the organizational structure.	NASA/FAA - 97
403	Determine whether current information content and structure are compatible with users’ needs. Consider using the “Information Mapping” style of organizing and writing.	NASA/FAA - 97
404	Consider all tradeoffs in planning the document repository. Fully linked, structured documents such as SGML are more reusable than standard word processing or paper documents; however, its strengths may not be exploited until extensive work on the information repository is completed.	NASA/FAA - 97

Guideline Number	Guideline Text	Primary Source
405	Review DO-178, "Software Considerations in Airborne Systems and Certification," DO-160, "Environmental Conditions and Test Procedures for Airborne Equipment," and DO-199, "Potential Interference to Aircraft Electronic Equipment from Devices Carried Aboard" (Available from http://www.rtca.org/ website). Become familiar with hardware and software certification requirements and procedures.	NASA/FAA - 97
406	Obtain a copy of Advisory Circular 120-64. Understand type certificates (TC) and supplemental type certificates (STC) requirements with respect to a fixed position electronic checklist.	NASA/FAA - 97
407	Review ATA Specification 2100, "Digital Data Standards for Aircraft Support," available through the Air Transport Association, at http://www.air-transport.org/.	NASA/FAA - 97
408	Evaluate system architecture options. The greater the functionality and integration with aircraft systems, the higher the certification level and cost.	NASA/FAA - 97
409	Enable specific procedural as well as hardware and software safeguards to ensure data integrity of the documents and user compliance with the process requirements to complete loads and updates.	NASA/FAA - 97
410	Review web design instructional material to help determine an organizational architecture for electronic documents.	NASA/FAA - 97
411	Review FAA Order 8400.10 for operating manual content requirements and approval processes.	NASA/FAA - 97
412	Evaluate current company inter/intranet security policies and procedures against the physical security of the information within the organization. Security should be based on the value of specific resources and the risk of their alteration, loss or misuse.	NASA/FAA - 97
413	Ensure that intranet security is an important part of an organization's security policy and maintain a high level of internal security by raising the organization's awareness.	NASA/FAA - 97
414	Enforce good password practices by not allowing them to contain proper nouns or dictionary words. Each password should differ from the user's login name as well as from standard variations of that login name. New passwords should differ from the old one by at least three characters.	NASA/FAA - 97
415	Conduct detailed analysis of current paper-based costs; include costs of materials, services, personnel and process costs. Evaluate proposal through different cost analysis methods.	NASA/FAA - 97

Guide Numb	Dev Process	Info Systems	Checklists	Philosophy	Procedures	Standards	Users	Guideline Partial Text	Source
100								Develop an organizing system based on the entire…	NASA/FAA - 97
101								Develop a user-centered organizing system…	NASA/FAA - 97
102								Treat each new effort or reorganization as an opportunity…	NASA/FAA - 97
103								Consider developing some form of a database, such as a DDB…	NASA/FAA - 97
104								Develop initial listings based on company and FAA/regulatory…	FAA 8400.10
105								Establish an iterative and flexible process where the DDB…	NASA/FAA - 97
106								Ensure that manufacturer information taken from the AFM…	NASA/FAA - 97
107								Ensure that crew coordination procedures, policies…	NASA/FAA - 97
108								Develop philosophy and policies based on the operational…	D&W-91
109								Identify or develop a consistent, high level philosophy…	D&W-91
110								Start the standardization process with a clearly articulated…	D&W-91
111								Guide the organization of a document system by criteria…	NASA/FAA - 97
112								Grouping criteria pertaining to importance and use of information	NASA/FAA - 97
113								The DDB should include a means to match information to actual…	NASA/FAA - 97
114								It may be helpful to create a mock up of each document in order…	NASA/FAA - 97
115								Determine document location by considering multiple criteria…	NASA/FAA - 97
116								Document location decisions are aided by considering usability…	NASA/FAA - 97
117								The decision to develop supplemental cards, guides…	NASA/FAA - 97

Guide Numb	Dev Process	Info Systems	Checklists	Philosophy	Procedures	Standards	Users	Guideline Partial Text	Source
118								Use redundancy of information for safety and reliability reasons…	NASA/FAA - 97
119								The designer of flight deck documentation should search for	D&W-94
120								Care must be taken that not only the principal participants…	D&W-94
121								When introducing new technology into the cockpit…	D&W-94
200								Ensure the manufacturers and component suppliers…	D&W-94
201								Ensure that any operator or developer's procedure…	D&W-94
202								Review other operators' best practices to gather…	NASA/FAA - 97
203								Use multiple approaches to establish across-fleet…	D&W-94
204								Use a standard sequence for checklist items across fleets…	FAA-95
205								Identify areas where across-fleet standardization is not appropriate	D&W-94
206								Establish a feedback loop from flight crews to flight management	D&W-94
207								Include intra-flight deck communication in procedure	D&W-94
208								Standardize terminology in operating documents whenever	FAA 8400.10
209								Evaluate all items that require variable responses. Such items	FAA-95
210								Define all significant terms used in manuals. Further, define all	FAA 8400.10
211								Avoid ambiguous and excess verbiage on checklists. Require	D&W-93
212								Promote strict use of the terms presented on the checklist to	FAA-95

Guide Numb	Dev Process	Info Systems	Checklists	Philosophy	Procedures	Standards	Users	Guideline Partial Text	Source
213			■			■		Evaluate the feasibility of placing common items on checklists with	FAA-95
214						■	■	Display information consistently using standards and conventions	S&M-86
215								Define significant terms used in operating documents, ensuring	FAA 8400.10
216						■		Establish standard meanings for graphic symbols and use them	S&M-86
217					■		■	Involve not only the principal users of a system…	D&W-94
218					■		■	Consider the limitations and capabilities of the device…	D&W-94
219					■			Evaluate all existing procedures and policies in light of the new	D&W-94
220			■		■			Develop checklists after a careful task analysis and ensure they are	FAA-95
221					■			Tailor procedures that recognize the characteristics of the	D&W-94
222			■		■			Identify situations where procedures are tightly linked…	D&W-94
223					■			Develop an operational philosophy that can be used…	D&W-94
224					■			Recognize that tasks involving the use of automation may be too	D&W-94
225								Use briefings as a critical crew coordination tool to reduce the	D&W-94
226					■			Evaluate the effect of a new procedure on the total workload of	FAA-95
227								Design the duties of each crewmember in order to facilitate	D&W-93
228					■			Protect information transfer during critical and high workload phases	D&W-94
229			■			■		Sequence checklist items to follow the "geographical" …	FAA-95
230			■					Sequence the most critical items so they are listed as close as	D&W-93
231			■					Sequence checklist items in parallel with internal and external	D&W-93

Guide Numb	Dev Process	Info Systems	Checklists	Philosophy	Procedures	Standards	Users	Guideline Partial Text	Source
232			■					Keep normal checklists as short as possible to minimize…	D&W-93
233			■		■			Use procedures that require the use of aural, visual and tactile	D&W-93
234			■					Identify decision points in normal checklists and indicate the correct	FAA-95
235			■					Reduce the possibility that two checklists are in progress	FAA-95
236			■		■			Specify each sequential step of a procedure in abnormal…	FAA-95
237			■					Consider using the Challenge-Do-Verify (CDV) method…	FAA-95
238			■				■	Consider the advantages and disadvantages…	G-95
239			■					Consider that with card or booklet checklists, it can be difficult…	G-95
240								Implement an ECL so that it does not displace other important	G-95
241								Specify the document structure at its beginning by explaining	A&S-97
242							■	Use a clear heading system to help users access the needed	A&S-97
243								Sequence information based on the following three criteria: 1)	A&S-97
244							■	Format the page so that the reader knows how to process…	A&S-97
245								Use horizontal and vertical spacing to define the basic…	A&S-97
246						■		Design each page based on the actual to-be-published size rather	A&S-97
247			■				■	Print the checklist in a style that will accommodate different age	FAA-95
248								Use sans-serif fonts in lower case wherever possible (D-92). When	D-92
249								Use black ink for letters over white or yellow for flight deck	D-92
250	■							Design indexes as an entire system and not just a collection of	NASA/FAA - 97
251					■			Supply an effective and consistent index in each manual	D&W-94
252						■		Use standard terminology for the main index entries, being sure to	NASA/FAA - 97

Guide Numb	Dev Process	Info Systems	Checklists	Philosophy	Procedures	Standards	Users	Guideline Partial Text	Source
300								Develop an information gathering, review and disposition system to	NASA/FAA - 97
301								Establish a means of gathering aircraft production change	NASA/FAA - 97
302								Maintain operating manuals of other operators of similar	NASA/FAA - 97
303								Establish a debrief system for obtaining input from line pilots to	D&W-94
304								Evaluate existing procedures and policies in light of the new	D&W-94
305								Document standardization and usability policies in a clear and	NASA/FAA - 97
306								Develop methods of communicating that cover the	D&W-94
307								Ensure that others within the organization that might…	D&W-94
308								Minimize frequent procedures or checklist changes. Frequent	D&W-94
309								Establish fleet support groups or teams made up of representatives	NASA/FAA - 97
310								The internal approval process should ensure compliance…	NASA/FAA - 97
311								Involve FAA Aircraft Program Managers (APM) early…	NASA/FAA - 97
312								Maintain accurate, detailed records…	NASA/FAA - 97
313								Coordinate internal review process with the required…	NASA/FAA - 97
314								Review not only the change, but its effects on the entire…	FAA 8400.10
315								Select a document development software application that…	NASA/FAA - 97
316								Ensure that the software you select meets your color display…	NASA/FAA - 97

Guide Numb	Dev Process	Info Systems	Checklists	Philosophy	Procedures	Standards	Users	Guideline Partial Text	Source
317								Design templates in the context of the entire document system…	NASA/FAA - 97
318								Format pages using the actual to-be-published size rather than…	A&S-97
319								Design templates based on a consideration of how…	NASA/FAA - 97
320								Provide a clear statement of formats, styles and rules…	NASA/FAA - 97
321								Ensure that thickness of the paper or material is adequate…	FAA-95
322								Ensure that the quality of the print and the paper…	D-92
323								Establish good legibility of operating documents by using…	FAA-95
324								Avoid using white characters over a black background...	D-92
325								Organize, design and revise document systems so that…	NASA/FAA - 97
326								Consider the revision process when designing documents…	A&S-97
327								Consider using the DDB to help manage the tracking…	NASA/FAA - 97
328								Implement a Revision and Bulletin Log system to help individuals…	NASA/FAA - 97

Guide Numb	Dev Process	Info Systems	Checklists	Philosophy	Procedures	Standards	Users	Guideline Partial Text	Source
400								Evaluate problems with current paper-based system…	NASA/FAA - 97
401								Examine basic architecture and decide to what extent…	NASA/FAA - 97
402								Identify conversion requirements and paybacks, then find….	NASA/FAA - 97
403								Determine whether current information content and structure...	NASA/FAA - 97
404								Consider all tradeoffs in planning the document repository…	NASA/FAA - 97
405								Review DO178, “Software Considerations in Airborne…	NASA/FAA - 97
406								Obtain a copy of Advisory Circular 120-64. Understand “TO”…	NASA/FAA - 97
407								Review ATA Specification 2100, “Digital Data Standards…	NASA/FAA - 97
408								Evaluate system architecture options…	NASA/FAA - 97
409								Enable specific procedural as well as hardware and software…	NASA/FAA - 97
410								Review web design instructional material to help determine…	NASA/FAA - 97
411								Review Operations Order 8400.10 for Operating Manual…	NASA/FAA - 97
412								Evaluate current company inter/intranet security policies…	NASA/FAA - 97
413								Ensure that intranet security is an important part of an organization's	NASA/FAA - 97
414								Enforce good password practices by not allowing them to contain…	NASA/FAA - 97
415								Conduct detailed analysis of current paper-based costs..	NASA/FAA - 97

Appendix C
Examples List

Examples PART 1: Organization of Documents	
Section 1.1: Organizing System	
Example Number	Example Descriptor
1.1.1	A Documents Database incorporates a systems approach to producing, organizing, testing, revising and maintaining operating documents.
1.1.2	A Documents Database may be used to manage aspects of your operating documents system such as information organization and requirements.
1.1.3	A Documents Database establishes an iterative and flexible process where the Information Topics can be reorganized, subdivided and updated on an ongoing basis.
Section 1.2: Required Information	
1.2.1	In organizing your document system, it may be helpful to review the way in which other operators' organize and locate their documents.
1.2.2	Documents must contain information required by Federal Aviation Regulations (FARs).
1.2.3	The Flight Operations Working Group (FOWG) of the Air Transport Association has been working to standardize the definition of Phases of Flight across the industry.
Section 1.3: Additional Information	
1.3.1	Documents such as the AIM and ATC Handbook contain information that may clarify policies and procedures.
1.3.2	Philosophy statements developed by the operator, such as checklist philosophy and automation philosophy, are useful for guiding the design of procedures.
Section 1.4: Creating a Document System	
1.4.1	Information type is one criterion for organizing the documents system and may help to determine where information should be located.
1.4.2	Grouping criteria such as importance and users are critical determinants for organizing one's document system.
1.4.3	Creating a list of operating documents will help you match information to an actual document in the system.
1.4.4	Location of documents is determined by considering numerous factors and tradeoffs.
1.4.5	Document location decisions are aided by considering usability issues as well as cost associated with document production.
1.4.6	The decision to develop supplemental cards, guides and checklists can be aided by organizing criteria related to information importance and use.
1.4.7	Abnormal and emergency indexing is important because of the time-critical nature of the information.
Section 1.5: Reviewing and Testing the Document System	
1.5.1	The review process is enhanced if you maintain a Document Database with a document list that includes revision information and last review date.

Examples PART 2: Design of Documents	
Section 2.1: Incorporating Regulations and Manufacturer Recommendations	
Example Number	Example Descriptor
2.1.1	Government regulations such as FAR Part 121 subpart G specifies information required of operating documents.
2.1.2	Operators should tailor manufacturer procedures to their specific operational environment.
2.1.3	Consider other operators' best practices by reviewing the operator's complete set of fleet documents.
Section 2.2: Standardization	
2.2.1	Use a standard sequence for checklist items across fleets to the degree possible.
2.2.2	Standardization of procedures and flows are promoted through a design and review process based on participation from all fleets.
2.2.3	Standardize terminology in a style manual to maintain consistency within and across fleets.
2.2.4	Where possible reduce usage of generic terms such as "checked" and require specific values, quantities or settings.
2.2.5	Display information consistently using formatting standards, consistent codes and graphic symbols.
Section 2.3: Optimizing Procedures	
2.3.1	Develop checklists after a careful task analysis and ensure they are consistent with the procedures section of the operator's flight manual.
2.3.2	Designers must be sensitive to the multi-tasking environment on the flight deck that leads to tight links between some tasks, subtasks and procedures. This is particularly true during takeoff and landing.
2.3.3	Develop an operational philosophy that can be used to specify consistent automation policies and procedures.
2.3.4	Designing procedures with an awareness of flight crew workload will promote safer, more efficient flight deck communication and performance.
Section 2.4: Usability of Checklists	
2.4.1	Sequence checklist items to follow the "geographical" organization of the items on the flight deck, to be performed in a logical flow such as top to bottom and left to right.
2.4.2	A long checklist should be subdivided into smaller task checklists or chunks that can be associated with systems and functions on the flight deck.
2.4.3	Specify each sequential step of a procedure in abnormal and emergency checklists and be sure that branching decisions are clearly delineated.
2.4.4	Consider the advantages and disadvantages of checklist media options, both from the perspective of the user and economics.

Examples PART 2: Design of Documents	
Section 2.4: Usability of Documents	
Example Number	Example Descriptor
2.5.1	Specify the document structure at its beginning by explaining organizing elements such as headings, main parts of the document, numbering scheme and other sources of coding or grouping.
2.5.2	Format the page so that the reader knows how to process the text simply by the look of the page.
2.5.3	Typography, including font and page orientation, influences how easy it is for a user to locate and read information.
2.5.4	Supply an effective and consistent index in each manual that helps flight crews in finding material they seek.

Examples PART 3: Production and Maintenance of Documents	
Example Number	Example Descriptor
Section 3.1: Introduction of New Procedures and Information	
3.1.1	Develop an information gathering, review and disposition system to process information obtained from the government, manufacturers and equipment vendors.
3.1.2	Establish a formalized, non-punitive debrief system for obtaining input from line pilots to flight management with timely mandatory feedback from management.
3.1.3	Develop methods of communicating that cover the implementation of new information (e.g., checklist revisions, Service Bulletin revisions) to include training, checking, and any others within the organization that might be affected.
Section 3.2: Internal and External Approval Process	
3.2.1	The approval process for changes within a fleet typically involves the members of the fleet support team.
3.2.2	Maintain accurate, detailed records and good communication with the POI in order to better manage the approval process.
3.2.3	Validation may refer to an operator's internal validation or to required FAA validation tests. Operators should work with POIs to determine the need for and type of validation.
Section 3.3: Production Process	
3.3.1	Standard Generalized Markup Language (SGML) allows manufacturers and operators to tag information in such a way that it can be identified and used across a number of different applications.
3.3.2	Provide a clear statement of formats, styles and rules to document developers with guidelines to maintain consistency and discipline in document creation.
3.3.3	Operators have the conflicting objectives of reducing the mass of paper required on the flight deck, while making sure that the actual paper used is sufficiently durable and provides good background for the printed characters.
Section 3.4: Revision, Distribution and Tracking	
3.4.1	Organize, design and revise document systems so that they can be efficiently distributed. Distribution should be considered when organizing the document system and can be useful element in the DBB
3.4.2	Revision logs should be maintained in order to provide the information user with current information.

Examples **PART 4: Electronic Documents**	
Example Number	Example Descriptor
Section 4.1: General Considerations	
4.1.1	Evaluate whether problems induced by a paper-based system are alleviated by the use of electronic media.
4.1.2	Examine basic architecture and decide to what extent the electronic documents will replace paper.
4.1.3	Information mapping is a commonly used style of organizing and standardizing document systems which transfers well to electronic documents.
4.1.4	Fully linked, structured documents using SGML terms can link attributes such as bullet type, column number, table entries and definitions within and across documents
Section 4.2: Regulatory Standards	
4.2.1	These documents describe certification requirements for hardware and software used in aircraft systems, and may result in a type certification or subtype certification depending on particular system or component.
4.2.2	Limited guidance is provided for electronic checklists (AC 120-64), thus the standards being developed through industry and regulatory initiatives are greatly needed.
Section 4.3: Considerations for Electronic Document and Display Systems	
4.3.1	Evaluate system architecture options. The greater the functionality and integration with aircraft systems, the higher the certification level and cost.
4.3.2	RTCA's DO-178B is part of the effort to develop standards and approval processes for the software aspects of airborne systems.
4.3.3	A data model for the exchange of data between manufacturers and operators can be facilitated by standards such as SGML entities; additional information may be stored through "metadata" elements.
4.3.4	When the electronic document display is integrated into the aircraft, basic perceptual principles relating to multiple display layout may come into play, as well as font size, color, and the use of graphics, icons, et cetera.
4.3.5	Review web design instructional material to help determine an organizational architecture for electronic documents.
Section 4.4: Planning for Internet/Intranet	
4.4.1	Intranets provide significant capability to update electronic documents anywhere a company network exists.
4.4.2	Security of company information is vital regardless of medium. Security should be based on the value of a resource and the risk of its alteration, loss or misuse.
Section 4.5: Cost/Benefits of Electronic Media	
4.5.1	Beyond simple cost/benefit analysis models, consider possible savings in personnel and materials as they relate to production, printing, warehousing and distribution savings.

Appendix D
Project History and Participating Organizations

Project History

This Manual grew out of a series of collaborative workshops addressing the issues of greatest concern to operating document developers. The list of meetings and workshops below provides a time line of the project and a brief summary of each event.

NASA/FAA Operating Documents Planning Session 1 - February 27-28, 1997
US Airways, Pittsburgh, PA
This original planning session focused on defining the goals, organization and logistics of Workshop I. The objective was to create an open forum for operators to share experiences and lessons learned pertaining to the development of operating documents.

NASA/FAA Operating Documents Workshop I - April 17-18, 1997
NASA Ames Research Center, Moffett Field, CA.
Workshop I provided the unique opportunity for operators to share their experiences in the design and development of operating manuals and checklists. Nineteen operators presented a description of how their operating documents were organized and where they were located (flight bag, aircraft, or home). Also highlighted were the most important issues, problems and solutions related to overall organization of the operating documents system, indexing and formatting. A survey was conducted that summarized and prioritized the participants' primary issues and a Proceedings document was prepared and distributed to all participants.

NASA/FAA Operating Documents Planning Session 2 – July 17, 1997
US Airways, Pittsburgh, PA
This planning session established the leadership and formulated the format and content of Workshop II. The results of the survey conducted at the end of Workshop I were discussed and provided the organizing structure for Workshop II.

NASA/FAA Operating Documents Workshop II - September 10-11, 1997
American Airlines Flight Academy, Dallas/Fort Worth Airport
Workshop II, hosted by American Airlines and American Eagle, was organized into concurrent focus group meetings designed to elicit further input into the Manual in the five areas of greatest concern identified by the operators:

- Organization of Documents
- Standardization of Documents
- Usability of Documents
- Developing and Maintaining Documents
- Transition to Electronic Media

The issues and examples generated by each of the working groups were presented to the group as a whole and compiled into a Proceedings document, later distributed to all participants.

NASA/FAA Operating Documents Planning Session 3 - March 29-30, 1999
Atlanta, GA
This planning meeting was held in order to outline the structure and identify key authors of the Operating Documents Manual and to discuss preparing and presenting the results to date of the NASA/FAA Operating Documents Project at the upcoming International Symposium on Aviation Psychology.

10th International Symposium on Aviation Psychology - May 2-6, 1999
Columbus, OH
A presentation entitled *Design and Use of Operating Documents* (prepared by Kanki, Seamster, Lopez, Thomas and LeRoy) was made at the biennial meeting hosted by Ohio State University. This presentation based on the paper in Appendix A provided an overview of key issues identified by the NASA/FAA Operating Documents participants and a summary of the first two workshops.

NASA/FAA Operating Documents Planning Session 4 - August 9, 1999
Chicago, ORD Airport
This planning meeting was used to review progress of the Operating Documents Manual. In addition this meeting was used to plan for the Industry Review to be held during Workshop III.

NASA/FAA Operating Documents Workshop III - October 20-21, 1999 Orlando, FL.
Workshop III was convened following the distribution of an initial draft of the Manual to all collaborators. The purpose of the Workshop was to elicit comments on the Manual's content and identify examples to accompany each subsection. At this meeting, the Documents Database Group was formed to address the development of a sample database structure.

Documents Database (DDB) Working Group Meeting 1 - December 15-16, 1999
NASA Ames Research Center, Moffett Field, CA.
The focus of this meeting was to define the scope and objectives of the DDB, to identify and refine information topics as potential DDB fields. The results of this group's work are evident in the sample documents database utilized in Examples throughout Part One of this Manual (see Example 1.1.2).

Documents Database (DDB) Working Group Meeting 2 - February 4, 2000
Madrid, Spain
The DDB working group reviewed the prototype user interface following the ATA Flight Operations Working Group (FOWG) meeting.

Documents Database (DDB) Working Group Meeting 3 – May 2 – 4, 2000
Miami, FL
Members of the DDB Working Group joined with the ATA Flight Operations Working Group to share the results of the DDB project and to observe and participate in that group's process in the development of the Flight Operations Informational Data Model. Members of the FOWG were invited to participate in the Industry Review of the Developing Operating Documents Manual.

HCI-Aero 2000 – September 27-29, 2000
Toulouse, FRANCE

A presentation entitled *User-Center Approach to the Design and Management of Operating Documents* was made during the International Conference on Human Computer Interaction in Aeronautics. It provided conference participants with an overview of the NASA/FAA Operating Documents Project, a summary of methods and results.

Participating Organizations List

AIR TRANSPORT ASSOCIATION

AERA

AIR CANADA

ALOHA AIRLINES

AMERICA WEST AIRLINES

AMERICAN AIRLINES

AMERICAN EAGLE

AMERICAN TRANS AIR

ATLANTIC COAST AIRLINES

ATLAS AIR, INC.

BETA RESEARCH, INC.

BOEING COMMERICAL AIRPLANE GROUP

BOMBARDIER AEROSPACE

CCAIR

CHAUTAUQUA AIRLINES

COGNITIVE & HUMAN FACTORS

COMAIR, INC.

CONTINENTAL AIRLINES

DELTA AIR LINES

DHL AIRWAYS

DUNLAP AND ASSOCIATES, INC.

FAA AAR-100

FAA PIT FSDO

FEDERAL EXPRESS

HAWAIIAN AIRLINES

HORIZON AIR

ISLAND AIR

MIDWEST EXPRESS AIRLINES

NASA AMES RESEARCH CENTER

NORTHWEST AIRLINES

PENINSULA AIRWAYS

RENO AIR

SOUTHWEST AIRLINES

TRANS WORLD AIRLINES, INC.

UNITED AIRLINES

UNITED PARCEL SERVICE

US AIRWAYS

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