REPUBLIC OF KENYA

KENYA CIVIL AVIATION AUTHORITY

efficiently managing air safety

PREPARATION OF OPERATIONS MANUALS

June 2018

FOREWORD

This manual is intended to provide guidance to Authority inspectors and Operators on the preparation and contents of operations manuals in line with the requirements of Kenya Civil Aviation Regulations (KCARs). It should also be noted that Kenya requires that the operations manual to include specified "mandatory" material. In addition, much of the material that goes to make up the complete operations manual is not produced by the operator, but is purchased from commercial agencies, or supplied with the equipment to which it refers, as in the case of route guides and aircraft operating manuals.

The primary purpose of this manual is to give guidance on those parts of the operations manual which are usually developed by the operator. This manual stresses the supervision of operations. Approval of the operations manual is a fundamental step in the approval of an operator and the issue of an air operator certificate.

This manual is not written as a checklist against which the contents of an operations manual should be compared, nor does it purport to be totally comprehensive as to the possible contents of an operations manual. It is intended to identify the topics that may need to be considered by the operator in developing an operations manual. The contents of a particular operations manual will depend on many factors, not the least of which will be the number and different types of aircraft being operated. The geographical extent of the operation will be another significant factor in this determination. In selecting the contents of an operations manual, the guiding principle should be to decide, in a pragmatic and common sense manner, what information and guidance must be included to ensure that a safe and efficient operation takes place. The operator is allowed the greatest possible freedom in developing an operations manual, commensurate with its complexity

Throughout this manual, the use of the male gender should be understood to include male and female persons.

DIRECTOR AVIATION SAFETY, SECURITY AND REGULATION

RECORD OF REVISIONS

Change Summary

Version	Brief Description of Change	Prepared by	Effective Date
NOTE: When printed this document is uncontrolled.			

DOCUMENT CONTROL

1. The Manager of Flight Operations will be responsible for the contents of this document. An officer or inspector will be formally appointed by the Manager for the issuance and amendment of the document in line with the document control policy and procedures of the Authority.

2. For ease of document control, when amended, this document will be re-issued in full as an electronic copy Portable Document File (PDF) in the ASSR online Library and KCAA website. A hard copy will be maintained in the Library.

3. Each page will indicate the control number, version and revision number, , and the total number of pages in the document. The version number must be the same on each page.

4. This document may be printed (in full or in parts) – but once printed this document becomes uncontrolled. Before use, all users should check the KCAA ASSR online library and website for the current release edition.

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CHAPTER 1

1.0 INTRODUCTION

1.1 This manual is intended to provide guidance to Authority inspectors and Operators on the preparation and contents of operations manuals in line with the requirements of Kenya Civil Aviation Regulations (KCARs).

1.2 It should also be noted that Kenya requires that the operations manual include specified "mandatory" material. In addition, much of the material that goes to make up the complete operations manual is not produced by the operator, but is purchased from commercial agencies, or supplied with the equipment to which it refers, as in the case of route guides and aircraft operating manuals.

1.3 The primary purpose of this manual is to give guidance on those parts of the operations manual which are usually developed by the operator. This manual stresses the supervision of operations. Approval of the operations manual is a fundamental step in the approval of an operator and the issue of an air operator certificate.

1.4 This manual is not written as a checklist against which the contents of an operations manual should be compared, nor does it purport to be totally comprehensive as to the possible contents of an operations manual. It is intended to identify the topics that may need to be considered by the operator in developing an operations manual. The contents of a particular operations manual will depend on many factors, not the least of which will be the number and different types of aircraft being operated. The geographical extent of the operation will be another significant factor in this determination. In selecting the contents of an operations manual, the guiding principle should be to decide, in a pragmatic and common sense manner, what information and guidance must be included to ensure that a safe and efficient operation takes place. The operator is allowed the greatest possible freedom in developing an operations manual, commensurate with its complexity.

1.5 It should be stressed that in some of the examples the terminology and units of measurement are not strictly in accordance with ICAO requirements. In addition, throughout this document when the guidance or requirement being discussed is based on the provisions of Civil Aviation (Operation of Aircraft-Commercial Air Transport) Regulations as amended, the term "aeroplane" is used. When the requirements include the provisions of Civil Aviation (Operation of Aircraft-Helicopters) Regulations, or are of a more general nature, the term "aircraft" is used.

1.6 Appendices at the end of this manual contain supplementary information to that contained in the main chapters or are included as a guide for implementation of certain regulatory requirements normally addressed in the Operator's Flight Safety Document System.

1.7 This manual is also intended to be a companion document to at least the following KCAA Technical Guidance Material as amended:

INSPECTOR AND OPERATOR MANUALS

1.	Information & Instructions For Passenger Safety	CAA-M-OPS011
2.	Designated Check Pilot Manual	CAA-M-OPS021
3.	Designated Cabin Crew Evaluator Manual	CAA-M-OPS024
4.	Performance-Based Navigation (PBN) Operations Manual	CAA-M-GEN021
5.	Extended Diversion Time Operations	CAA-M-GEN022
6.	All Weather Operations	CAA-M-GEN023

INSPECTOR GUIDANCE

	Title	**Control No.**
1.	Flight Operations Inspectors Manual	CAA-M-OPS023
2.	Dangerous Goods Inspectors Manual	CAA-M-OPS031
3.	Acceptance Of Operator's Aircraft Performance Data	CAA-O-OPS009
4.	Crew Flight And Duty Time Scheme	CAA-AC-OPS033
5.	Ground Handling Procedures/Manual	CAA-O-OPS042
6.	Operating Minima For Aeroplanes & Helicopter Operations	CAA-O-OPS034

OPERATOR GUIDANCE

	Title	**Control No.**
1.	Structure of Operations Manuals	CAA-AC-OPS022
2.	Air Operator Training Program Approval Process	CAA-AC-OPS005
3.	Carry On Baggage	CAA-AC-OPS010
4.	Large Aircraft Ground De-Icing	CAA-AC-OPS018
5.	Check Pilot Approval And Surveillance	CAA-AC-OPS021
6.	Structure Of Operations Manuals	CAA-AC-OPS022
7.	Crew Flight And Duty Time Scheme	CAA-AC-OPS033
8.	Ground Handling Procedures/Manual	CAA-O-OPS042
9.	Information & Instructions For Passenger Safety Manual	CAA-M-OPS011

CHAPTER 2

2.0 ADMINISTRATION AND CONTROL OF THE OPERATIONS MANUAL

2.1 GENERAL

2.1.1 Civil Aviation (*Air Operator Certification and Administration*) Regulations requires that an operator provide an operations manual for the use and guidance of operations personnel. The manual must be revised and amended to keep it current, and operations personnel must be made aware of any amendments or revisions. The requirement to provide an operations manual is an integral part of the operator's method of control and supervision of flight operations which must be approved by the Authority. It follows, therefore, that the operator is required to provide a copy of the operations manual and with all revisions and amendments.

2.1.2 Civil Aviation (*Air Operator Certification and Administration*) Regulations, lists the minimum requirements for material that must be included in the operations manual. In addition, there are throughout Civil Aviation (*Operation of Aircraft-Commercial Air Transport*) and Civil Aviation (*Operation of Aircraft-Helicopters*) Regulations in particular, but also throughout the other KCARs, requirements that can best be met by including material in the operations manual. Examples would be guidance on procedures to follow when fueling with passengers on board; and from Civil Aviation (*Rules of the Air)* Regulations, interception of civil aircraft. In addition, operations manuals often contain information related to the operator's own requirements, such as information on the operator's company radio frequencies at different aerodromes. It is necessary, however, to guard against the inclusion of irrelevant material in the operations manual, as this document is intended to be easily usable in the operational environment.

2.2 VOLUMES OF AN OPERATIONS MANUAL

A number of volumes normally go to make up the operations manual. The actual contents of these manuals will vary from operator to operator, but a representative breakdown of contents would be as detailed below.

2.2.1 General Policies and Administration - Operations Manual Part A

This manual contains information on the operator's organization, management structure, departmental responsibilities and authority (with particular reference to the flight operations area). More details of this manual are contained in Section B of the Flight Operations Inspectors Manual, Chapter 2 and in the Advisory Circular CAA-AC-OPS022 as amended.

2.2.2 Aircraft Operating Information – Operations Manual Part B

This manual contains information and guidance on the technical, procedural and performance aspects of the operation of the aircraft. This manual is often provided in several volumes. All data and information in this manual must comply with the Aircraft flight manual (AFM), where applicable. In general, the responsibility for developing and issuing amendments and revisions to AFMs rests with the aircraft manufacturer. Operators may develop additional instructions, procedures or guidance to be inserted in this manual. More details of this manual are contained in Section B of the Flight Operations Inspectors Manual, Chapter 2 and in the Advisory Circular CAA-AC-OPS022 as amended.

2.2.3 Minimum equipment list (MEL) and configuration deviation list (CDL)

MEL/CDL provides definitive guidance to the operations and maintenance personnel as to which equipment or part may be inoperative for a particular operation. The master minimum equipment list (MMEL), which is provided by the aircraft manufacturer and approved by the State of Design, serves as a guideline for the development of these lists. Detailed guidance is contained in CAA-O-GEN005 and CAA-AC-GEN005 as amended.

2.2.4 Training manual – Operations Manual Part D

This manual contains information on the training policy and requirements of the operator. It should also contain guidance on the standards of training that will apply. The manual may be divided into a number of sections, one on general policy and guidance, with other sections dealing with specific aircraft types. The manual should also contain information on the syllabi of training courses, both ground and flight. When appropriate, minimum standards of experience for appointment or promotion should be specified, and information given on the training and testing, both initial and recurrent that will be required. Guidance on the selection, role and duties of staff for flying training, checking or testing shall be included. More details of this manual are contained in Section B of the Flight Operations Inspectors Manual, Chapter 2 and in the Advisory Circular CAA-AC-OPS022 as amended.

2.2.5 Aircraft performance manual

Aircraft performance data are published in the flight manual. Normally, an expanded version of this is published in the aircraft operating manual. Based on these data, operators often produce their own performance manual which presents performance information for the operator's own route network. This manual typically contains take-off and landing data for each usable runway at each destination and alternate aerodrome. Where an operator has a very extensive route network, the information could be presented in separate volumes for different geographical areas. Cruise control information is often included in the aircraft performance manual. The manual must contain information on the method of derivation of the data presented, which must be in agreement with the data presented in the flight manual. Guidance on how to use the data presented and a number of examples of use of data are normally included. KCAA considers the contents of this manual to be part of Aircraft Operating Information though produced as a stand-alone manual. More guidance is provided in CAA-O-OPS009 and CAA-AC-OPS009 as amended.

2.2.6 Area, Route and Aerodrome Guide – Operations Manual Part C

This contains information relating to communication facilities, navigation aids, air traffic services, aerodromes, etc. Normally the route guide also contains the required en-route charts and charts for aerodromes along the route. The charts carried in the route guide should be those for destination and alternate aerodromes, as well as for any aerodrome along the route at which the aircraft might land in the event of an emergency. More details of this manual are contained in Section B of the Flight Operations Inspectors Manual, Chapter 2 and in the Advisory Circular CAA-AC-OPS022 as amended.

2.2.8 Dangerous goods manual

Civil Aviation (*Air Operator Certification and Administration*) Regulations require that the operator provide information in the operations manual to enable the flight crew to carry out its responsibilities with regard to the transport of dangerous goods and provide instructions as to the action to be taken in the event of emergencies. Operators without approval to carry dangerous goods are required to add a dangerous goods chapter in the Part A. More details of this manual are contained in Dangerous Goods Inspectors Manual and in the Advisory Circular CAA-AC-OPS022 as amended.

2.2.9 Other Manuals

The above list is for illustrative purposes only. In fact, an operator may combine many of these manuals into one or two volumes. On the other hand, because of the size of the operation, many more volumes may be required. An operator may choose to include other manuals in the operations manual. An example would be a ground/ramp handling manual on the procedures and methods of operation during ground handling of the aircraft. A description of the constituent volumes and manuals of the complete operations manual should be included, possibly in the Operations Manual Part A. Other manuals required are listed in the CAA-O-OPS001 and CAA-AC-OPS001 as amended. Detailed guidance for these manuals is contained in various Manuals, Orders and Advisory Circulars. Inspectors and Operators are expected to access the ASSR online technical library and KCAA website respectively for these TGMs.

2.3 ORGANIZATION OF THE OPERATIONS MANUAL

2.3.1 In selecting a format for the operations manual, the primary criterion is that the manual be easily used and understood. The volume size should make the manual easy to handle on the flight deck, at least for those volumes that are part of the aircraft library. The quality of the paper and of the printing and reproduction of the text and illustrations should be such that the material is readable under all operational conditions. The manuals should be in a format which is easily amendable, e.g. loose-leaf in a ring binder.

2.3.2 In selecting the number of volumes that make up the operations manual, the aim should be to limit the number while not allowing any one volume to become so large or full of pages that it would be unwieldy in actual use. The volumes should be designed so that, if possible, each is complete in itself. For example, all the performance information should be available in one volume. If this is not possible, as for example if the aircraft performance manual is divided into volumes for different regions of the world, the individual volumes of one manual must be logically numbered. Thus, if the aircraft performance manual comprised Volume 4 of the operations manual, then in the case of there being separate volumes they would be numbered Volume 4-1, Volume 4-2, and so on.

2.3.3 If the operator has a number of different aircraft types, it is common practice to differentiate the volumes of the operations manual that are specific to a particular aircraft type and to identify those volumes that are general in their application. Some operators achieve this by colour coding the volumes. For example, all general volumes of the operations manual, such as the policy and administration manual, would have red covers, while volumes specific to a particular aircraft type, such as the ATR 42, for example, would have yellow covers. Within each fleet the volume numbering will be similar, so that Volume 4 on all aircraft types will be the performance manual. The result of this would be that in any aircraft library there would only be two cover colours (in the ATR 42 example, red and yellow) and, if possible, the numbering of all the volumes in an aircraft library should be sequentially complete.

2.3.4 The operations manual should have a master subject index, possibly placed in the Operations Manual Part A. In addition, each volume should have its own subject index. There should be a table of contents at the beginning of each volume. Each page should be numbered and have a date of original issue. Each volume should have a checklist of pages identifying page numbers and dates of issue to ensure the validity of the contents. The entry of each amendment and/or additional page should be recorded on a page specially provided in each volume for that purpose and signed for by the person making the amendment or addition. See Appendix A for details on Flight Safety Document System (FSDS).

2.3.5 The post holder charged with the responsibility for the control of the contents of the operations manual should also be responsible for the issuance of individual volumes and for ensuring that appropriate amendments are dispatched to the holders of the volumes. This task may obviously be delegated to another individual or unit reporting to the post holder. To ensure adequate control of the volumes and their amendments, it is necessary to number each volume individually. Complete records must be kept of the disposition of each volume of the operations manual in aircraft libraries, in operations offices, etc. Records must also be kept of individuals who are holders of all, or part, of the operations manual. Certain parts of the operations manual, such as the emergency evacuation procedures manual, are usually issued to all crew members. Other parts of the operations manual should be available in sufficient quantities to allow copies to be issued to individuals for study and reference purposes.

2.3.6 Amendments, revisions and additions to the operations manual must be approved by the post holder responsible for the manual. In some cases this will consist of ensuring that such changes issued by the originator of a particular volume are correct and appropriate to the operations manual. This would be the case with amendments issued by the aircraft manufacturer for the aircraft operating manuals, or with amendments issued for the route guide, when the route guide is purchased from a commercial agency. However, in the case of amendments or additions which originate within the organization, the post holder responsible must ascertain that the proposed change is necessary and determine how it is to be promulgated. In most cases the amendment will be issued through normal channels to all holders of the operations manual. In other cases, because of the urgency of the information contained in the amendment it will be necessary to issue a notice to the flight crew and to other concerned operational personnel. This notice should be replaced by an amendment to the manual as soon as possible. In revising or altering the contents of the operations manual, operators must bear in mind that the Authority is required to approve the contents of the operations manual and that certain parts of the manual include material which is considered mandatory. It is therefore necessary that the amendments be approved by the Authority. In practice, since much of the material in an operations manual only requires the general approval, it is often appropriate to agree with the Authority which parts of the operations manual need the specific approval of that authority before they are amended and which parts only require notification of changes made.

2.3.7 Amendments to the operations manual must be produced as new or replacement pages. Handwritten amendments to an operations manual are generally not acceptable. The new or replacement pages must include a page identification number and a date of issue. A letter or covering sheet must identify the reason for the amendment and provide a checklist of the amendment to be made. This is particularly necessary when an amendment is made to any safety-related information. Instructions should be included for inserting the amendment in the appropriate volume and for recording insertion of the amendment. The signature of the post holder approving the amendment must also appear. A revision to the list of effective pages must be included with any amendment to the operations manual.

2.3.8 Users of operations manuals should be encouraged to make comments on their contents. In particular, when errors in operational information are discovered, reports should be made immediately to the post holder charged with control of the operations manual. Users also should be encouraged to comment on the general presentation of information in the manual and to suggest other subjects that should be addressed.

CHAPTER 3

3.0 OPERATIONS ADMINISTRATION AND SUPERVISION

3.1 General

3.1.1 Civil Aviation (*Air Operator Certification and Administration*) Regulations states that an operator shall establish and maintain a method of control and supervision of flight operations, as one of the prerequisites for the issue and continued validity of an air operator certificate.

3.1.2 Supervision of flight operations is the responsibility of the post holder in charge of the control and administration of operations. The post holder in charge is normally assisted by other managers and/or supervisory pilots. The number of management/supervisory personnel required depends on the size and complexity of the operation. Regardless of the size of the operation, it is necessary to establish the responsibilities and functions of the different individuals involved and their relationship to each other, both within the flight operations area and within the organization as a whole.

3.1.3 The maintenance of safety and efficiency of flight operations requires that all personnel be fully aware of the areas of responsibility of the different supervisory pilots/ managers, etc. It is therefore necessary that the operations manual carry a description of the administrative structure of the flight operations department. This description should contain information on the functions of the supervisory personnel responsible for the establishment, administration and maintenance of operational standards. The manual should contain, at least, information on the areas of responsibility of the following management/supervisory personnel:

- Head of Operations
- Chief pilot;
- Head of Safety
- Head of Quality
- Head of Maintenance

3.2 Head of Operations

He is responsible to the accountable manager for the development and implementation of operations policy. In particular, it should be the responsibility of the flight operations manager to ensure that in developing a company plan, full recognition is given to the need for safe and efficient operations. Other responsibilities of this position include ensuring that operations are in compliance with all relevant regulations, both in the Kenya and when operating into or over the territory of other States. In this respect, he must liaise with the Authority and with the appropriate authorities of other States. He is responsible for liaison and coordination with other departments, for approving the contents of the operations manual and, ultimately, for authorizing all operations.

3.3 Chief Pilot

The chief pilot is the post holder responsible for the day-today implementation of the company’s policies and for direct supervision of the operation. The chief pilot is directly responsible for the establishment of standards and the maintenance of discipline within the flight crew group and also for the establishment and supervision of methods of record-keeping for flight crew licences, type ratings, endorsements, appropriate renewal dates, and flight time/ duty time records. The chief pilot assists the Head of Operations in establishing new policies and procedures for aircraft operations, flight crew duties, cabin crew duties and operational administration. The Chief Pilot may also be the training manager who is responsible for all crew training and for the establishment of a ground and flight training programme which should ensure that crew members are adequately trained to perform their assigned duties. In complex companies, the training manager may be a separate post holder. He is responsible for monitoring the operation and identifying problems which may require the provision of extra training or changes in operational procedures, and for the selection and training of all training personnel and should ensure that common standards apply throughout. He is responsible for the establishment and promulgation of the standards and piloting techniques with which flight crew will be expected to comply during flight operations and which the flight crew will be required to demonstrate during recurrent checks.

3.4 Head of Safety

He discovers, identified and assesses hazards, and should make recommendations to eliminate them and should keep management and pilots informed of safety trends and problems within the organization and within the industry. He develops a safety risk management system that ensures proactive and predictive identification of safety risks and their mitigation. He provides safety assurance by ensuring that there are measuring and monitoring systems actively in place. Ensures operator has a robust and practical Emergency Response Plan that satisfies KCAA regulations and industry standards. He should circulate safety data, information concerning the experiences of other operators and other relevant safety information. He should report periodically to the accountable manager on safety matters and must be free to make recommendations to any manager within the organization if it is considered necessary in the interests of flight safety. To be fully effective, he must be given full and visible support by all management and supervisory personnel.

3.5 Head of Quality

He develops and maintains a quality policy that promotes a safe culture and operating environment. Quality Management System to ensure that high standards of safety performance are achieved, to satisfy regulatory requirements. Ensures appropriate corrective or preventive actions that address relevant compliance and/or conformity issues have been implemented and are being monitored for effectiveness.

3.6 Head of Head of Maintenance

He develops and updates the MCM, and ensure amendments to the same are furnished to all organizations and/or persons to whom the Maintenance Program has been issued. He ensures continued airworthiness of the company fleet of aircraft, in accordance with regulatory requirements. He maintains a close liaison with respective AMOs and OEMs. He ensures maintenance (preventive and continuous) and alterations are performed in accordance with approved maintenance programs and manuals and that compliance with all applicable Airworthiness Directives, Service Bulletins, Service Information Letters is fulfilled.

3.7 Management Organization

Circumstances will dictate the number of managers or supervisors required. For example, in a small airline the position of head of operations and chief pilot might be combined. In a large airline a number of supervisors are usually required to ensure proper administration of operations. In any case, the overriding concern in establishing a management/supervisory structure is to ensure that proper control is exercised over the operation and that management decisions on company procedures and operational instructions are swiftly conveyed to the personnel affected. Moreover, the existence of a properly defined structure will mean that necessary operational information is conveyed back along the reporting lines to the appropriate administrative level. This is particularly necessary, as the nature of flight operations is such that in many instances flight crew are the only people aware of operational deficiencies or hazards. A structure which clearly delineates duties, areas of responsibilities and reporting lines will ensure a swift transmission of information to the appropriate point in the management structure for further necessary action. The absence of such a structure, or the failure to adequately respond to reports, will result in flight crew not making reports.

Attachment A to Chapter 3 Example of an operator's terms of reference

Responsibilities

1. *Flight operations section*

1.1 The head of operations is responsible to the accountable manager for:

a) all flying and operational standards of all aircraft operated;
b) supervision, organization, manning and efficiency of the following departments within flight operations:
   1) all aircraft flight operations;
   2) cabin services;
   3) crew scheduling and rostering;
   4) flight watch;
   5) navigation and performance;
   6) air crew emergency training;
   7) flight safety committee; and
   8) flight operations at outstations;
c) the standards of the operations manuals governing each type of aircraft;
d) liaison with the KCAA on matters concerning the operations of all company aircraft, including any variations to the air operator's certificate;
e) the supervision of, and the production and amendment of the operations manual and the air crew training manual;
f) liaison with any external agencies which may affect company operations;
g) ensuring that company operations are conducted in accordance with current legislation and company instructions;
h) ensuring that the rostering section complies with both company and current legislation concerning the rostering of air crew, and that crew members are kept informed of any changes to this legislation;
i) the receipt and actioning of information circulars;
j) the dissemination of aircraft safety information, both internal and external, in conjunction with the flight safety committee;
k) the administrative arrangements for air crew training courses(both recurrent and conversion);
l) all matters relating to flight time limitations; and
m) in the absence of the chief pilot, assuming responsibility for the duties normally carried out by the chief pilot.

1.2 The chief pilot is responsible to the flight operations manager for:

a) defining basic principles, methods and standards for flying instruction on all types of aircraft relative to:
   1) type conversion;
   2) recurrent training and checks; and
   3) route flying;

b) supervision of all items in 1), 2) and 3) above, on all types of aircraft operated by the company;

c) the supervision of the issue of Notices to Aircrew with the fleet managers who will issue notices applicable to their own fleets as they see fit;

d) the categorization of airfields in conjunction with the fleet managers;

e) the actioning and distribution of the welfare, promotion and discipline of flight crew, including possible suspension;

f) assuming any responsibilities delegated to him by the head of operations; and

g) in the absence of the head of oeprations, assuming responsibility for the duties normally carried out.

1.3 The fleet managers are responsible to the chief pilot for:

a) ground and flying training of all air crew in their respective fleets to the standard required by the company and in accordance with the relevant air legislation;

b) supervision of the standards of, and amendments to their respective operations manuals;

c) the issue of the commander's Area Competency Certificate for every captain in their fleet and for ensuring that each certificate is kept up to date;

d) the processing and actioning of the Voyage Reports of their respective fleets;

e) monitoring a selection of flight envelopes each calendar month and liaising with the chief pilot as necessary on any problems emerging;

f) the day-to-day administration of their fleets; and

g) the execution of any tasks or responsibilities assigned to them by the chief pilot.

1.4 The fleet captains, or deputy fleet managers, are responsible for:

a) assuming any responsibilities delegated to them by the fleet managers; and

b) assuming responsibility for the duties normally carried out by the fleet managers, in their absence.

1.5 The chief training captains are responsible to their respective fleet managers for:

a) the supervision of ground and flying training of all aircrew in their respective fleets; and

b) liaison with the operations superintendent (crew scheduling) concerning training details.

1.6 The training captains are responsible to their respective chief training captains for the maintenance of the professional standard of all pilots as required by the company and in accordance with the relevant air legislation.

1.7 The line check captains are responsible to their respective fleet managers for periodical route checking and initial sector checking of all pilots.

CHAPTER 4

4.0 TRAINING

4.1 GENERAL

4.1.1 Describing the training programme in some detail in the operations manual has obvious administrative advantages as it makes it easier to approve and oversee the programme. It also acquaints the operational personnel with the contents of the programme, with the training philosophy of the operator, and with the standards, both in terms of skill and knowledge that flight crew and other operational personnel will be expected to meet.

4.1.2 The training programme could be described in detail in the operations manual or in a training manual issued as a separate volume. The choice will generally depend upon the extent of the operations and the number and types of aircraft in the operator's fleet. For example, a small operator with one or two aircraft types may incorporate the training information directly in the operations manual. On the other hand, an operator with a large number of aircraft types and having an extensive network of operations may find it more convenient to incorporate the information in a separate volume perhaps consisting of several parts, each dealing with a different aircraft type. Whatever the format, the principal features of the training programme remain the same.

4.1.3 The training programme should contain information on:

a) training staff:
b) duties and responsibilities;
c) selection, appointment and supervision;
d) experience and qualifications required;
e) syllabi of courses;
f) operational aspects of airborne training;
g) approval of flight simulators;
h) approval and use of other operators' training facilities and instructors;
i) emergency duties training;
j) human factors training;
k) dangerous goods training programme;
l) cabin crew member training;
m) flight operations officers/flight dispatchers training; and
n) record keeping: licences/ratings; route/aerodrome qualifications; proficiency checks; recurrent training, etc.; date of issue/renewal of licences/ratings/ approvals.

4.2 SYLLABI OF TRAINING COURSES (FLIGHT CREW)

4.2.1 The syllabus for a training course will vary from aircraft to aircraft. It will also be affected by many other factors, such as the basic qualifications and experience of the pilot and the training aids available (simulator, cockpit procedure trainer, etc.). Information should be given in the training programme on the syllabi for specific requirements, although it should be recognized that it will not be possible to address all eventualities. However, comprehensive information on syllabi will make it easier to select the appropriate training programme combinations which are relevant to the qualifications of the trainee and the facilities available.

4.2.2 A syllabus is normally divided into ground training and flight training. Ground training will be mainly concerned with gaining an understanding of the aircraft systems and any extra equipment; special procedures for the aircraft; performance and flight planning; emergency and survival training; etc. Details of the syllabus should be given in the training manual and information should also be given on what portions of the ground training can be accomplished using self-teaching aids and what portions will be accomplished through an instructor. Information should also be given on the form which technical examinations will take and the required standard of technical knowledge..

4.2.3 Flight training can consist of combinations of use of an aircraft and synthetic flight trainers. A syllabus for flight training should take account of the experience and background of the pilot under training. For example, the syllabus for a newly trained, inexperienced pilot should be more detailed than that for an experienced pilot. The training manual should give as much guidance as is feasible in this regard. The manual should also give guidance on the particular sections of a training programme which can be accomplished in a flight simulator, those which must be accomplished during airborne training and those which form part of line or route training. The particular combination will depend on many factors, not the least being the sophistication of the flight simulator available, i.e. the realism of the simulator's duplication of the aircraft handling characteristics, flight control loads and aircraft performance. This consideration could be further affected by the availability of a cockpit procedures trainer. A flight training programme could consist of cockpit procedure, flight simulator, airborne flight and line training. The time and resources allocated to each part of such a programme will vary, but the training manual should specify the optimum, which should be designed to produce a flight crew member with the appropriate knowledge, experience and skill, commensurate with the normal cost considerations.

4.2.4 In specifying the contents of a flight training programme, it will be necessary to give details of the exercises to be practised at each stage. For simulator training, instructions should be given on the operational environment that is to be simulated and for airborne training, instructions should be given on how instrument flying conditions are to be simulated and how engine failure and other emergency conditions are to be simulated. It should be noted that regulations states that in-flight simulation of emergency or abnormal situations when passengers or cargo are being carried is forbidden.

4.2.5 The training manual should also specify what levels of skill and knowledge must be achieved at each stage of a training programme, and in the event that the student fails to achieve these standards, what procedures, e.g. decisions on extra training, review by the training manager, etc., are to be followed.

4.2.6 In establishing the training programmes for different aircraft types, it is good practice to achieve as high a degree of commonality between the types as is feasible. A standard approach to methods of presentation of information, to the format of emergency and normal checklists, to terminology and to the attitude and philosophy of training will all ease the transition from one aircraft type to another. More details regarding training programmes requirements and approval are contained in Section B of the Flight Operations Inspectors Manual, Chapter 4, CAA-AC-OPS022 and CAA-AC-OPS005 as amended

4.3 PILOT PROFICIENCY CHECKS

The requirement for pilot proficiency checks and their frequency and period of validity is given in the regulations. Many of the considerations affecting these checks are the same as for any training detail. Information on the content and form of these checks should be given in the training manual. Where some or all of the checks may be accomplished in an approved flight simulator, the details of such approval shall be in the manual. It is necessary to specify which exercises and/or emergency drills should be satisfactorily accomplished on every proficiency check (engine failure between V_1 and V_2 is an example for a multi-engine aeroplane), and which exercises (such as manual extension of the landing gear) are optional. The training manual should be specific where different requirements apply to pilots-in-command and co-pilots. If a technical knowledge examination forms part of the recurrent check, the form and possible content of this examination should be described. It is necessary to describe how records of these checks are to be kept, and how they are to be annotated both for a satisfactory and an unsatisfactory check. Instructions should be given on the procedures to be followed in the event of the pilot failing to satisfactorily complete a proficiency check.

4.4 OTHER TRAINING PROGRAMMES

An operator should establish a training programme outside the “minimum” statutory requirement. This programme could consist of technical refresher training and associated simulator exercises. Exercises similar to those performed during the proficiency check may be carried out, but in a training rather than a checking environment. It may be possible to establish a line-oriented flight training (LOFT) programme, but whatever is done, it is necessary to describe the form and contents of these exercises in the training manual. In designing these programmes, care should be taken to ensure that over an established period, as full a review as is possible is conducted of the total operating environment of a particular aeroplane type.

4.5 ROUTE AND AERODROME QUALIFICATIONS

4.5.1 Although the requirements are only addressed to the pilot-in-command, it is common practice for operators to apply similar requirements to all pilots. The training manual must specify how these qualifications are to be gained and how they are to be kept valid. It is normal practice to give each pilot a "general" route or line check at least every 12 months. This check will qualify pilots into those aerodromes/heliports that form part of the normal operation. Certain aerodromes/heliports or areas may be designated as requiring a "briefing". The contents of such a briefing should be specified in the training manual, as should the period of validity. To qualify to operate into certain aerodromes/heliports, it may be necessary, because of particular operational problems, that a simulator training exercise using the approach procedures of that aerodrome/ heliport be completed. Again, this should be specified, as should the term of validity of any approval. Finally, certain aerodromes/heliports or areas may require that a pilot operate into them initially under the supervision of a designated line training pilot or as a supernumerary crew member.

4.5.2 Weather and its effects must be considered when developing a training programme. The training information and guidance (both ground and flight) that must be given will depend on the climate of the geographical areas over which operations take place. However, severe weather conditions which are rarely encountered are, by the nature of their unfamiliarity, all the more dangerous and the programme must go beyond the obvious and give the necessary information and details of the training required so that the flight crew are adequately prepared to cope with the full range of environmental conditions they might encounter.

4.5.3 Some of the environmental training required could be integrated with other training exercises. For example, during a simulator training exercise, the weather conditions simulated would be those associated with icing problems, and the opportunity could be taken to review the correct procedural actions.

4.5.4 Some training can be accomplished through crew notices or by the distribution to crew members of the required information extracted from other publications. Some training material of this nature may be distributed annually, as for example, the distribution of instructions on operations in snow and ice at the start of every winter, or the distribution of information on operations in severe weather associated with the inter-tropical convergence zone.

4.5.5 When a flight is to be operated to an area unfamiliar to the crew, the climatology of the route and the aerodromes/heliports must form part of the route/ aerodromes/heliports briefing.

4.5.6 Information and, where possible, simulator training, should be given on the effects of severe weather on the aeroplane flight and handling characteristics. A very good example is the simulator training for recovery actions on encountering severe low-level wind shear (e.g. microburst). If possible, flight crew should be exposed to the effects of wind shear in a sophisticated full-motion flight simulator. If this is not possible, the greatest amount of information and training that is possible should be given.

4.5.7 The manual should specify the training required for environmental factors on the operator's normal route network, and the person responsible for deciding what extra training is required for flights to new areas or aerodromes. Normally the training manager would be given this responsibility. Co-ordination with other sections of the company is necessary to allow adequate notice to be given of the need for such training, and the manual should specify that records of those who have received the training for a particular route be kept and details given of the term of validity of any such training.

4.6 PILOT-IN-COMMAND TRAINING The company policy on licences, ratings, flying hours and experience required prior to appointment as pilot-incommand should be detailed. The command training programme should be described. This programme will vary from operator to operator, but may include details of an initial check to determine suitability for command, a ground school command course that would instruct the new pilot-in-command on his duties and responsibilities, and a detailed programme for conversion (simulator and airborne) training, including information on the number of route sectors and flying hours to be flown under supervision before the actual command check. A detailed description of the form a command check will take should be included in the training manual. It should specify the number of sectors that must be flown and the number of different types of approaches and/or areas into which the trainee must operate to demonstrate his competence as pilot-in-command.

4.7 EMERGENCY DUTIES TRAINING (FLIGHT CREW)

4.7.1 An operator is required to assign to each flight crew member the necessary functions to be performed in an emergency or in a situation requiring emergency evacuation. Regulations requires that the training, which includes instruction in the use of all emergency and life-saving equipment and drills in the emergency evacuation of the aircraft, shall be performed on a yearly basis.

4.7.2 Certain aspects of the training specified should form part of the normal recurrent training programme; for example, the procedures to prepare a cockpit for ditching will be best practised in the simulator. However, certain other aspects of the required training, for example, how to launch life rafts or evacuate passengers after a ditching, can only be accomplished on the aeroplane or in a cabin mockup. The training manual must give guidance on these aspects of the training. It is considered that the most effective flight crew training in this regard would be accomplished in conjunction with the cabin attendants' training.

4.8 APPROVAL OF FLIGHT SIMULATORS AND APPROVAL OF OTHER OPERATORS' TRAINING FACILITIES

4.8.1 The extent to which an aeroplane flight simulator can substitute for airborne training depends, to a great extent, on the realism of the simulator's duplication of the aeroplane performance, handling characteristics and flight control loads, as well as the simulation of the aeroplane's systems and instrumentation. There are other factors that should be considered in deciding the breakdown between airborne and simulator training for any particular programme, e.g. the experience of the pilots being trained, the availability of a flight simulator with a visual attachment and the quality of that visual attachment, the sophistication of the flight simulator's motion, etc. The training manual should address these questions and give instructions as to the use that can be made of any flight simulator. The realism of a flight simulator's duplication of an aeroplane must be maintained and guidance must be given on how this is to be checked, particularly after major maintenance. To do this, it will be necessary to nominate some instructor pilots as responsible for certifying that a simulator operates at the standard required for the training programme.

4.8.2 In the event that training is accomplished using some other operator's facilities, it will be necessary to specify a system of checking that the training, both ground and airborne, is compatible with the operator's own requirements, and to the standard required. It is essential to ensure that the training given at some other facility meets with requirements laid down by the Authority A physical check should be made to ensure that any differences between the flight simulator and an operator's own aeroplane are not operationally significant. It is essential to get the approval for training personnel and the training manuals should list, by name, the training personnel approved. In the event that all initial, recurrent, and proficiency training is done at some other operator's training facility, the training manual should specify any additional route training and checking considered necessary to ensure that there is an adequate exposure of flight crew to the operator's own operational philosophy and training procedures.

4.9 SECURITY TRAINING

4.9.1 An operator establish and maintain an initial and recurrent training programme which enables crew members to act in the most appropriate manner to minimize the consequences of acts of unlawful interference.

As a minimum, this shall include:

a) Security of the flight Crew compartment
b) Aircraft Search procedure checklist
c) Determination of the seriousness of any occurrences
d) Crew communication and Coordination
e) Appropriate self-defence responses
f) Use, as authorised by the CAA, of non-lethal protective devices assigned to crew members
g) Understanding of behaviour of terrorists
h) Live situational training exercises regarding various threat condition and
i) Post flight concerns for the crew

4.10 DANGEROUS GOODS TRAINING PROGRAMME

The successful application of regulations concerning the transport of dangerous goods and the achievement of their objectives are greatly dependent on the appreciation by all individuals concerned of the risks involved and on a detailed understanding of the regulations. This can only be achieved by properly planned and maintained initial and recurrent training programmes for all persons concerned. *Dangerous goods Training,* will be as per applicable KCARs and Technical Instruction (TI). Requirements to include;

a) Approval requirement for dangerous goods
b) General requirements of training and recurrent training
c) Required training Syllabus on dangerous goods
d) Training Instructors qualifications
e) Identification of training and testing materials

4.11 CABIN ATTENDANT TRAINING

4.11.1 The training manual shall provide details of the necessary functions to be performed by cabin attendants in an emergency or in a situation requiring emergency evacuation. These functions shall be assigned for each aircraft type and shall form the basis of the cabin attendant's initial and recurrent training. The basic subjects that should be addressed in the training programme are detailed in the regulations (Civil Aviation – Operation of Aircraft for both aeroplanes and helicopters). An essential aspect of this training programme is that the crew be aware of other crew members' assignments and functions in the event of an emergency. In this regard the training programme shall specify that cabin crew and flight crew take part in joint training exercises to practise the drills and procedures used in emergency evacuations and to highlight how essential flight crew/cabin crew co-operation is in an emergency.

4.11.2 The training programme shall also require that records be kept of the aircraft types on which a cabin attendant is trained and on the period of validity of recurrent training for each aircraft type. It may be considered practical for each cabin attendant to carry a document with these details, and if such is decided, instructions should be given on the form of such documentation.

4.11.3 As part of their training it shall be specified, especially on aircraft with two-pilot crews, that cabin attendants be trained to assist the flight crew in the event of flight crew incapacitation. Such training should be detailed in the training manual and should at least require that cabin attendants be familiar with the operation of the pilot's seat controls and with methods of restraining an incapacitated pilot. In addition, cabin attendants could be introduced to the philosophy of checklists and be given some experience of their use so that they could assist in the event of pilot incapacitation.

4.12 FLIGHT OPERATIONS OFFICER/ FLIGHT DISPATCHER

4.12.1 Regulations require that the operational personnel employed in conjunction with an approved method of flight supervision be licensed (scheduled operations). For operations not requiring licensed FOO/Dispatchers, their functions, duties and training form part of the approval of the method of operating supervision. The requirements for age, skill, knowledge and experience for licensed flight operations officers/flight dispatchers are in Civil Aviation (*Personnel Licensing)* Regulations. Details of the requirements for initial appointment and the maintenance of competency are in Civil Aviation (*Operation of Aircraft-Commercial Air Transport*) and Civil Aviation (*Operation of Aircraft-Helicopters)* Regulations as are details of the duties of flight operations officers/flight dispatchers.

4.12.2 Training for both licensed and unlicensed FOO/Dispatchers is contained in the training manual in accordance with the regulations. In either case the functions and duties of flight operations officers/flight dispatchers are broadly similar. Details should be given in the training manual, as should information on on-the-job training, maintenance of competency and route familiarization flights.

4.13 HUMAN FACTORS TRAINING

4.13.1 In implementing training programmes, operators seek to develop professional competence among operational personnel which will allow them to properly discharge their responsibilities and thus contribute to not only safe but also efficient operations. Traditionally, training programmes for operational personnel centred on the development of technical competence. Evidence from accident investigation, however, has clearly established that lapses in human performance underlie an overwhelming majority of accidents and incidents. Therefore, it is essential to broaden the scope of training programmes for operational personnel to develop new competence, including knowledge of human capabilities and limitations, in addition to technical competence.

4.13.2 The findings of a substantial body of research support the design of Human Factors training programmes that are operationally relevant and that avoid academic approaches. The most important application of Human Factors knowledge of human performance and limitations into a training programme is known as Crew Resource Management (CRM). CRM aims primarily at preventing accidents and incidents where ineffective crew performance as a team might be a major factor. It also contributes to the improved performance, both in terms of safety and effectiveness, of the aviation system through improved performance of the basic units: flight crew-aircraft; maintenance crew-aircraft; flight operations officer-flight crew; flight and cabin crew, etc. The objectives of CRM training are to develop the communications, management and teamwork skills and to create an understanding of how humans operate, particularly in difficult and stressful situations. CRM training typically includes an initial indoctrination following a classroom or seminar-type format. This first phase provides the framework for the acquisition of the basic concepts as well as a common language. Recurrent training is used thereafter to consolidate and update the newly acquired competency.

4.13.3 A third and essential component of Human Factors training for operational personnel is known as line oriented flight training (LOFT). LOFT is the inseparable ally of CRM, since it provides an opportunity to apply CRM concepts in practice, in operational settings and in real time. LOFT consists of carefully structured scenarios developed in flight simulators where flight crew are confronted with operational situations where the application of sound CRM principles is the key for a successful outcome.

4.13.4 The realization of the potential benefits CRM and LOFT can bring into the safety and effectiveness of flight operations depends on their integration into the philosophies, policies, procedures and practices of operators. A piecemeal approach, such as the incorporation of a CRM training module into the training curricula, may be a beginning but it is not enough. CRM principles must be slowly embedded into every aspect of the operator's standard operating procedures. Furthermore, CRM training should not be limited to flight crews, but it should be extended to include maintenance personnel, flight operations officers/flight dispatchers and cabin crews. On the larger organizational scale, awareness packages are available for supervisory and managerial personnel. Such packages foster the notion that operational personnel practices during the course of operations will simply reflect management and supervisory policies; therefore, it is a precondition to the success of CRM that managers (including senior executives) and supervisors demonstrate and exercise appropriate CRM behaviours.

4.14 DE/ANTI-ICING OPERATIONS TRAINING

To ensure a thorough understanding of all aspects of winter operations, flight and ground crews must be trained and qualified in procedures for safe de/anti-icing operations during ground icing conditions.

Attachment A to Chapter 4 Example of company initial indoctrination

All newly hired members.

Duration

Five training days (40 hours). The subjects to be covered will include the following:

a) Operator's organisation, scope of operation, and administrative practices as applicable to crew member assignments and duties;
b) Appropriate provisions of civil aviation regulations and other applicable regulations and guidance materials;
c) AOC holder policies and procedures;
d) Applicable crew member manuals; and
e) Appropriate portions of the AOC holder's operations manual.

Attachment B to Chapter 4
Example of the layout of a ground school training programme

INITIAL AIRCRAFT GROUND SCHOOL TRAINING
Participation
Selected pilots whose licence is not endorsed for the Aircraft
Duration
40 hours — 5 training days.
Course content
Introduction – 8 hrs
Dimensions, areas, loading
Doors, windows and emergency exits
Forward, pax and aft compartments
Equipment and configurations
Center of gravity
Servicing
Dart engine and APU – 16 hrs
Characteristics
Controls and operations
Starting and ignition
Fuel and oil
Water methanol
APU description and operation
Shut-down
Warning devices
Capabilities and limitations
Propeller system – 16 hrs
Design characteristics
Governing
Ground and flight fine pitch
Stops

Attachment C to Chapter 4 Example showing syllabus and breakdown between simulator and aircraft

TRAINING RECORD	SIMULATOR												AIRCRAFT											
Training Items	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1.0 FAMILIARIZATION																								
1.1 Exterior check																								
1.2 Systems check																								
1.3 Flight deck preparation																								
1.4 F/E station																								
2.0 ENGINE STARTING																								
2.1 Normal start																								
2.2 Cross bleed start																								
2.3 Hot start																								
2.4 Hang start																								
2.5 Wet start																								
2.6 Battery start																								
2.7 Alternate start																								
2.8 High-pressure start																								
3.0 TAXI AND TAKE-OFF																								
3.1 Taxi checks and briefing																								
3.2 Rolling take-off																								
3.3 Standing take-off																								
3.4 Noise abatement																								
3.5 Heavyweight																								
3.6 Cross-wind																								
3.7 Abandoned take-off																								
3.8 Engine failure after V_1																								
3.9 Anti-ice procedures																								
4.0 DEPARTURE AND CLIMB																								
4.1 Area departure																								
4.2 En-route climb																								
4.3 Best angle																								
4.4 Best rate																								
4.5 Climb power settings																								
5.0 AIRWORK MEDIUM LEVEL																								
5.1 Accelerate to VMO																								
5.2 Effect of controls																								
5.3 Stab trim (manual)																								
5.4 Stab trim (runaway)																								
5.5 Stab trim (jammed)																								
5.6 Use of speed brakes																								
5.7 Steep turns (45° bank)																								
5.8 Engine out familiarization																								
5.9 Shut down and relight																								
5.10 Stalling																								

TRAINING RECORD	SIMULATOR												AIRCRAFT											
Training Items	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
5.11 Slow flying																								
5.12 High sink rate																								
6.0 AIRWORK HIGH LEVEL																								
6.1 Accelerate MMO																								
6.2 Mach trim/tuck																								
6.3 Buffet and recovery																								
6.4 Dutch roll																								
6.5 Emergency descent																								
7.0 CRUISE FAMILIARIZATION																								
7.1 Cruise procedures																								
7.2 Autopilot																								
7.3 Turbulence penetration																								
8.0 DESCENT AND HOLDING																								
8.1 High speed																								
8.2 Low speed																								
8.3 Holding																								
9.0 INSTRUMENT APPROACHES																								
9.1 Briefing																								
* 9.2 ILS flight director																								
* 9.3 ILS raw data																								
* 9.4 ADF																								
* 9.5 VOR																								
* 9.6 Missed approach																								
* Please annotate whether on																								
2, 3 or 4 engines																								
10.0 VISUAL CIRCUITS																								
10.1 4 engines																								
10.2 3 engines																								
10.3 2 engines																								
10.4 Manual stabilizer																								
10.5 Jammed stabilizer																								
10.6 Cross-wind																								
10.7 Circling																								
10.8 Flapless approach																								
10.9 Go-around 4 engines																								
10.10 Go-around 3 engines																								
10.11 Go-around 2 engines																								
10.12 Approach and landing no VASIS																								
11.0 EMERGENCY PROCEDURES																								
11.1 Engine fire																								
11.2 Wheel well fire																								
11.3 Electrical smoke/fire																								
11.4 Fire on ground																								

TRAINING RECORD	SIMULATOR												AIRCRAFT											
Training Items	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
12.0 ABNORMAL PROCEDURES																								
12.1 Instrument failures																								
12.2 Electrical failures																								
12.3 Loss of generators																								
12.4 Loss of essential power																								
12.5 Loss of P2 panel power																								
12.6 Hydraulic failures																								
12.7 Gear malfunction																								
12.8 Anti-skid failure																								
12.9 Manual gear extention																								
12.10 Flap malfunction																								
12.11 Electric flap extension																								
12.12 Fuel dumping																								
12.13 Pilot incapacitation																								
12.14 Wind shear																								

PROGRESS REPORT SIMULATOR
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
PROGRESS REPORT AIRCRAFT
1
2
3
4
5
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7
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10
11
12
13
14
15
NOTE: Continuation sheets will be used if additional space is required for progress reports.

Attachment D to Chapter 4 Example of qualifications, training and supervision procedures

Pilot-in-command

Qualification requirements

A pilot may commence training to pilot-in-command when he has been selected for this training by Flight Operations. In order to be qualified for selection, he shall have served a minimum of four years as flight officer, whereof the last year as co-pilot and also fulfil licence requirements as specified by the CAA.

Ground training

A syllabus provided by flight crew training shall ensure that the student is adequately qualified to assume responsibility as pilot in-command of the aeroplane type concerned. Particular emphasis shall be laid on captain's authority, company organization and policy, passenger relations and other points relating to the responsibility.

Flight training

Syllabi for simulator and aeroplane training provided by flight crew training shall ensure that the student is adequately qualified to assume responsibility as pilot-in-command on the aeroplane type concerned.

Licence check

A licence check will be given only if required by the authorities.

Route introduction

The pilot will receive a route introduction flight under the supervision of an instructor according to the syllabus provided by flight crew training. At the end of the route introduction he shall be given a school release flight by an instructor to deem if he is qualified for flight base training as captain candidate on the aeroplane type concerned.

Flight base training

After a satisfactory release flight, the pilot shall be scheduled as captain candidate to carry out a minimum of 60 landings whereof at least 30 as pilot flying in the left-hand seat. In the case of a captain candidate being promoted on the same aeroplane type, 30 landings as pilot flying in the left-hand seat shall be considered sufficient. During this training, the captain candidate should be scheduled on such routes and aerodromes as he will later be required to fly. The administration of this training is the responsibility of the flight base concerned. Upon completion, the flight base shall inform flight crew training that the captain candidate is ready for final training release.
The captain candidate's Pilot's Route and Aeroplane Experience Form shall, when completed, be signed by him and delivered to the chief pilot concerned.

Final training release
Upon completion of the flight base training, he shall be given a final training release flight at flight crew training and then released to his flight base for a base release flight.

Base release flight
After the final training release he shall be scheduled with a chief pilot or a supervisory pilot selected by the chief pilot for the base release flight.

Appointment
Upon satisfactory completion of the base release flight, he will be appointed captain to serve as pilot-in-command. After appointment, the new captain shall make all take-offs and landings himself until he has accumulated at least 100 hours or 25 landings as pilot-in-command.

Attachment E to Chapter 4 Example of emergency training

EMERGENCY TRAINING

1. General

All flight deck and cabin crew members shall complete emergency training and tests according to the rules laid down below.

2. Type of training

2.1 Initial emergency training, which is performed at the initial employment.

2.2 Transition emergency training, which is performed when qualifying on a new aeroplane type.

2.3 Periodic emergency training, which is performed as follows:

- for flight deck crew members, twice a year as periodic flight training and a specially composed emergency/ technical brush-up training programme;
- for cabin crew members, once a year on the aeroplane type flown.

3. Tests and qualification requirements

3.1 Flight deck crew members will be given a test included in the periodic flight training examination.

3.2 Cabin crew members will be given a written test on knowledge of emergency procedures and equipment once a year on each aeroplane type flown.

3.3 The required standard for passing the written test is 90%.

4. Syllabi and training aids

Syllabi for emergency training shall be provided and included in flight crew training. These shall cover:

- emergency equipment;
- procedures for evacuation on land and on water and the post-evacuation procedures;
- training in the use of oxygen systems and fire fighting equipment;
- instruction and/or practical training in the use of exits, evacuation slides, slide rafts, life rafts and life vests;
- training in first aid and medical assistance.

Attachment F to Chapter 4 Example of a simulator lesson plan
Flight crew briefing

Lesson objective
- Reinforcement of previously accomplished manoeuvres and procedures
- Selected normal, abnormal, supplementary and emergency procedures
- Instrument approaches

Flight planning
- Navigation and communications
- Dispatch data and computations

Pre-flight
- Cockpit safety inspection
- Preliminary cockpit preparation
- Cockpit preparation

Engine start
- Normal start

Taxi-out and take-off
- Normal procedures
- Normal take-off
- Noise abatement take-off
- Wind shear on take-off

Climb
- Normal procedures
- Climb-in holding
- Turbulence procedures Electrical caution lights

Cruise
- Normal procedures
- Engine caution lights
- Engine shut-down in flight
- Drift-down procedure
- One engine inoperative
- Cruise

Descent approach
- Flight director ILS approach
- One engine inoperative VOR or NDB approach
- One engine inoperative circling approach
- System “A” and “B” failure

- T.E. flaps-up approach
- Standard call-outs
- Missed approach procedure

Landing

- Normal procedures
- Normal two-engine landing
- Manual reversion landing
- T.E. flaps-up landing VASI light approach
- Landing roll procedure

Taxi-in and parking

- Taxi-in procedure
- Parking procedure
- Shut-down procedure

Attachment G to Chapter 4 Example of a CRM programme

Essential curriculum elements

Introduction

Curriculum elements are divided into two major areas: concepts to be understood and skills to be acquired. There is a great value in enhancing "understanding" of certain topics that pertain to the interrelationships between crew members. It is of equal importance, however, to develop "skills".

Concepts to be understood

These topics constitute the "language" and awareness that enable skills to be developed and, ultimately, used in an operational environment:

a) a common language or glossary of terms;
b) the concept of synergy (a combined effect that exceeds the sum of individual effects);
c) the need for individual commitment to CRM principles;
d) guidelines for continued self-improvement (continuation training);
e) individual attitudes and behaviour and how they affect the team effort;
f) complacency and its effect on team efforts;
g) fitness to fly: the concept that each individual is responsible for arriving at work "fit to fly" and the ramifications and refinements of this concept;
h) the impact of environment, such as company policy and culture, air traffic control and aircraft type;
i) resources available: identification and use;
j) identification and assignment of priorities;
k) human components and behavioural characteristics: awareness of the human being as a composite of many complex characteristics, often not controllable. Crew members must be aware of these characteristics in order to adjust their own actions and behaviour;
l) interpersonal relationships and their effect on team work: the way in which crew members approach or respond to each other has a critical effect on team-building and team results;
m) "team required" versus "individual" tasks: some problems require a team solution while others may be solved through individual effort;
n) identification of norms (i.e. tacitly accepted actions, procedures and expectations): whether consistent with or deviant from written policy, norms exert strong pressures upon individuals to conform;
o) pilot judgement: once all information is available to the pilot-in-command, the situation may be clear-cut or may require judgement. These judgement calls are the ones most likely to spark dissent, produce initial resistance and have a negative effect on the team;
p) the statutory and regulatory position of the pilot-in-command as team leader and commander: all decision-making must be done or funnelled through the pilot-in command; and

q) ground rules; policies and procedures to be followed during the course of instruction, as well as subsequent operations. For example, management support for the programme and concepts taught; management support for those who attempt to act in accordance with learned principles; and absence of punitive action during the course and afterwards in actual flight operations.

Skills taught

There are six major areas to be taught:

a) Communication/interpersonal skills
   1) cultural influence
   2) barriers, e.g. rank, age, crew position
   3) polite assertiveness
   4) participation
   5) listening
   6) feedback
   7) legitimate avenues of dissent;
b) Situation awareness
   1) total awareness of surrounding environment
   2) reality versus perception of reality
   1) conflict management
   2) review (immediate, ongoing);
d) Leadership/“followership”
   1) team-building
   2) managerial and supervisory skills: plan, organize, direct, control 3) authority
   4) assertiveness
   5) barriers
   6) cultural influence
   7) roles
   8) professionalism
   9) credibility
   10) responsibility of all crew members 11) time/workload management;
e) Stress management
   1) fitness to fly: mental and physical
   2) fatigue
   3) incapacitation in varying degrees; and
f) Critique (three basic types)

1) pre-mission analysis and planning
2) on-going review
3) post-mission.

Training techniques
Seminars or workshops
Panels
Group exercises
Videotaping of group exercises
Role playing
Case studies
LOFT

CHAPTER 5

5.0 FLIGHT CREW FATIGUE AND FLIGHT TIME LIMITATIONS

5.1 REQUIREMENT FOR RULES

5.1.1 KCAA has established regulations specifying the limitations applicable to the flight time and flight duty periods for flight crew members. These regulations make provision for adequate rest periods and ensure that fatigue, occurring either in flight or successive flights or accumulated over a period of time due to these and other tasks, does not endanger flight safety. A similar requirement is also established for cabin attendants. On the basis of these regulations an operator shall formulate rules limiting the flight time and flight duty periods of all crew members. These rules shall also make provision for adequate rest periods. The rules shall be approved by the Authority and included in the operations manual.

5.2 OPERATIONAL CONSIDERATIONS

5.2.1 The actual form the flight time limitations will take depends on the type of operation being considered. The limiting consideration for a single sector intercontinental operation may well be different to the limiting factor for a multi-sector short-haul operation. An operator may engage in both types of operations and may well have regulations for each. Other factors that may be relevant are the type of aeroplane (pressurized as against unpressurized); the number of flight crew (whether the minimum required by the flight manual or increased to allow longer flight duty times); the number of time zones crossed during a particular operation; the time of day that the operation commences and the time at which it finishes; the type of duty and rest that preceded a particular operation; etc.

CHAPTER 6

6.0 OPERATIONS SUPERVISION — GENERAL

6.1.1 Civil Aviation (*Air Operator Certification and Administration*) Regulations states that an operator shall establish and maintain a method of control and supervision of flight operations, as one of the prerequisites for the issue and continued validity of an air operator certificate.

6.1.2 To fulfil this requirement, it will be necessary for the operator to specify in the operations manual those rules and regulations which are pertinent to flight operations. The basic information should be drawn from the applicable regulations, but an operator will typically include some of his own regulations which he considers necessary to ensure a safe and efficient operation. The operations manual is therefore the basic reference document for describing the authority and function of operational personnel and their relationship to each other. In addition, information is normally given in this section of the manual on other related, but non-regulatory subjects.

6.2 PILOT-IN-COMMAND

6.2.1 The pilot-in-command is responsible for operating an aircraft in accordance with the rules of the air and has final authority as to the disposition of the aircraft while in command. It is therefore essential that the manual have a statement on the authority of the pilot-in-command. The regulations should be quoted, as should the ICAO annexes dealing with the authority of the pilot-in command.

6.2.2 The operations manual must detail the chain of command during a flight. This will depend on the number of crew and their functions and a typical example would be:

- pilot-in-command;
- co-pilot (second-in-command);
- Senior cabin crew member; — other cabin crew.

It should also be indicated who will be pilot-in-command in situations where the standard ranking system does not apply. An example is when two senior pilots, both qualified as aircraft commanders, are flying together, and in this case it is typically specified that airline seniority will determine command. It is normal, as well, to specify who is pilot-incommand when an instructor is in the cockpit. Instructions on this need to be quite specific, as for example when it is specified that the instructor pilot is pilot-in-command when occupying a handling pilot’s seat and conducting a training or checking assignment.

6.2.3 In addition to describing the basis and extent of the authority of the pilot-in-command, the operations manual shall contain information on his duties and responsibilities.

6.2.4 The responsibilities of the pilot-in-command shall be described in a company operations manual in accordance with regulations. The subjects specifically mentioned in the regulations are:

- the need to report violations of local regulations in an emergency;
- the pilot-in-command's responsibility for ensuring that the flight preparation is satisfactory;
- for approval of the operational flight plan;
- for the operation and safety of the aircraft and for the safety of all persons on board;
- for ensuring that the checklists provided are used;
- for reporting an accident;
- for reporting aircraft technical defects;
- for the general declaration/journey log book; and
- reporting acts of unlawful interference.

6.2.5 There are a number of other areas in the regulations that fall within the area of the pilot-in command's responsibility, such as in-flight procedures. There is also the requirement on the provision of information by the pilot-in-command to aerodrome authorities concerning the presence of dangerous goods on board in the event of an in-flight emergency. In *Search and Rescue*, there are procedures to be followed by pilots-in-command at the scene of an accident or when intercepting a distress transmission. In *Rules of the Air*, there is information on interception of civil aircraft.

6.2.6 The operations manual should also give information on the duties and responsibilities of the pilot in-command, which are not a requirement in the regulations, but are assigned by the operator. These duties or responsibilities will be a policy decision of the operators and will reflect their particular requirements.

6.3 CREW

6.3.1 The operations manual should give details on the number of flight crew required and on the applicable licence and rating requirements for each flight crew position. While the minimum crew will normally be that specified in the flight manual, it is possible that for certain operations extra crew members will be required. An example would be an extra or "relief" crew member for very long flight duties, or it could be specified that for certain flights a navigator shall be carried. Instructions should be given on which flights, if any, require extra or specialist crew and on the qualifications of such crew. When a navigator is required the selection of the crew member is obvious, but it is not so obvious that a relief pilot required for a two-pilot crew should be qualified to occupy both seats, and guidance on the qualifications of the extra crew member shall be given where necessary.

6.3.2 The operator shall also establish, to the satisfaction of the Authority, the number of cabin crew required for each type of aircraft. In the case of aeroplanes, the ratio is typically one cabin attendant to 50 passenger seats. However, it must be ensured that the number of cabin crew is adequate to ensure a safe and expeditious evacuation of the aeroplane. Detailed instructions and guidance to this effect should be given in the operations manual.

6.3.3 Some operators, rather than detailing in one list all the different duties of each crew member, make a general statement as to areas of responsibility and assign the different functions in the specifically related section of the manuals.

6.3.4 Guidance should also be given on areas of responsibility of crew members as they affect other members of the operator's staff. Specific guidance and direction should be given on the responsibilities and authority of the pilot-in-command and other crew members when at an aerodrome where the operator has no representative. It is quite common to specify the pilot-in-command's authority to incur necessary expenses in this type of situation. However, since the operator will have nominated representatives at most aerodromes, it will normally only be necessary to specify the areas of responsibilities of the different parties and their need to consult and advise each other.

6.4 OPERATIONAL STAFF RESPONSIBILITIES

The operations manual shall give information on the functions and responsibilities of other operational personnel, such as the responsibility for assigning crew duties, supervision of flight time/duty time limits and associated record-keeping and flight preparation forms recordkeeping. The manual should specify the responsibilities and functions of flight operations officers/flight dispatchers. The actual responsibilities assigned will depend on whether licensed or unlicensed personnel are part of the approved method of supervision of flight operations. For licensed flight operations officers/flight dispatchers, regulations gives information on their duties; however, the duties assigned will be very similar for any flight operations officer/flight dispatcher, licensed or unlicensed. The operations manual should give clear details of the respective responsibilities of pilots-in-command and flight operations officers/flight dispatchers. The ultimate authority of the pilot-in-command should be made clear, yet the requirement that he consult and seek the advice of the flight operations officers/flight dispatchers, as appropriate, should be included.

6.5 DOCUMENTS

6.5.1 The operations manual shall list those documents that should be carried on each aircraft, in its library. The list shall include, as appropriate, those documents listed in Article 29 to the Convention on International Civil Aviation and those required according to regulations but should also detail those extra documents necessary for operational reasons. The operations manual should also specify who is responsible for ensuring that all the required documents, in usable condition and amended as required, are aboard the aircraft.

6.5.2 Flight crews are required to have their licences in their possession while operating. In addition, it may be necessary to specify that they have valid passports and visas and, for operations in some regions of the world, valid health certificates. In addition, crew members' certificates may be issued to non-licensed crew members. Guidance on necessary personal documentation should be given in the operations manual.

6.5.3 Copies of certain documents, such as the operational flight plan, the aircraft technical log, the mass and balance sheet, etc., must be filed with the operator or his agent before a flight. In addition, certain documents used during the flight should be returned after a flight and held for a specified period. Instructions should be given on copies of which documents shall be filed before flight, which documents shall be available on the flight, and which documents shall be returned after the flight.

6.6 HEALTH REQUIREMENTS

6.6.1 The operations manual shall include guidance and regulation on preventive measures to safeguard health.

6.6.2 Many of the subjects that should be addressed will be common to all operators, while the area of the world in which operations take place, or might take place, will, because of particular medical problems associated with those areas, decide the information that other operators include.

6.6.3 An operator may require crew members to have other vaccinations (immunizations) depending on the possible exposure of the crew member to disease. The manual should not only contain information on where certain immunizations are required, but should give some basic guidance on precautionary measures.

6.6.4 Guidance is necessary on health precautions during flight. The operating crew has a responsibility to be fit, yet the nature of airline operations can make it difficult for a crew to comply with the advice given. An example is hypoglycaemia, or low blood sugar levels, which has been a factor in a number of accidents. The dangers of this condition should be explained and, if necessary, suitable measures to prevent its occurrence should be adopted.

6.6.5 Information should also be given on a number of activities which are incompatible with being part of an operating crew unless appropriate precautions are taken. For example, blood donations must be separated from flying by a number of days and, in the case of scuba-diving, at least one day must elapse before flying.

6.6.6 The dangers of food poisoning in airline operations are known and the manual must have regulations and guidance on crew meals. The advice given normally extends to the type of meals that should be eaten before a flight.

6.6.7 Certain commonly available drugs can affect a crew member's ability to properly perform his duties. Crew members must be aware of this fact and of the dangers of self-medication, and the manual should contain appropriate guidance. As a minimum, crew members should seek information as to the possible deleterious effects of a drug before use. In seeking such information or advice, the crew member should be conscious of the need to consult someone with the appropriate knowledge of aviation medicine, as certain drugs generally considered harmless may be inappropriate to aviation.

6.6.8 It is necessary for the manual to contain company regulations on the abuse of certain substances, such as alcohol, illegal drugs, etc. The abuse of these substances is completely incompatible with flight operations. In the case of alcohol, the regulations must specify an absolute minimum time between consumption and flight duty. Information should also be given on the dangers of smoking, both in the long term and also in the short term where, for example, a smoker in the cockpit has the effect of lowering the crew's resistance to hypoxia. In all these cases ongoing education, and where necessary, organized mutual support groups are of considerably more benefit than the mere presence of regulations in the manual.

6.7 MEDICAL SUPPLIES

6.7.1 Regulations requires that an aeroplane be equipped with accessible and adequate medical supplies appropriate to the number of passengers the aeroplane is authorized to carry.

6.7.2 The manual should specify who is responsible for ensuring that the kits are maintained and serviced regularly. When any medical or first aid kit is opened on a flight, a report should be submitted so that the kit can be replenished and re-sealed.

6.7.3 If it is decided to place a "physician's use only" kit on board, it must be securely stowed and the key placed in the possession of a designated crew member, normally the pilot-in-command.

6.8 COMMUNICATIONS

6.8.1 The nature of flight operations is such that an essential part of effective operational supervision is a reliable company communications network. The operations manual should list the operational offices with which it may be necessary to establish contact during operations, and the functions of these offices. The phone number (internal, external, long-distance codes, etc.), telex number, facsimile number and SITA code of each office should be listed, as should information on hours of work so as it can be seen who to contact outside normal hours.

6.8.2 Many operators use commercial communications agencies to provide telephone patch facilities on HF and on VHF to maintain contact between "operational control" and the aircraft. When this type of service is used, guidance should be given on frequencies and best time of use, SELCAL procedures and form of messages. Information on this type of facility, and also on the company's own radio facilities and on the frequencies and use of commercial agencies' radio facilities at other aerodromes, should also be included in the route guide.

6.8.3 In establishing and describing a company communications network, the operator should specify, as a matter of operational policy, that "company" calls from an operating aircraft be kept to a minimum and should never be allowed to interfere with the primary task of operating the aircraft safely and efficiently.

Attachment A to Chapter 6
Example of an operator's description of crew composition and functions

1. General function description of the captain

1.1 *Position in the organization*

The pilot-in-command is directly subordinate to the chief pilot of the division to which he is assigned. It should be recognized, however, that he also has certain duties as described by law.

1.2 *Responsibility and authority*

1.2.1 According to the regulations, the pilot-in-command is responsible for the execution of the flight and for the safety of the aeroplane and its occupants during the flight. He has authority to take such measures as necessary for the safety of the flight and in this connection he may take such reasonable measures as are necessary for order and discipline on board. These measures may include the restriction of freedom of one or more occupants until they are delivered to the competent authorities.

1.2.2 This general description of the pilot-in-command's legal responsibility requires elucidation on the following points:

a) The legal text leaves many specific questions open to interpretation. It is, however, a basic philosophy of our legal system to leave room for judgement against the specific circumstances prevailing at the time.
b) This legal philosophy implies that the law draws no strict lines as to the beginning and end of the pilot-in command's responsibility and authority, and it does not exclude the responsibility of others at the same time as that of the pilot-in-command (for instance authorities on the ground, ATC).
c) The term "flight" as used in the law may in general beassumed to represent the period between "doors closed" and "doors open" (ref. article 5.2 of the Tokyo Convention).

1.3 *Function description*

1.3.1 *General.* The pilot-in-command:

a) maintains over-all responsibility for the flight execution;
b) is the representative of the company when dealing with other crew members during flight duty time and at slip stations, and towards passengers in his capacity as commander of the aeroplane;
c) promotes an atmosphere under which optimum crew co-operation may be expected;
d) is responsible for flight preparation and execution incompliance with legal and company regulations;

e) reports facts which may influence the quality of the general flight execution to his chief pilot;
f) should have no doubts about his condition and proficiency when reporting for duty.

1.3.2 *Flight preparation.* The pilot-in-command will:

a) acquaint himself with all relevant particulars and latest instructions concerning aeroplane type and flight to be flown;
b) co-ordinate the flight preparation and ascertain that all aspects have been covered;
c) convince himself of the airworthiness of the aeroplane and have no doubts as to the fitness and proficiency of his crew members.

1.3.3 *Flight execution.* The pilot-in-command will:

a) co-ordinate all crew duties as described in company manuals;
b) direct his flight management in such a manner that all cockpit crew members are constantly aware of his intentions (two-way communications rule);
c) ensure that checklist and standard operating procedures are adhered to and thoroughly carried out;
d) take all actions which may improve the efficiency and comfort of the flight, without adverse effect on safety;
e) take all actions deemed necessary to ensure the safety of the flight; if these actions divert from prescribed procedures he will (if time permits) do so in consultation with the other crew members and submit a report about his action to his chief pilot.

2. General function description of the first and second officers

2.1 *First officer*

2.1.1 *General.* The first officer:

a) is subordinate to the chief pilot of the division to which he is assigned, and to the pilot-in-command during the flight execution;
b) is expected to report facts which may influence the quality of the general flight execution to the pilot-in command and/or the chief pilot;
c) should have no doubts about his condition and proficiency before starting the flight execution.

2.1.2 *Flight preparation.* The first officer will:

a) acquaint himself with all relevant particulars and latest instructions concerning aeroplane type and flight to be flown;
b) advise the pilot-in-command if, in his opinion, any aspect of the flight preparation has been overlooked.

2.1.3 *Flight execution.* The first officer will:

a) perform all duties as described in the company manuals under the supervision of the pilot-in-command;
b) assist in promoting an atmosphere in which a good understanding and co-operation between the crew members may be expected;

c) be alert on developments which may endanger the safety of the flight; if he believes these developments exist he will:
   1) advise the pilot-in-command;
   2) ask the pilot-in-command to take appropriate action;
   3) if, in his opinion, strong doubts exist as to the physical or mental fitness of the pilot-in-command (incapacitation) and/or immediate action is required to prevent a highly critical situation, he shall take such action (if possible in consultation and agreement with other crew members).

Note.— It is obvious that with the action described above a highly undesirable situation is created. All further initiatives should be aimed at the safe completion of the flight.

3. General function description of the cabin crew

3.1 Cabin personnel are subordinate to the head of the cabin personnel division. During flight duty time and at slip stations, the “command” rules apply. The purser’s authority towards the cabin crew is then similar to the authority of the pilot-in-command towards the crew as a whole; the authority of the pilot-in command is, however, overriding.

3.2 The cabin personnel are charged with the care of the passengers. Their duties are laid down in detail in the flight safety instructions, cabin personnel.

3.3 Cabin crew must inform the pilot-in-command whenever smoke, fire, unusual sounds or other abnormal conditions are observed.

3.4 During an emergency, the purser is in charge of cabin preparation and evacuation procedures.

3.5 If an evacuation is anticipated, he may request assistance from any additional and non-working crew members.

Attachment B to Chapter 6

Example of an operator's guidance on the documentation to be carried on board the aircraft

The pilot-in-command will be responsible for ensuring that forms, charts, manuals and equipment, as well as the following equipment and operational forms, are on board the aeroplane:

MANDATORY DOCUMENTS — INTERNATIONAL

OPERATIONS (carried as required)

1) flight manual;
2) certificate of airworthiness;
3) noise certificate (if any);
4) radio licence;
5) certificate of maintenance;
6) technical log;
7) one copy of the aircraft operating manual;
8) one copy of the company operations manual;
9) route guide (two copies, one for each pilot);
10) topographical maps for area of operation;
11) navigation charts for area of operation;
12) ICAO flight plan forms;
13) "Air Reports" forms (sufficient number for anticipated routing);
14) one pad of mass and balance forms;
15) copies of general declaration (sufficient number for anticipated routing);
16) copies of passenger manifest (sufficient number for anticipated routing);
17) copies of cargo manifest (sufficient number for anticipated routing);
18) bills of lading (for cargo) (sufficient number for anticipated routing);
19) customs and immigration forms as required.

CHAPTER 7

7.0 OPERATIONS SUPERVISION — GROUND

7.1 GENERAL

7.1.1 An operator shall ensure that a flight will not commence unless it has been ascertained by every reasonable means available that the ground and/or water facilities available and directly required on such flight, for the safe operation of the aircraft and the protection of the passengers, are adequate for the type of operation under which the flight is to be conducted and are adequately operated for this purpose. Regulations requires that before a flight commences the pilot-in-command certify that certain necessary preparations and checks have been completed. Among these is the need to complete an operational flight plan. To do this the pilot will need meteorological information, information on the status of facilities along the route to be flown and such other information as is required to ensure a safe and efficient operation.

7.1.2 The aerodrome meteorological office will supply the required weather information and the aeronautical information service will provide NOTAM and aeronautical information circulars (AIC). The operator will provide information, normally through notices to flight crew, regarding temporary operational information, internal company operational matters, amendments to the operations manual prior to their incorporation in the manual, matters affecting airworthiness of aircraft, etc. It is a common practice for operators to locate their crew briefing/planning offices in the same area as the AIS and MET offices for the convenience of the users and to facilitate exchange of information. Many operators also collect, or have supplied to them by the MET and AIS offices, the necessary documents which they display and provide to their flight crew in their own crew briefing/ planning office.

Note.— For the purposes of this manual the situation discussed is one in which an operator provides all the required information in his own crew briefing/planning office.

7.2 OPERATIONS OFFICES

7.2.1 The information provided in a crew briefing/ planning office will include:

a) The following pre-flight information:

1) aeronautical information publications (AIPs) including amendment service;
2) supplement to the AIP;
3) NOTAM, decoded where necessary, and preflight information bulletins (PIBs);
4) aeronautical information circulars (AICs);
5) checklists and summaries;
6) maps and charts;
7) additional current information relating to the aerodrome of departure, concerning the following:
   - (i) construction or maintenance work on or immediately adjacent to the manoeuvring area;
   - (ii) rough portions of any part of the manoeuvring area, whether marked or not, e.g. broken parts of the surface of runways and taxiways;
   - (iii) presence and depth of snow, ice or water on runways and taxiways, including their effect on braking action;
   - (iv) snow drifted or piled on or adjacent to runways or taxiways;
   - (v) parked aircraft or other objects on or immediately adjacent to taxiways;
   - (vi) presence of other temporary hazards including those created by birds;
   - (vii) failure or irregular operation of part or all of the aerodrome lighting system including approach, threshold, runway, taxiway, obstruction and manoeuvring area unserviceability lights and aerodrome power supply;
   - (viii) failure, irregular operation and changes in the operational status of ILS (including markers), SRE, PAR, DME, SSR, VOR, NDB, VHF aeronautical mobile channels, RVR observing system, and secondary power supply;
8) any other relevant matters.

Information concerning the level of protection provided at an aerodrome for aircraft rescue and fire fighting purposes shall be made available. Significant changes in this level of protection normally available at an aerodrome shall be notified to the appropriate air traffic services units and aeronautical information units to enable those units to provide the necessary information to arriving and departing aircraft. When such a change has been corrected, the above units shall be advised accordingly. NOTAM shall be originated and issued promptly whenever the information is of direct operational significance, such as significant changes in the level of protection normally available at an aerodrome for rescue and fire fighting purposes. NOTAM shall be originated only when a change of category is involved and such change of category shall be clearly stated.

b) The information, for pre-flight planning, which includes any or all of the following information:

1) current and forecast upper winds, upper-air temperatures, tropopause heights and maximum wind information;
2) expected significant en-route weather phenomena and jet stream information;
3) a forecast for take-off;
4) aerodrome reports and aerodrome forecasts.

c) In addition to supplying the above information for display, the meteorological service will provide written or printed documentation for use during flight and appropriate to the duration of flight.

1) For flights of more than two hours' duration this documentation should comprise:
   - upper winds and upper-air temperatures;
   - expected significant en-route weather phenomena and, if relevant, tropopause heights and jet streams; — aerodrome forecasts.

2) For flights of less than two hours' duration, flight documentation should comprise information on:
   - upper winds and upper-air temperatures;
   - expected significant en-route weather phenomena and, if relevant, tropopause heights and jet streams;
   - aerodrome forecasts;
   - aerodrome reports, special reports, SIGMET information and appropriate special air reports.

7.2.2 It is essential to establish a method of ensuring that the latest information is being supplied. To do this it will be necessary to arrange a method of collection of data from AIS for each flight. In the case of the MET services, observations should be supplied, and amended if necessary, in accordance with the routine and special observation and reports schedule. In consultation with the operator, special observations and reports related to the operator's particular requirements should also be made available. Applicable aerodrome forecast information should be supplied and amended as necessary. The information supplied by the State services can be supplemented by the operator using his own resources. As an example, Class 2 NOTAM are normally transmitted through the mail. An operator can be made aware of the contents and effects of these notices earlier if flight crew members collect appropriate NOTAM at foreign aerodromes and return them to their home base. Flight crew should also make available air-reports (AIREP), especially those associated with a special aircraft observation, to their own operations staff so that the information is available to other flight crew members. The same procedure should be followed with reports to the AIS concerning the state and operation of air navigation facilities.

The information that will be supplied by the AIS and meteorological offices to the operator must be described in the operations manual. This guidance should include the contents of such information, means of ensuring that the latest information is supplied, means of notifying the operator of any significant change, method of collection of the information and responsibility for administering and overseeing these functions.

7.3 OPERATOR-PRODUCED INFORMATION

7.3.1 The operator will need to ensure that operationally significant information is made available to flight crew and other operational staff. Operationally significant information is information on the adequacy of the facilities available and directly required for a flight. A system of distributing this information must be established. Methods used could range from distributing the notices to individual crew members, to displaying the notices in the operations office and requiring crew to read them. In addition, copies of these notices must be carried on the aircraft until the information is withdrawn or incorporated in the operations manual. These notices must be numbered, have effective dates, and be signed by a senior operations official. Depending upon the size of the operation, it might be desirable to issue different notices for different aircraft types or fleets, or to divide the notices into "specific aircraft technical" and "general administrative/ operational" categories. The purpose is to limit the amount of information that must be read prior to the flight to that which is actually required. However, such a system requires a proper indexing method as well as regular notification of which notices are still in force.

7.3.2 Examples of classes of information that might be promulgated by an operator are as follows:

a) *Technical notices*:
   1. general technical or engineering notices, such as information on the type and qualities of the anti-icing and de-icing fluids being used;
   2. specific technical notices, such as information on a modification being progressively carried out on an aircraft type;
   3. airworthiness notices, notices usually originating with the manufacturer or an airworthiness authority concerning matters affecting the airworthiness of aircraft;

b) *Administrative/operational notices*:
   1) administrative notices, such as a change in the terms of reference of the chief pilot, or a change in telephone number for an operations office;
   2) operational notices, such as:
      - notice giving information on the aeroplane performance that will be available on a particular runway which has temporarily shortened declared distances because of maintenance work;
      - notice giving information on the level of protection for fire fighting purposes provided at aerodromes used by an operator, when such level has significantly changed and may affect the commencement of a flight.

7.4 OPERATIONAL REPORTING FORMS

7.4.1 The operator should make available in the operations office a supply of forms and documents that might be required by the flight crew. Examples of such forms would be:

- accident notification form;
- incident reporting form;
- confidential safety report form;
- air traffic incident report form; and
- bird strike reporting form.

7.4.2 The operator may also develop some reporting forms for his own use. These forms could include the following:

Incident notification form. This form should be modelled on the accident notification form;

Operator's confidential safety report form. (Where the operator has established his own confidential reporting system);

Ground proximity warning report form. (This may be defined as requiring reporting under the mandatory incident report system);

Voyage or trip report forms. These forms are normally used to report any unusual occurrence during a particular flight, or to report any deficiency observed in the facilities used. Some operators have special forms for some of these occurrences, such as airfield/ATS/ operational deficiency report forms, or pilot-in command's discretion report for when flight time/duty time regulations have been exceeded. Requiring flight crews to repetitively fill in forms will not encourage reporting of occurrences, and an effort should be made to arrange a system whereby filling in one easily comprehensive form will suffice in supplying the information required to all the interested parties. For example, in a situation where mandatory reporting of incidents is a KCAA requirement, the report to the operator by the pilot should be a carbon copy or photocopy of the form.

7.4.3 The forms that should be available and the administrative responsibility for maintaining an adequate supply should be described in the operations manual.

7.5 OPERATIONAL FLIGHT PLAN FORMS

7.5.1 Regulations states that an operational flight plan shall be completed for every intended flight; it also establishes that the operations manual must describe the content and use of the operational flight plan. The operator will provide operational flight plan forms for the use of flight crew. These forms may require that the flight crew fill in all the necessary details or be pre-prepared for specific aircraft types and/or for specific routings. When a pre-prepared operational flight plan contains operational information, it is necessary to ensure that only current forms are available. This requirement also means that an operations staff member must be charged with the responsibility of monitoring operational information and amending and altering pre-prepared operational flight plan forms when required. It will be necessary to have an effective date on such forms and a notice in the operations office should detail the current effective dates of all pre-prepared operational flight plans.

7.5.2 The operator must provide the necessary information and facilities for flight crew or operations personnel preparing operational flight plans. This would include current aerodrome weather, a copy, or a means of listening to, the current aerodrome terminal information service broadcast, where applicable, and a copy of the current upper-winds chart. If the operator uses pre-prepared runway performance information, that information should be available at the place where operational flight plans are prepared. Appropriate aeronautical charts, the operator's route guide, NOTAM and copies of the AIP(s) must also be available for flight planning purposes.

7.6 ATS FLIGHT PLANNING FORMS

7.6.1 A supply of ATS flight planning forms must be available in the operations office. Where required, a means of filing the flight plan with the ATS must be established. In many regions, repetitive flight plans (RPL) are used for frequently recurring pre-planned flight operations. Where this is the case, it will be necessary for the operator to provide information detailing which flights have repetitive flight plans stored and the details of the actual plan stored should be given.

7.6.2 When, because of local requirements, an ATS non-repetitive flight plan must be submitted earlier than normal and the flight crew are not available to do this, either because they have not yet reported for duty or have not completed a previous flight, an operations officer must be nominated as being responsible for filing the plan.

7.7 AEROPLANE LOADING

7.7.1 The operations manual should include guidance and instructions on the calculation of aeroplane mass and balance, on the use of standard figures for passenger mass and baggage, and on any special loading instructions.

7.7.2 In some operations the flight crew will be responsible for the preparation, calculation and completion of the mass and balance documentation. In other cases there will be an office responsible for this task. Increasingly these documents are produced using computers. Whichever method is used, the operations manual must give instructions on the method of calculating aeroplane mass and balance. When a special office produces the mass and balance documentation, the operations manual must define its responsibility and the responsibility of the pilot-in command in checking and accepting these calculations.

7.7.3 In calculation of aeroplane mass and balance, certain standard masses may be used. Initially, the actual aeroplane empty mass and centre of gravity index must of course be known. For many operations, standard masses are given for the equipment and catering that will be carried. Standard figures are typically used for fuel used in taxiing. Standard passenger mass is normally used as well. The figure used may apply to all passengers, or may differ for male and female passengers, children, infants, etc. Some operators also include hand baggage in the passenger mass, whereas other operators separate it and calculate, using a standard mass for each piece, the mass of hand baggage. Details of the standard mass permitted and when they may be used should be given in the operations manual. The standard figure used should be conservative and it must be recognized that on occasion it will be unrealistic to use standard masses, and actual figures must be used.

7.7.4 The operations manual should give information and instructions on any special loading requirements. The most obvious requirements are those related to the carriage of dangerous goods. The ICAO *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc 9284) will be known to flight crew through the dangerous goods training programme. If an operator has more restrictive requirements or differences to the Technical Instructions, these should be clearly identified in the operations manual. Appropriate information and instructions must be given on the carriage of other special loads. Examples would be guidance on the carriage of livestock, valuable cargo, perishable cargo, diplomatic mail, etc. While the guidance given will not be as detailed as that given to the personnel engaged in the loading and handling of cargo, baggage, etc., it should be sufficiently detailed to allow crew to check that the regulations and company requirements have been complied with.

7.8 CREW BRIEFING/ PLANNING OFFICE

7.8.1 The documents and manuals used in pre-flight planning and on the aircraft must be administered and controlled so as to ensure that the current information is always available. In many instances, technical manuals (e.g. the aircraft operating manual) and documents (e.g. the route guide) are distributed to each crew member. The upkeep and amendment of these documents then becomes the responsibility of the holder. However, it is necessary to organize a system of distribution of any amendments, and a system of numbering the amendments and of recording their incorporation in the manuals must be established. A notice giving the latest revision date or status of each document must be displayed in the operations office. Copies of each document will be available in the operations office for reference purposes and the task of amending these particular documents must be assigned to an operations staff member. The operations staff member charged with over-all control of documents and manuals should retain a master copy of each. In situations where the required documents are issued to the flight crew at the beginning of each flight duty, a method of ensuring that the documents are current must be established, and the amendment status of any manual or document must be readily identifiable. Some operators leave many of these documents, such as the route guides or the aeronautical charts, on board the aircraft as part of the ship's library. This again requires that a member of the operations staff be charged with the responsibility of ensuring that the documents on board the aircraft are complete, amended and current. It is probable that the system established by an operator will be a combination of the above methods, so that some documents are issued to the flight crew individually while some are held in the operations office (either permanently or taken to the aircraft by the operating crew), and others are left on the aircraft permanently. In any case, what is essential is that a system of control, numbering and recording the incorporation of amendments be established so that the status of any document can be easily determined.

7.9 OPERATIONS ORIGINATING FROM OUTSTATIONS

7.9.1 When the aircraft and/or crew are based at outstations, it will be necessary to ensure that the documents and manuals on the aircraft are current and that the latest operational information is supplied to crews. When the number of operations and crews based either permanently or temporarily at an outstation becomes large enough to warrant it, it may be practicable to establish a crew briefing/ planning office at the outstation. A crew briefing/planning office at an outstation can be responsible for the normal functions of the main office for the aircraft and crews based at the outstation. If this is done, however, a clear reporting line between the outstation(s) and the crew briefing/planning office at the main base must be established.

7.9.2 When the aircraft and/or crews are based at an outstation on an irregular basis or for very short periods, such as for a single overnight stop, it would not be reasonable to require that a crew briefing/planning office be established at that outstation. In these circumstances it is necessary for the crew briefing/planning office at the main base to retain control of this type of operation and to ensure that any relevant operational information or essential amendments to any operational document is made known to the operating crew prior to their completing their pre-flight preparations.

7.10 PRE-FLIGHT REPORTING AND DUTIES

7.10.1 The operations manual must specify the preflight reporting time and duties of flight crew. If an operator requires crew members to phone in ahead of reporting for duty, instructions on this must be given; or, if the operator has a system of standby or "on-call" flight crew, the method of operation of that system must be described. The operations manual will normally specify the procedure to follow in the event that a crew member is unable to report for duty.

7.10.2 For operations originating at outstations, the operations manual will normally give details of the reporting time for flight crew. The manual might also list the appropriate telephone numbers at outstations so that flight crew can contact local operational personnel when required.

7.10.3 The operations manual should specify the flight planning/briefing duties of flight crew members. These duties will vary from operator to operator. For example, the duties of a flight crew member where an operator uses computer-generated flight plans and keeps all the necessary documents and manuals on the flight deck of the aircraft will be different from the situation where the flight crew member completes his own flight plans and is also responsible for amending his own route guides, etc.

7.10.4 Many operators use flight operations officers/ flight dispatchers to complete or to assist the flight crew in completing the pre-flight planning. The extent of the duties of the flight operations officer/flight dispatcher in pre-flight planning will vary, depending on the method of work or of supervision of operations that a particular operator chooses. Typical duties of flight operations officers/flight dispatchers would include the provision of assistance to the flight crew to complete the flight planning. An example would be where the officer gathers the necessary documentation for the flight crew and, when required, completes some of the operational flight plans or files the ATS flight plan. Another example would be where the preparation of all the necessary pre-flight documentation is the responsibility of the flight operations officer/flight dispatcher, who also briefs the flight crew, and in the light of the pilot's operational decisions, completes the documentation. The operations manual will need to give instruction on the division of duties where flight operations officers are employed.

7.11 POST-FLIGHT DUTIES

The operations manual shall describe which records are to be kept, how and where they are to be stored, who may have access to them, and how long they are to be retained.

The role of the flight crew in returning various documents to the main operations office should be emphasized. It will be necessary to detail which records the crew must return.

7.12 CONCLUSION

In summary, a system of disseminating information from AIS, MET, and from the company's own internal system concerning matters relevant to the conduct of operations and to the pre-flight planning process should be established. This system must be described in the operations manual, as should the administrative responsibilities for overseeing the working of the system. An indication should be given of the information that should be made available, of the forms and documentation that should be supplied, and of the records, both pre-flight and post-flight, that should be retained. In addition, the operations manual should indicate the responsibility for administering the manuals retained in the operations office and, as appropriate, the documents that go to make up the aircraft library. The operations manual should specify the pre-flight duties of the flight crew and of the flight operations officers/flight dispatchers and, where appropriate, assign the different preflight functions among these groups.

Attachment A to Chapter 7 A-1. Example of an administrative notice

(AIRLINE)

NOTICE TO FLIGHT CREW

ADMINISTRATIVE NOTICE: NO. 01/18

APPLICABILITY: ALL FLEETS

The summer flight schedule commences on 1 August. All personnel note the revised departure times.

Issued by: Operations Director

Date issued: 1 March 2018

Valid until: 30 September 2018

Signed . . . .
(Name)

A-2. Example of an operational notice

(AIRLINE)

NOTICE TO FLIGHT CREW

OPERATIONAL NOTICE:NO. 10/18

APPLICABILITY: B-737/B-747

With reference to the newly introduced schedule from ABC to XYZ, will Captains please uplift maximum fuel out of ABC (preferably round-trip fuel) because of the high cost of fuel at XYZ.

Issued by: Chief pilot

Date issued: 1 June 2018

Valid until: Further notice

Signed. . . . .
(Name)

A-3. Example of a technical notice

(AIRLINE)

NOTICE TO FLIGHT CREW

TECHNICAL NOTICE: NO. 02/18

APPLICABILITY: B-707 FLEET

225 mph tires are now fitted to all company B-707 aircraft. This will permit operations from all listed aerodromes without tire speed limitations.

Issued by: Fleet Manager, B-707 Fleet

Date issued: 12 June 2018

Valid until:The notice is incorporated in the operations manual.

Signed. . . . .
(Name)

Attachment B to Chapter 7

Example of flight crew pre-flight duties from an operations manual

PRE-FLIGHT DUTIES

1. Reporting for duty

1.1 Pilots will report for duty at the times shown in the pilots' roster.

1.2 Long-haul pilots will also phone crew control one hour before reporting time, for all duties.

2. Punctuality

2.1 In order to meet the company's standards of punctuality, the following criteria must be met:

2.1.1 Flight crew should check in immediately on arrival at the airport and not later than the reporting time specified on the roster.

2.1.2 Flight crew must be in operations, in uniform, at the reporting time specified on the roster.

2.1.3 Whenever, for any reason, a pilot is unable to report for duty, the earliest possible notification must be given. Only in the most exceptional circumstances should this be less than the reporting time, minus one hour.

2.1.4 Flight crew on airport reserve duties, when not available in the briefing/planning office, are personally responsible for ensuring that their whereabouts are known at all times.

2.1.5 Flight crew on standby) must register a telephone number with crew control at commencement of standby duty. They must be available at this number for the duration of the duty.

2.1.6 Flight crew must report punctually for all other rostered duties, including company and State medicals, training, drills, briefings, etc.

2.2 Failure to meet these criteria will be regarded as a matter of discipline, in accordance with current staff regulations for all employees. Any deviation from the above standards must be explained in writing, without delay to the chief pilot.

3. Reporting for duty — outstations

3.1 Crews should depart from the hotel at the time indicated on their roster or, when no such time is indicated, in sufficient time to ensure adequate completion of all pre-flight duties. In no case should they report to the airport less than thirty minutes prior to stated departure time (SDT).

4. Pre-flight preparations

4.1 On arrival at operations, the captain and co-pilot pre-flight duties are as follows.

4.1.1 *Captains*

4.1.1.1 Collect the meteorological folder, study the forecasts and, after MET briefing, brief the co-pilot and inform him of the routing, alternates, fuel requirements and any other decision necessary for operation of the flight.

4.1.1.2 Collect and read the daily NOTAM and check the notice board for latest airport and ATC information.

4.1.1.3 Read relevant notices to crew, other relevant briefing material and cross-check route guides and Nav Bag contents.

4.1.1.4 Check and sign all flight plans and confirm ATC flight plans (including repetitive flight plans).

4.1.1.5 Ensure final fuel load is passed to load planning as early as possible.

4.1.2 *Co-pilots*

4.1.2.1 Collect the route bag.

4.1.2.2 Prepare and sign the operational flight plans and ATC flight plans (if not repetitive flight plans) and submit them together with those prepared by operations control to the captain for checking and signature, drawing attention to any pertinent factors.

4.1.2.3 Pass fuel and regulated take-off mass information to load control, together with any revisions, in sufficient time to allow fuelling to be completed by STD-20.

4.1.2.4 Read daily NOTAM, relevant notices to crew.

4.1.2.5 Cross-check contents of route guide for validity against checklist.

4.1.2.6 Check contents of route bag against current contents checklist.

4.1.2.7 Check notice board for latest ATC and airport information.

Attachment C to Chapter 7

Example of flight operations officer/flight dispatcher pre-flight duties from an operations manual

Pre-flight duties

The flight operations officer/flight dispatcher on duty shall, one hour before the scheduled departure of a company flight, have:

- thoroughly analysed the possible effects of the weather on the route to be flown in the light of meteorological reports and forecasts for the destination and alternate aerodromes; recent weather reports and forecasts for the route and areas adjacent to it; and current weather maps;
- decided, if empowered to do so, whether to delay, consolidate or cancel the flight or otherwise decide on a possible route or alternative routes which may be flown safely and in accordance with company procedures and standards, taking into account likely weather conditions at the destination and alternate aerodromes; en-route weather; and the maximum fuel load possible. This last factor will have been calculated by deducting from the regulated take-off weight of the aircraft the aggregate of all other weight elements;
- prepared an operational flight plan consistent with standard instrument departures, noise abatement operational procedures, ATC regulations and the regulations of all the States to be overflown, for the consideration of the pilot-in-command;
- collected the latest available data on standard instrument departures, en-route facilities, noise abatement operational procedures, navigation aids, aerodrome facilities, ATC and communications procedures, NOTAM, runway conditions, search and rescue facilities and other information and regulations likely to affect the flight.

Note.— It is important for the flight operations officer/flight dispatcher and the pilot-in-command to keep in mind that a flight shall not commence unless the pilot-in-command is, by every reasonable means at his disposal, satisfied that the communication and navigation facilities essential to the route are in satisfactory condition and that the ground and/or water facilities available and directly required for the safe operation of the flight are adequate for the type of operation to be conducted.

On arrival of the pilot-in-command, the flight operations officer/flight dispatcher shall:

- attend the meteorological briefing with him;
- show him the route analysis and the operational flight plan he has prepared, bringing to his notice the factors that have influenced the choice of route;
- obtain his concurrence with the operational flight plan;
- countersign the operational flight plan after the pilot-in command has signified approval by signing it;
- furnish the pilot with all latest available information on the route to be flown;
- prepare the ATC flight plan for the pilot-in-command's signature; and
- file the ATC flight plan.

Attachment D to Chapter 7

D-1. Example of completion and disposition of flight records from an operations manual

FLIGHT RECORDS

Completion and disposition of flight records

Completing flight records. Pilots will complete the following records, en route and on termination of a flight:

a) All flights:
   (i) aircraft and engine log books incident reports, if required
   (ii) fuel log record
   (iii) flight log;

b) *Overseas flights:* 1) revised upper air contour chart 2) flight progress chart.

Disposition of flight records. Flight records will be filed by the first or second officer on return to base in the following order. Do not staple more than one date together and file separately for different captains. When filing flight records that do not include a flight log/flight plan, the top form shall indicate all the flight numbers for which forms are attached. Also, if flight plan comments have been written on any attached form, include the notation "FPC" in bold letters. File the flight records in the following order:

a) flight plan — log side up;
b) ATS flight plan;
c) route and terminal forecasts;
d) B-747— fuel log record;
e) DC-8 freighter, B-747, and B-767 cargo load verification sheet;
f) nav data card and/or datalink clearance message;

CHAPTER 8

8.0 OPERATIONS SUPERVISION — FLIGHT

8.1 INTRODUCTION

An operator will need to specify the procedures and policies that will be adhered to during flight operations as part of the "method of supervision" of flight operations required by regulations. Information on the piloting of the aircraft, the in-flight procedures, the normal, abnormal and emergency procedures, etc., is normally provided in the aircraft operating manuals, the checklists and the other documentation supplied by the manufacturer. These documents form part of the operations manual. However, an operator will need to give additional guidance in the operations manual on those procedures and methods of operation which are of a more general nature, such as policy on co-pilots flying the aircraft, or on the contents of passenger cabin briefings. This chapter attempts to identify those issues which would typically be addressed by the operator in the operations manual.

8.2 FUELLING

8.2.1 The operations manual should include details of the procedures and policies to be followed while refuelling aircraft. This would include instructions on the procedure to be followed to ensure that the planned fuel load is on board. This means that besides checking quantities on the aircraft's gauges there must be an independent check, such as by dipstick or by checking the fuel bowser quantities delivered, etc. The actual detail will vary from type to type but it is essential that there be two completely independent checks. There will inevitably be differences in the quantities recorded by the different means of measurement, and the operations manual must specify the acceptable limits for different aircraft types and for different fuel quantities. The operations manual must also give details of the other necessary checks, such as water contamination checks, and on when and where they are required. In addition to these specific directives the operations manual may also contain a list of general precautions to be observed during aircraft fuelling.

8.2.2 In particular, the operations manual must clearly identify the "qualified personnel" required to man the aircraft during these operations. Additional precautions are required when refuelling with fuels other than aviation kerosene, when refuelling results in a mixture of aviation kerosene with other aviation turbine fuels or when an open line is used. This is necessary because of the greater risk associated with the use of wide cut fuels, and with the mixture of these fuels with kerosene. An example of the information given by one operator on these topics is shown at Attachment A to this chapter. Another point that should be addressed is the action to take in the event of a significant fuel spillage.

8.3 RECORDS TO BE LEFT WITH GROUND PERSONNEL

In addition to the flight preparation forms that are retained by the operator, it is the practice to require that copies of the records regarding the technical serviceability of the aircraft, of the amount of fuel on board, the pilot's dangerous goods notification form, and of the final version (i.e. including any last-minute changes) of the load and trim sheet are left with ground personnel. If this is a requirement details must be given in the operations manual. As well as specifying which forms are to be left behind, it is necessary to state to whom they are to be given, where they are to be retained or how they are to be returned to the operator for retention.

8.4 USE OF MINIMUM EQUIPMENT LIST (MEL) AND CONFIGURATION DEVIATION LIST (CDL)

The operations manual must describe how the minimum equipment list (MEL) and the configuration deviation list (CDL) are to be promulgated and used. The actual status of the MEL/CDL, i.e. whether they are approved, whether they have extra items added by the operator, etc., must be described. Generally, the MEL relates to items or equipment which may be inoperative without affecting the airworthiness of the aircraft. The CDL defines the panels or parts which may be missing from the aircraft structure without affecting airworthiness, but which normally have an effect on the aircraft performance. In some instances the MEL and CDL are combined in one document, whereas in other cases they are published separately. The operations manual must detail the procedures that will be followed when an aircraft is being dispatched with items or equipment unserviceable. This is especially important with items from the CDL, as these, by definition, have performance effects which must be taken into account during the flight planning process. Items from the MEL can also affect planning decisions. Therefore, a system for early notification to the flight crew of MEL and CDL items must be established. When an aircraft has an MEL or CDL defect, the defective equipment or its controls or indicators must carry placards to alert the crew. In addition, it is normal practice to enter the details of the defect in the log book used for recording technical defects. While ultimately the pilot-in-command must decide as to whether to operate an aircraft with a defect, the operator should give some guidance where possible. This would be particularly important when considering different combinations of failures. MEL and CDL lists are normally designed for use before flight; however, they are often consulted during flight when the operational effects of a failure are being considered. Where it is feasible to do so, an operator should give guidance in this respect as well. Operators often list those preferred aerodromes to which aircraft should divert in the event of a failure in flight, so that the defect can be rectified before another flight is undertaken.

8.5 PASSENGER CABIN BRIEFINGS, INSTRUCTIONS AND COMMUNICATIONS

8.5.1 Regulations requires that certain information and instructions be given to passengers. This will normally consist of a briefing on, and demonstration of the safety equipment, features and procedures of the aircraft. Normally this takes place before take-off. In addition, passenger emergency instruction cards shall be available at each passenger seat. The operations manual shall detail the contents of the passenger briefing and demonstration to be given by the cabin attendants. Typically this will include information on emergency exits; emergency equipment; use of seat belts (including advice on keeping seat belts fastened at all times); no-smoking areas and restrictions; observing seat belt/no-smoking signs and, when appropriate, information on, and a demonstration of passenger oxygen masks; and for flights where required, location of and instruction in use of life jackets. Although the requirement is to brief passengers when the equipment is required to be carried, many operators interpret this liberally and specify that a briefing should include instruction on use of all the safety equipment on board and not just that required for a particular flight.

8.5.2 In addition, the operations manual should give guidance to the pilot-in-command on when he should turn on and off the seat belt sign, and also on communicating with the cabin crew wear their safety belts or harnesses. The manual should specify standardized signals between the cockpit and cabin, such as a signal prior to commencing take-off, or prior to landing. A standardized report for the cabin crew to inform the pilot-in-command that the passenger cabin is prepared for take-off or landing should also be detailed in the manual. Guidance should also be given in the manual on the use of electronic devices in the passenger cabin and on the need to include instructions in the passenger briefing. Other electronic devices such as personal computers, calculators, etc., may also cause interference, but the range of possibilities is such that it is impracticable to give guidance here and operators will, depending on the type of aircraft and navigation equipment involved, have to develop their own instructions.

8.6 IN-FLIGHT PROCEDURES

8.6.1 *General*

The operations manual should spell out those policies and procedures of which the flight crew should be aware and which they should follow during flight operations. The list of topics that the operator should address will be related to the type of operation and its complexity, but typically would include at least those described in 8.6.2 to 8.6.13 below.

8.6.2 *Standard operating procedures*

Standard operating procedures consist of the procedures described in the operations manual (in-flight procedures), the flight profiles and patterns described in the operations manual, the standard call-outs, the standardized use of checklists (both normal, abnormal and emergency) and the allocation and division of duties among flight crew members. Adherence to these standard procedures is essential to a safe operation. The operations manual must specify that compliance with standard operating procedures is required at all times. Any deviation from standard operating procedures must be challenged immediately by the other flight crew members. If the deviation is not rectified or if there is no reaction, subtle incapacitation must be assumed and the appropriate action taken to restore the flight to correct operation.

8.6.3 *Cockpit discipline*

The avoidance of non-essential conversation during critical periods of flight should be emphasized, as should the need for the pilot-in-command to ensure that other activities, such as keeping log books, technical logs, etc., do not interfere with the primary duty of all flight crew members to monitor safe progress of flight. The need to keep a good look-out at all times, the proper use of radiotelephony techniques, the monitoring of radios, the wearing of head sets, seat belts, harnesses, etc., are all topics that should be addressed in the operations manual.

8.6.4 *Use of checklists*

The proper use of checklists, both normal and emergency, is essential to safety. The operations manual must contain instructions on the standard use of checklists. The actual method of using checklists will vary from one aircraft type to another. Some aircraft checklists are only read as a check or back-up when the actual required actions are complete. Other checklists are intended to be used as requiring an action in response to the item called out. The number of flight crew will also affect the form a checklist will take. In any event, it should be clearly specified in the operations manual who will read the checklist and who will carry out the required actions, or confirm that the required actions have been carried out and make the required response. It is usually specified as well that each item on the checklist must be responded to before the check can continue. It might also be specified that certain checks must be read by a specific crew member. For example, it might be specified that the pre-start check must be read by the co-pilot and answered by the pilot-in-command. Emergency checklists usually have a number of drills that contain “memory items” and the checklist will normally be used to confirm that these memory items have been accomplished.

8.6.5 *Aircraft ground-handling communications*

The operations manual must detail standard methods of communication between the ground crew and the flight crew. This should cover both ground-to-cockpit intercom and hand signals. A set of standardized phrases must be described for use on intercom during engine-starting, push-back, towing and parking. For engine-starting, the phraseology should address both normal engine starts and non-normal starts, such as the use of external batteries or high-pressure bottles. A description must be given of the signals to be used when intercom is not available. Marshalling signals are described in *Rules of the Air* regulations. A copy of these signals should be made available in the operations manual, or be prominently displayed where both ground personnel and flight crew can see them.

8.6.6 *Taxiing*

The aircraft operating manuals usually give information on turning radii, propeller clearances, jet efflux, ingestion dangers and the effect of long taxiing distances and excessively harsh braking on tire temperatures. The operations manual should give general instructions on the need to exercise due care while taxiing an aircraft.

8.6.7 *Take-off and landing data*

The operations manual should describe how the operational figures, take-off speeds V_1, V_r, V_2, the landing reference speed V_{ref}, the engine power settings, etc., are to be derived and by whom. It should also be specified how these figures are to be cross-checked. If take-off and landing data cards are used, the manual should indicate what information is to be shown on the card, who should derive the data, and how it is to be cross-checked.

8.6.8 *Briefings*

Guidance should be given on standard briefings. The briefing for take-off would typically include actions in the event of an emergency before, at or after decision speed (V_1); identification of non-standard procedures such as emergency or compulsory turns after take-off; non-standard height for fourth segment (acceleration segment); standard instrument departures; departure routing; radio aids for departure; etc. Guidance should also be given on the necessary changes to the standard briefing when the co-pilot is flying the aircraft, such as the responsibility for the decision to abandon or continue take-off in the event of a serious failure, and on the actions to follow in the event of emergency. Instructions should be given on the need to repeat a full briefing for each take-off or on the use of the term “standard briefing” or on abbreviated briefings.

Normally it is specified that for the first take-off a full briefing must be given and that for subsequent take-offs with the same flight crew, the use of the phrase “standard briefing” is acceptable provided there are no operationally significant differences. The before landing brief should be discussed. Matters typically addressed are minimum safe altitudes, standard arrival routes (STARs), radio aids for approach, aerodrome operating minima, minimum sector altitude, actions to follow in the event of engine failure, missed approach and radio aids to be used, review of holding procedures and fuel requirements for diversion to selected alternates, etc. In all briefings, the most important consideration is the need to identify and brief for those factors in the take-off or landing that differ from the standard procedure.

8.6.9 *Standard call-outs*

Guidance on standard call-outs should include the particular speeds to be called during take-off, standard calls after takeoff, standard calls en route, standard calls changing altitude or flight level, standard instrument cross-check call after take-off and at top of descent. The standard call-outs during approach should include speed deviations, deviations from the glide slope/localizer and standard height calls. The points at which calls should be made during a precision approach should be identified, such as 1 500 ft/outer marker, 500 ft, 100 ft to “decision”. Standard calls for the transition to landing phase should be established, such as runway in sight, airspeed, and rate of descent. Standard calls during the landing roll should be established, such as speeds and reverse power settings. Standard calls during the missed approach, the go-around call and configuration and power setting calls, instrument cross-checks and height checks should also be established.

8.6.10 *Standard noise abatement procedures*

Standard noise abatement procedures should be described. This may include information on noise-sensitive aerodromes, on the use of preferential runways for take-off and landing, on the use of preferential routes during the take-off and approach phase, and the use of specific procedures during take-off and landing.

8.6.11 *Altimeter procedures*

Although there will be specific procedures relating to altimetry and allowable tolerances, etc., for each aircraft type in the aircraft operating manual, it is still necessary to detail over-all guidance and policy on this subject in the operations manual. Typically this would consist of information on accuracy checks to be carried out, both altimeter to-altimeter and altimeter-to-true altitude, on the ground and during the flight. Instructions should be given on the procedures and cross-checks to use when changing from standard pressure to local pressure (QNH) and, where appropriate, from QNH to QFE and vice versa. A system of cockpit cross-checking should be detailed for each of these changes and guidance given on the procedures to follow in the event of a difference between the altimeter readings. Typically this would specify that in cruise, at higher levels, the level flown should be the average of the readings. During descent, or when terrain clearance is a factor, the lower reading should be used. Finally, during the approach a check can be made when crossing the outer marker or any other point with a known glide slope crossing altitude, bearing in mind that the glide slope, etc., can also be in error. Where radio altimeters are part of the aircraft's equipment, instructions should be given on their use. This would normally indicate when and how they are to be used recognizing that these procedures would normally be different for the differing types of approaches that might be flown. For example, the operations manual could specify that the radio altimeter is to be set at 1 500 ft initially, and after passing that height the decision height is only to be set for Category II and Category III approaches.

Note 1.— QNH or "altimeter setting" is that value of the pressure for a particular aerodrome and time which, when set on the subscale of a standard altimeter, will cause the altimeter to indicate its elevation (above mean sea level).

Note 2.— QFE is that value of the pressure for a particular aerodrome and time which, when set on the subscale of a standard altimeter, will cause the altimeter to indicate its height above aerodrome elevation or threshold elevation.

8.6.12 *Fuel remaining — shortage of fuel*

The operations manual should contain guidance on the actions the operator requires of pilots when the fuel remaining on board the aircraft is reducing towards the amount required to fly to the destination alternate and it is not possible to land at the intended destination. The operations manual should be specific in instructing pilots-in command that they proceed to the destination alternate no later than when the fuel state reduces to that required for the diversion, which includes the holding fuel at the alternate. The operations manual should also state that when a pilot in-command believes that the fuel state is problematical, in terms of time remaining airborne, or when it has reduced below the point at which a diversion should have been made, the pilot must declare an emergency with the reason for the emergency — shortage of fuel — and giving the flight time remaining in minutes, in order to obtain priority from the air traffic services. The manual should contain specific examples such as an unexpectedly long holding time due to bad weather and/or an adverse traffic situation.

8.6.13 *Stabilized approaches*

Each aircraft type will have recommended procedures, for airspeed and configuration changes, etc., during the approach and landing. In addition to these, the operations manual should detail over-all policy guidelines on the need for all aircraft, but especially for large turbine-powered aircraft, to use stabilized approach techniques. The operations manual should emphasize that stabilized approaches must be flown. Typically it is specified that the aircraft must be stabilized with reference to speed, configuration and power by a certain height or a go-around must be executed to recommence the approach. More details are contained in Appendix C.

8.7 ADVERSE WEATHER OPERATIONS

8.7.1 *General*

The operations manual must contain information and guidance on flight operations in adverse weather conditions. This should consist of a statement of the operational policies related to flight in these conditions, and would normally give some information on the weather phenomena involved. A typical list of topics addressed would be operations from contaminated runways, ground operations in adverse weather, aircraft ground icing, thunderstorm avoidance, turbulence, in-flight icing conditions and wind shear.

8.7.2 *Operations from contaminated runways*

Information on the effect of runway contamination (snow, slush, ice, standing water, etc.) on aircraft performance is included in the performance information. In this section of the operations manual, additional information on runway contamination could be given. Examples would be information on methods of measuring runway coefficient of friction, on aquaplaning and on definitions of wet snow, slush, etc.

8.7.3 *Ground operations in adverse weather*

Of primary interest under this heading is the effect of ice on an aircraft. Normally, the operations manual would define what icing conditions are, i.e. those conditions during which it is necessary to begin taking precautions against the possible occurrence of ice on the aircraft's surfaces. These conditions can prevail when the reported temperature is still well above freezing. It is normally stated that precautions must be taken any time the temperature is below 10°C and visible moisture is present. Obviously as the temperature decreases the possibility of icing increases and the type of icing that may be experienced will also change. The operations manual should give information and guidance on the different types of ice that may be experienced, on how icing conditions may be recognized and on the means of guarding against and removing the ice. Different types of anti-icing and de-icing fluid are usually approved, as are different methods of removing ice from the aircraft's surfaces. Information and guidance must be given on these factors (if applicable), as must information on the holdover times of the different fluids, of the different mixtures and of combinations of fluid. In addition to information on anti-icing and de-icing, the operations manual should give guidance on the problems caused by ice- and snow-covered aprons and taxiways for aeroplane taxiing, push-backs and parking. The operations manual should also give the wind speed limits for operation of integral aeroplane airstairs, passenger and cargo doors, etc.

8.7.4 *Thunderstorms*

8.7.4.1 The dangers that thunderstorms pose for aircraft are well known. The operations manual should give information on the different causes of, and forms that thunderstorms can take. Typically this would include information on thunderstorms associated with frontal passage, air masses, squall lines, etc. The phenomena experienced during thunderstorm passage across an aerodrome or inadvertent penetration should be discussed. The effect of hail, severe turbulence, extreme levels of precipitation, lightning, gusts, wind shear and icing are all items which should be addressed. The operations manual should state that flight through or near thunderstorms is not permitted, and the authority of the captain to divert, delay, re-route or to cancel flights to avoid encounters with thunderstorms should be emphasized. It must also be recognized that flights in areas of thunderstorm activity cannot be avoided all the time and that, on occasion, inadvertent penetration of thunderstorms will take place. Guidance should be given on the precautions that must be taken when flying in areas of thunderstorms. This guidance would include the need for passengers and crew to be seated and wearing safety belts, tidying and stowing away loose objects on the flight deck, switching on cockpit lights to minimize the blinding effects of lightning, etc. Information should also be given on the recommended turbulence airspeeds and power settings, on the correct aircraft handling techniques, and on the buffet margin (especially for large turbine-powered aeroplanes) that should be established. Where it is possible to circumnavigate thunderstorms, advice should be given on the margin by which the storm should be avoided. This may vary for aircraft type and height, and apparent severity of the storm.

8.7.4.2 *Weather radar*. The operations manual should give information on the use and the limitations of weather radar. The aircraft operating manual may contain system description information and operating instructions for the radar system fitted. However, it is appropriate for the operations manual to expand on this material. Topics discussed might include radar return strength from different forms of precipitation (rain, ice, hail, etc.), interpretation of radar returns, and effect of radar controls (gain, antenna tilt, contour, etc.). The characteristics of the different types of radar that an operator might have on different aircraft in his fleet should be discussed. For example, an operator's fleet might have both C band and X band radars and information on the different attenuation characteristics of these radars should be given. Another example would be the need, where necessary, to describe the differences between the "newer" flat plate and the "older" parabolic-type antenna and the need to interpret the returns differently.

8.7.5 *Turbulence*

Turbulence that is not associated with cloud conditions (i.e. clear air turbulence (CAT)) is difficult to detect. However, a knowledge of the conditions associated with the presence of turbulence, both CAT and turbulence associated with cloud, can aid in avoidance. The operations manual should give information on this subject, particularly on turbulence associated with the jet stream and on turbulence caused by mountain waves. Guidance should be given on avoiding turbulence and on the actions to take if an inadvertent encounter should occur. This should cover not only the appropriate flying technique, which is generally not different from the technique appropriate to thunderstorm encounters, but should also give advice on the quickest method of exiting from an area of clear air turbulence. An example would be that the jet stream should be crossed at right angles when turbulence is known or suspected to be present.

8.7.6 *Flight in icing conditions*

As well as discussing the effect of, and the appropriate precautions against, icing on the ground, the operations manual should discuss the problems associated with encountering icing conditions during flight. To an extent, the severity of the problems associated with this condition varies with different aircraft. Icing does not have as great an effect on the aerodynamics of large turbine-powered aeroplanes during cruise, as it does on smaller propeller-driven aeroplanes which normally operate at levels where exposure to icing conditions is much greater. Nevertheless, icing does present dangers for all aircraft, such as the danger to the correct functioning of pitot-static systems or the detrimental effect the icing can have on the power output of engines, both turbine and piston. The operations manual should give guidance on these topics appropriate to the aircraft being operated and to the environment in which it operates.

8.7.7 *Wind shear*

Although methods of recognizing the presence of wind shear and the appropriate piloting actions to take if shear is inadvertently encountered will be addressed in the training section of the operations manual, it is necessary to give additional information in this section. The different types of conditions where shear can be experienced such as thunderstorms, gust fronts, frontal shears, mountain waves, etc., should be discussed. The effect of shear on aeroplanes should be described and it should be emphasized that some shears (microbursts) can be of such intensity aeroplanes cannot successfully fly through them. Information should also be given on systems which are designed to detect the presence of shear, such as the low-level wind shear alert system (LLWAS), and of the limitations of these systems. The technology of wind shear detection and reporting and the recommended flight techniques are becoming available. Refined techniques will be recommended for flight in wind shear conditions and airborne systems to aid in selecting the appropriate flight path. This improved information should be incorporated in the operations manual as it becomes available.

8.7.8 *Pilot reports*

All the above weather phenomena, if encountered when not forecast, should form the basis of a pilot report. A report may be a special aircraft observation, e.g. where the phenomenon is severe, or an observation during climb-out and approach. The latter report is especially important in the case of wind shear. The operations manual should give guidance on the form these reports should take and on the descriptive terms used. Except where regional supplementary procedures dictate otherwise, aircraft are required to make routine meteorological observations (AIREP). The operator must provide AIREP forms based on the form shown in an Appendix in the Advisory Circular CAA-AC-OPS022 as amended when his aircraft operate in areas or on routes where such reports are required. The operations manual should give instructions on the completion of this form.

8.8 WAKE TURBULENCE The hazards associated with wake turbulence are well known. ATS apply the required longitudinal separation between aircraft.

8.9 VOLCANIC ASH The operations manual should, where appropriate, contain information on the hazards to aircraft of flight in volcanic ash cloud. This should not only deal with the specific hazards of volcanic dust, but should also discuss recognition of an inadvertent encounter, as this can be very difficult at night or in cloud. The need to avoid flying in these areas and recommended recovery actions to restart engines should be discussed. Measures have been established to make information available on the possibility of a volcanic eruption affecting ATS routes. As part of the measures, the flight crew is requested to make a special air-report when a volcanic eruption is observed or when a volcanic ash cloud is observed or encountered. The form for the Special Airreport of Volcanic Activity is given in Appendix 2 of CAA-AC-OPS022. Information on volcanic activity affecting air routes is distributed through Class 1 NOTAM and through the use of SIGMET messages. The contents and forms of these messages and reports should be described in the manual.

8.10 NAVIGATION

8.10.1 *General*

Specific navigation procedures are dependent on the aircraft equipment, the route being flown and ATS requirements. Consequently, much of the guidance related to navigation procedures will be contained in the aircraft operating manuals or in the route training guidance. Nevertheless, overall policy and guidance on navigation procedures should be contained in the operations manual. General policy on the need to log, or record all clearances, for example, should be detailed, as should the need to keep a complete and accurate log of the navigation of the flight. The aim should be to keep a log such that the navigation of the flight could be accurately reconstructed subsequently.

8.10.2 *Navigation log*

The form that the navigation log will take may vary, not only from operator to operator, but also from flight to flight. For example, the log for a long-haul flight in minimum navigation performance specification (MNPS) airspace would be different to that required for a short-haul flight. However, all flight logs have a number of common features and instructions should be given in the operations manual on the need to properly log these basic details. These would typically include estimated arrival time at each reporting position, revised estimates, actual arrival time and altitude or flight level crossing each position. There should also be a requirement to log all ATS clearances. Fuel usage must also be logged, both as total quantity at a given time or position and as a measurement against planned usage or against fuel required at destination. These are the absolute minima and an operations manual would normally go into considerably more detail based on the actual navigation log being used.

8.10.3 *Airways navigation*

Guidance on the proper methods of selecting, using, checking and monitoring the aids used for navigation should be given in the manual. This could include instructions on the need to always properly identify aids, to use all available aids to cross-check the primary aid being used for navigation, and to monitor aids continuously for the presence of warning flags, etc. The operations manual should stress that during approaches and landings, all available radio aids should be used, irrespective of the type of approach being flown, visual or instrument. The operations manual could also require that during departures the radio aids be set up in a standard manner so that, for example, the primary aids are set to show the initial track to the pilot flying and other aids are set to confirm this or to show necessary cross-tracks, etc. If there is an extra radio aid available, such as a standby VOR set or a second ADF, these could be set to give immediate return guidance to the take-off aerodrome.

8.10.4 *Long-range navigation*

8.10.4.1 Appropriate guidance must be given where long-range flights, requiring the use of long-range navigation systems such as INS, GNSS, are undertaken. The primary method of navigation may be specified. The actual details will depend on the equipment being used and the route being flown. The operations manual should detail the primary responsibility of the pilot-in-command for the safe navigation of the aircraft.

8.10.4.2 When long-range flights are undertaken and systems such as GNSS are used for navigation, instructions for pilot navigation techniques and the associated procedures must be detailed in the manual. The operations manual must outline clearly, how the navigation systems are to be set up (both pre-flight and during flight), how they are to be checked, and what record (log) is to be kept during flight. The need to continuously cross-check navigation systems against each other and against other sources of position information (such as off-track VORs, ADFs, etc.) must be emphasized. Information on and the limitations associated with using weather radar in the mapping mode to crosscheck aircraft positions should be included. Typically, for long-range flights a chart is carried with the planned route plotted pre-flight. During the flight at each reporting point, or way-point, the pilots must check the navigation system present positions against the flight plan position, log the system position and verify that the track and distance for the next track are correct. In addition, the operations manual might specify that between way-points a check of the system position must be made at sector midpoint. Instructions could also be given on how the different systems are to be set up. For example, it could be specified that the pilot flying monitor cross-track, and the pilot not-flying monitor along track. The manufacturers of navigation systems normally supply pilots' operating handbooks and it may be possible to incorporate these handbooks in the operations manual with very little alteration. However, it will probably be necessary to develop some additional procedures, reflecting the operator's own methods of operation.

8.10.4.3 In addition to the above requirement, when flights are conducted in special airspace such as MNPS, RVSM, PBN etc., the operations manual must give guidance on the procedures to be followed.

8.11 EMERGENCY PROCEDURES

8.11.1 *General*

Although the actual drills and procedures to be followed in the event of an emergency are included in the aircraft operating manuals and in the associated checklists, it is necessary to provide some general guidance on the subject in the operations manual. This will consist of policy decisions, considerations and guidance which do not form part of the standard emergency drill but which still must be addressed. The following topics as a minimum should be addressed.

8.11.2 *Rejected take-off decision*

While the pilot-in-command is always responsible for this decision, there are a number of complicating factors. Primary among these is the decision process when the copilot is flying the aircraft. In any event the nature of the technical problem encountered, the speed of the aircraft and the length of runway remaining are all factors that must be considered in an extremely short period of time. The operations manual must give guidance and detail company policy on the subject. It goes without saying that after the take-off decision speed (V_1) has been reached the take-off must be continued, but the policy on abandoning take-off at speeds below V_1 must be detailed. Many operators specify that at high speed, for example, above 100 kt in a large transport aircraft, take-off shall only be abandoned for major failures, such as engine fire or failure, or the failure of a major system when continued flight would be hazardous. Some operators state that the "abandon" decision must always be made by the pilot-in-command. Other operators, at the pilot-in-command's discretion, allow the decision to be delegated to experienced co-pilots. The responsibility for and the method of initiating a rejected take-off should be part of the briefing before a take-off. Because of possible areas of confusion that might arise when a problem which does not lend itself to simple analysis occurs during the take-off, many operators specify that the pilot-in-command clearly call out what his intentions are, so he will call "abandon take-off", or, if a decision to continue is made, he will call out "continue". The particular policy laid down in this regard by an operator will be dependent on a number of factors, such as aircraft type, number of flight crew, relative experience of flight crew members, etc. However, the operational policy must be clearly spelt out in the operations manual.

8.11.3 *In-flight engine shut-down*

The operations manual should give guidance on the procedures following in-flight engine shut-down. Normally, for a twin-engined aircraft this will mean landing as soon as possible at the nearest suitable aerodrome. For three- or four-engined aircraft there are a number of other factors that could be considered before a decision to continue to destination or land at some other suitable aerodrome is made. When safety considerations allow a choice from a number of suitable aerodromes, technical and passenger facility considerations can be a factor. Some operators give information on preferred technical alternates, where spare engines may be held or suitable technical facilities for repairs are available.

8.11.4 *Overweight landings and fuel dumping*

Many smaller aircraft have the same maximum mass limitation for both take-off and landing. Larger aircraft can have a considerable difference of mass between these two operational limits. On occasion, for emergency reasons, an aircraft may have to land immediately after take-off at a mass well in excess of the maximum permissible landing mass. Three- and four-engined aircraft normally have the facility to dump fuel and the procedures for this are given in the aircraft operating manual and in the appropriate checklists. However, many twin-engined aircraft do not have this facility and there will be occasions when they must land overweight. In addition, even for three- and four-engined aircraft there will be occasions when it is more prudent to land immediately, although overweight, than to attempt to dump fuel. The operations manual must give guidance and advice on the many factors that will need to be considered before a pilot-in-command decides whether to burn off fuel, to dump fuel or to land overweight. Factors that may need to be considered are the length of runway available, the runway condition (wet or dry, etc.) and the malfunction or failure that is the reason for the emergency landing, as for example, a hydraulic failure might mean that the braking capability of the aircraft is adversely affected.

8.11.5 *Dangerous goods incidents*

Training in dealing with dangerous goods incidents will be given to both flight crew and cabin crew as part of the dangerous goods training programme. In addition, the ICAO manual on *Emergency Response Guidance for Aircraft Incidents involving Dangerous Goods* gives guidelines to assist in developing emergency response procedures for dangerous goods incidents on board aircraft. This document may be incorporated in the operations manual or an operator may choose to develop procedures based on the material. In either case, the alphabetical and numerical list of dangerous goods and the associated emergency response drill chart should form part of the operations manual. An operator may specify the appropriate drill number for each dangerous goods item carried on the dangerous goods notification form.

8.11.6 *Incapacitation*

The operations manual should give guidance on the recognition of pilot incapacitation. Complete and sudden incapacitation is easily recognized, and the need for other flight crew members to take immediate and positive action to maintain a safe flight profile is obvious. The more insidious case is when the incapacitation is subtle or partial, and guidance should be given on recognizing these events at an early stage. This would typically consist of advice as to the type of deviation from normal, or standard, operating procedure that should alert other crew members to the possibility of incapacitation. Such incidents normally require that assistance be given by the cabin crew in handling the incapacitated pilot. The procedures involved normally form part of the recurrent training programme.

8.11.7 *Distress and urgency radiotelephony communications procedures*

An operations manual should give guidance on these procedures based on the regulations. The operations manual should, as a minimum, specify the elements that should be contained in a distress or urgency message.

8.11.8 *Unlawful interference*

The procedures to be followed by a crew in the event of an act of unlawful interference taking place should be detailed in the operations manual. This should include information on procedures to be followed during such an event, and particularly information on any procedures specific to a particular State or region over which flights may be conducted. Information should also be included on actions to follow after receipt of a bomb threat. The information given should include details on the method of classification of threats used by the operator, and should describe, for the information of the flight crew, how such a system will operate and what action will be taken on the ground to support the crew in the event of any act of unlawful interference. Guidance must also be given to assist the pilot in-command in the assessment of a threat when he is unable to communicate with ground services. Regulations also requires that an aircraft search procedure checklist be provided, together with information on the procedures to follow if an explosive device or suspicious object is found on an aeroplane, including advice on the suggested methods for minimizing the damage that such a device could cause.

8.11.9 *Interception procedures*

The operations manual must contain information on the signals used by intercepting and intercepted aircraft. *Rules of the Air* regulations contains information on the procedures to be followed and on the signals that are to be used by the aircraft involved. Typically, operators provide a graphical chart of these signals for the use of the flight crew. In addition, information is usually given on any differences to the standard procedures or signals, notified by any State over which operations may be conducted.

8.11.10 *Emergency signal for cabin attendants*

A system of alerting the senior cabin crew member to report immediately to the flight deck for briefing on a possible emergency situation must be described in the operations manual. This could be by pre-arranged standard signal, or by a suitably worded request on the PA system. The signal used should be appropriate to the aircraft type and should be clearly understood by all crew members.

8.11.11 *Passenger cabin emergency procedures*

The procedures for many of the emergencies that might arise in a passenger cabin will be detailed in different volumes of the operations manual. Procedures for smoke clearance, for example, will be contained in the aircraft operating manual, while the standard emergency evacuation procedures will be contained in the emergency evacuation procedures manual. These emergency procedures will also be addressed in the training programme. In addition to these sources of information and guidance, operators often produce guidance of a more general nature. This would typically involve a discussion of those issues which are not directly addressed in the procedures themselves. An example would be guidance on the use and effectiveness of different extinguisher types on different types of fires. Other points of discussion could be the selection of passengers to aid in an emergency evacuation, the briefing of passengers, the use of the public address system in preparing for evacuation, etc. In developing this material it should be borne in mind that the advice given is intended for both cabin attendants and flight crew members. The guidance given is included in Operations Manual Part B.

8.12 GENERAL OPERATIONAL POLICIES

8.12.1 *General*

As well as the specific policy and guidance on matters relating to the actual operation of the aircraft, the operations manual will need to state policy and give guidance on a number of related issues. The items addressed would include use of cockpit jump seats, flight inspectors, cockpit visitors, co-pilots flying the aircraft, weather minima for newly promoted pilots-in-command, ferry flights, test flights, etc.

8.12.2 *Cockpit jump seats*

The operations manual should specify who is entitled to occupy cockpit jump seats. Normally this would include crew members and other technical staff as well as authorized flight inspectors. The operations manual should detail the procedures to follow to get approval to occupy the jump seats. The pilot-in-command’s authority to grant or refuse admission to the cockpit should be emphasized.

8.12.3 *Flight inspectors*

KCAA inspectors are normally entitled to occupy the cockpit jump seat. A system of identifying such inspectors, whether by the issuing of government identification cards or airline identification cards, must be established and described. The authority of the flight inspector should be described as detailed in the relevant legislation or regulations. It is normal practice to specify that the greatest possible co-operation be extended to these inspectors. Annex 9 — *Facilitation* recommends that Contracting States ensure that flight operations and cabin safety inspectors of another Contracting State, when engaged in inspection duties, are treated in the same manner as crew members. It also recommends that flight operations and cabin safety inspectors be provided with a certificate similar to those granted to crew members and that similar privileges of temporary admission also be extended to them.

8.12.4 *Cockpit visitors*

The operations manual should specify the company policy on visits to the cockpit. The manual shall also specify the company policy on the security of the flight deck and the locking of the cockpit door and the action to be taken in this respect when an increased level of security risk has been notified to the company.

8.12.5 *Co-pilot flying*

The over-all objective should be to divide piloting time equally between pilots-in-command and co-pilots. This ensures an integrated and effective crew operation since both pilots will be familiar and practised in the duties of the pilot flying (PF) and the pilot not-flying (PNF). This policy also ensures that when a pilot is promoted to pilot-in-command he has the greatest possible experience, including aircraft handling experience, to enable him to best carry out his new function. This policy of equally sharing the duties must be modified in some circumstances. Many operators specify that a newly-promoted pilot-in-command must fly the aircraft himself and not hand over sectors to the co-pilot, until he has achieved at least 100 hours as pilot-in-command. Some operators also specify that the pilot-in-command should fly the aircraft when in his opinion the conditions may be outside the experience of the co-pilot. The pilot-in command's authority must be recognized and whilst the aim should be to share the duties equally, the pilot-in-command must be encouraged to exercise his judgement and ensure that co-pilots do not fly the aircraft in conditions beyond their experience.

8.12.6 *Minima for use by newly promoted pilots-in-command*

Until a pilot-in-command has gained a certain amount of experience, many operators specify that an increment be added to all aerodrome operating minima for take-off and landing. For example, the operations manual might specify that until the pilot has 100 hours' experience on type as pilot in-command, an increment of 300 m must be added to all landing visibility minima, 30 m (100 ft) must be added to all minimum approach heights or altitudes, and 100 m must be added to all take-off visibility minima. The increment used by an operator will depend on the type of aircraft being flown and the normal aerodrome operating minima being used. The operations manual should give the appropriate guidance.

8.12.7 *Ferry flights*

On occasion it will be necessary to operate an aeroplane with unserviceable equipment or systems to a maintenance base, e.g. operating an aeroplane unpressurized, or with the gear extended, or in the case of three- or four-engined aeroplanes with one engine inoperative. These flights normally require approval by a senior company official. For approval of such flights, factors which must be considered and for which special data may need to be produced are take-off performance, en-route performance, fuel required, landing and takeoff weather minima, alternate minima, routing restrictions, effects on other aeroplane systems of failed system or engine, etc. Some ferry operations, most notably those where an aeroplane is being ferried with an engine inoperative, will require that the flight crew is trained and authorized for such an operation. Flights with an engine inoperative must only carry the required flight crew. Some national authorities require that specific approval be granted for such operations, and in the case where different States are being overflown it may be necessary to seek their approval as well. All these considerations should be addressed in the operations manual. It should be borne in mind that when permission to conduct such an operation is being sought, the aeroplane may well be at a remote aerodrome from where communication is difficult. It is therefore essential that the guidance given be as clear and detailed as possible and, where appropriate, contain contact phone and telex/SITA addresses. When certain types of ferry flights must be operated by specifically approved flight crew members, the names or required qualifications of those crew members should be listed in the operations manual.

8.12.8 *Test flights*

Test flights are required after certain maintenance procedures to test certain components or to investigate reported defects which cannot be reproduced on the ground. The operations manual must specify who is authorized to require or approve such flights. Certain test flights may only be operated by suitably qualified pilots, e.g. it could be specified that certain manoeuvres may only be flown by instructor pilots. For certain tests it may be specified that daytime VFR conditions must exist or other special limits will apply. An essential feature of such flights is that the flight crew is properly briefed as to what tests are required and what readings or data are to be recorded.

8.13 VISUAL ILLUSIONS

Pilots should understand the causes and effects of the visual illusions that may be encountered during flight operations. Understanding these illusions will enable the pilot to recognize and compensate for them and thus reduce the risk of their causing an accident. Common factors in illusions which should be discussed in the operations manual include sloping approach terrain, runway slope, non-standard runway width, featureless approach terrain, rain showers, rain on the windscreen, white-out in snow, shallow fog, fascination, auto-kinesis and empty visual field myopia. The standard textbooks provide information suitable for inclusion in the operations manual.

8.14 REPORTING AND CLASSIFICATION OF AIRCRAFT DEFECTS

8.14.1 According to regulations, the pilot in-command is responsible for reporting all known or suspected defects. The method of reporting and, where appropriate, classifying defects will need to be explained, and the necessary guidance given. This will depend to a great extent on the method of recording defects used. For example, on some aircraft a coded system developed by the aircraft manufacturer to record defects is used, while some operators have developed their own coded systems. Use of these coded systems normally means that instructions for deriving and recording codes must be included in the operations manual. In many cases defects are still recorded in plain language. Many of the code systems also allow for plain language explanations to be added to the text when judged necessary by the reporting pilot. Some systems also require the pilot to classify the defect; for example, a defect might need to be classified as to its effect on aircraft airworthiness. Where this is the case, guidance should be given in the operations manual.

8.14.2 Some operators keep a separate technical log for aircraft passenger cabin defects, and the senior cabin crew member is responsible for making entries in this log. However, it is necessary to ensure that defects in the passenger cabin of an "airworthiness" nature are brought to the attention of the pilot-in-command. Typically, this is achieved by requiring the pilot-in command to countersign the cabin technical log. Where such a system is in existence, details must be given in the operations manual.

Attachment A to Chapter 8
Example from an operator's guidance on refuelling with passengers on board

Refuelling with passengers on board

1.1 Refuelling is permitted with passengers boarding, on board or disembarking. Refuelling of aircraft is a routine procedure. Precautions are always taken to preclude the possibility of fire. Fuelling fires have not been a feature of the airline industry. The risk of fire is just as low when refuelling with passengers on board, boarding, or disembarking, as when there are no passengers on the aircraft. However, when passengers are involved, precautions must be taken to ensure that they can be evacuated in the unlikely event that fire does occur. These precautions involve the ramp agent, the engineer, the cabin crew and the pilots.

1.1.1 The ramp agent must ensure that pilots, cabin crew and engineer are at their stations that the area around emergency exits is kept clear, that the fire service is alerted and that passenger boarding and/or disembarkation is carried out in a controlled manner.

1.1.2 The engineer must establish communications with the pilots, inform the pilots of the beginning and ending of refuelling, and alert the pilots if fire occurs. He must stop refuelling if the pilot turns on the anti-collision light. He must have a headset plugged in ready for use in the event of fire, but need not wear it except in emergency.

1.1.3 The cabin crew must prepare the emergency exits as appropriate to type, warn passengers not to smoke, etc., and be alert for aisles or exits blocked or for build-up of fumes.

1.1.4 The pilots must establish communications with the engineer, inform cabin crew of the beginning and ending of refuelling, listen for fire warning from the engineer and be prepared to initiate passenger evacuation if necessary. He can signal refuelling to be stopped by switching on the anti-collision beacon.

1.2 Detailed refuelling procedures are issued separately for each aircraft type. These procedures meet all international standards.

1.3 Extra precautions are taken when refuelling with, or within, 20 flying hours of fuelling with JP-4/Jet B. These precautions are included in the detailed procedures for each type.

Note.— Passengers may be on board but may not join or leave the aircraft during refuelling with JP-4/Jet B, except in an emergency.

2. Precautions during use of alternative and mixed fuels — all aircraft

2.1 The following requirements concern the types of fuel permitted for use on all aircraft and advise on the stringent precautions which *must* always be observed when refuelling JP-4 or when refuelling an aircraft with JP-1 where the fuel tanks already contain JP-4 or a mixture of JP-4 and JP-1.

2.2 *Fuel specifications*

Grade	*Type*
JP-1 (Jet A-1 fuel)	kerosene-type fuel
JP-4 (Jet B fuel)	wide cut gasoline-type fuel

2.3 A major consideration when mixing fuels at normal temperatures is the fuel-air mixture that develops in the space above the fuel inside the tank. JP-4 develops an ignitable fuel-air mixture at frequently encountered ambient air temperatures and when JP-4 and JP-1 are being mixed, the fuel vapour mixture is in the explosive or ignitable envelope throughout an even broader range of ground temperatures common at the majority of airports during all or part of the year.

2.4 Ordinarily the vapour pressure of JP-1 is too low to develop an ignitable mixture. Gasoline usually develops an over-rich mixture that will not ignite. It is the mixture of these two fuels that can develop the ignitable fuel-air combination.

2.5 It is important to remember that any fuel should be handled as though it develops an ignitable fuel-air mixture, which it will do under the right conditions.

2.6 These precautions are in addition to the normal precautions contained in the relevant maintenance and engineering manuals, and are issued for the advice and action of all concerned.

3. Approved fuels

3.1 Normally JP-1 is the only fuel approved for use on company aircraft, but in exceptional circumstances JP-4 may be uplifted when JP-1 is not available.

3.2 JP-4 is a “wide cut” fuel, i.e. it is a varying mixture of gasoline and kerosene-type hydrocarbon fractions.

3.3 JP-4 or JP-1 can be used interchangeably in the turbo-jet and turbofan engines installed on aircraft. The manufacturers have determined that no trim adjustments on the jet engine fuel control unit are required when changing from one fuel to another.

4. Precautions and restrictions when using JP-4 fuel

4.1 The use of JP-4 necessitates stringent precautions because of the lower flash point of the JP-1/JP-4 mixture. Because of the extra hazard associated with an ignitable mixture in the tank, underwing refuelling *only* is permitted and then only at reduced flow rates when JP-4 is being added to a tank containing JP-1 or vice versa.

4.2 Tests and experience indicate that a static charge potential can develop between the fuel surface and some point inside the tank structure, even though all structural parts are bonded together. Velocity and turbulence within the fuel itself tend to increase the static charge, and the charge dissipates slowly because of the electrical insulative qualities of the fuel.

4.3 The following precautions and restrictions must be strictly adhered to when using JP-4 or a mixture of JP-4 and JP-1.

4.3.1 *Bonding*

Strict adherence to the bonding and grounding precautions must be observed because of the lower flash point of the mixture, i.e. aircraft and refueling vehicles must be securely connected to adequate ground earthing points. The refuelling vehicles must be bonded to the aircraft prior to connecting the nozzle to the aircraft fuelling adaptor.

4.3.2 *Refuelling*

4.3.2.1 Overwing refuelling is not permitted when loading JP-4 into an aircraft with JP-1 already on board or when loading JP-1 into an aircraft which was refuelled with JP-4 during the preceding *20 flight hours*.

4.3.2.2 Underwing refuelling must be carried out at a *reduced flow rate*. This is achieved on 747 aircraft by using *only* one fuel supply hose on each side attached to the underwing fuel manifold and ensuring at least two tank inlet valves are open to keep the flow rate to each tank low, even though fuel enters the manifold through only one hose. This procedure is aimed at reducing the electrostatic charge build-up inside the fuel.

4.3.2.3 Normal refuelling calculations as appropriate for each aircraft type should be carried out.

4.3.2.4 On completion of refuelling with JP-4, a placard will be placed adjacent to the relevant cockpit fuel contents gauges (and refuelling panel on applicable aircraft) stating that overwing refuelling must not be carried out until *20 flying hours* from that aircraft time at which refuelling was carried out (current time from aircraft technical log) and an entry will be made in the Captain’s Technical Report to the effect that JP-4 was uplifted.

5. Defuelling

Defuelling within the 20 flying hours previously referred to should be avoided. If considered absolutely necessary to defuel within this time limit, then the fuel company concerned *must* take the necessary precautions to ensure that the mixed fuel is segregated from unmixed fuel and if reloaded, the same precautions will apply as when loading pure JP-4 into a tank containing JP-1.

Attachment B to Chapter 8 Example from an operator's guidance on fuel spillage

Actions required for fuel spillage

When significant spillage of fuel occurs, the following safety measures have to be taken:

- Fuelling operations must be stopped at once.
- Any persons on board must be warned immediately.
- Ground power-units and other engines or electrical motors of equipment in the fuelling zone must be shut down and all further electrical switching avoided.
- Handling personnel must leave the fuelling zone.
- The airport fire brigade must be warned.
- Station management must be informed.
- If fuelling operation was done with one engine running, that engine must be shut down.
- If considered necessary, the aircraft must be towed to a safer place.

Attachment C to Chapter 8

Example from an operator's guidance on the preparation of a cockpit checklist

Cockpit checklist

1. The use of an up-to-date cockpit checklist for normal and emergency operations is compulsory. One checklist must be within immediate reach at each pilot's station. Normally, the pilot not flying will read the checklist.
2. The items on the checklist shall be called out separately in a loud voice, except where the instructions for a given aircraft type specify that certain parts of the checklist are performed silently. The next item is not to be called until this item is properly checked. The exact terminology of the cockpit checklist shall be adhered to.
3. If during or after reading of the pilots' Pre-flight — or Before Starting checklist, both pilots simultaneously vacate the cockpit, these checks are invalidated. This also applies when two members of a basic three-man crew simultaneously vacate the cockpit.

Notes.

- *Proper use of the checklist is essential to safety and requires that good discipline be maintained by the cockpit crew*
- *Interruptions by other crew members or ground engineers should be avoided whenever possible.*
- *When interrupted by radio communication, reading of the checklist should be suspended until the radio communication has been finished.*

CHAPTER 9

9.0 FLIGHT PREPARATION

9.1 FUEL, OIL AND OXYGEN SUPPLY REQUIREMENTS

9.1.1 As part of the flight preparation, regulations requires that an operational flight plan be completed for every intended flight. The plan must be approved and signed by the pilot-in-command, and where applicable, signed by the flight operations officer/flight dispatcher. A copy of the operational flight plan must be left at the aerodrome of departure.

9.1.2 In preparing the operational flight plan, there are a number of factors that must be addressed and which are detailed in the regulations. These are the standards relating to alternate aerodromes, weather conditions, fuel and oil supply and, where applicable, oxygen supply. In addition, the performance operating limitations requirements must be considered. For aeroplanes, these operating limitations require that, following one power-unit becoming inoperative in the case of a twin-engined aeroplane, or, in the case of three- or four-engined aeroplanes, two power-units becoming inoperative, the aeroplane must be able to continue the flight to an aerodrome and make a landing thereat. Furthermore, in the case of extended range operations by aeroplanes with two turbine power-units, the availability of a suitable aerodrome to which the aeroplane can divert following failure of a power-unit, or of failure of essential aeroplane systems, must be considered.

9.1.3 Operational flight planning can be considered under two broad headings; firstly, alternate aerodromes and their operational suitability, and secondly, the required fuel and oil supply, which will probably be directly affected by the availability of suitable alternates.

9.2 ALTERNATE AERODROMES

9.2.1 The basic requirement for an alternate aerodrome is stated in regulations. The regulationsbrequires that flights conducted under instrument flight rules specify a destination alternate aerodrome, unless there is reasonable certainty that the flight can approach and land at a destination under visual meteorological conditions. An alternate aerodrome is not required when the destination is isolated and no aerodrome is available as an alternate. The performance requirements must also be considered. The alternate aerodrome requirements following single- or double-engine failure are rarely restrictive, except for longer-range flights or flights in oceanic airspace or over remote areas. The requirement is that following one power unit becoming inoperative, the aeroplane shall be able, without flying below the minimum flight altitude at any point, to continue to an aerodrome at which the same performance standard as at the aerodrome of intended landing can be met. In the case of two power-units becoming inoperative on aeroplanes having three or more power-units, the requirement is that the aeroplane be able to continue the flight to a suitable aerodrome at which a landing can be made. *Operation of Aircraft* regulations illustrates these requirements in more detail and should be consulted in developing policy.

9.2.2 The operations manual must include guidance on which aerodromes are usable as alternate aerodromes. Any aerodrome which is a destination aerodrome can be used as a destination alternate for any other aerodrome. Other aerodromes must be examined as to their adequacy and a list of any such aerodromes must be available for consultation. Operators often list for each destination the "preferred" alternate. This alternate may be the most preferable in terms of passenger handling, or may be the closest so that the minimum fuel for diversion may be carried. It is obvious that the actual destination alternate used for a flight must be related to the conditions on a given day, and operators often specify that the closest alternate can only be used when the weather forecast at the destination aerodrome makes the possibility of an actual diversion occurring extremely unlikely.

9.2.3 A further consideration is the availability of an en-route alternate aerodrome in the event of failure of the aeroplane pressurization system. This is usually only critical on longer-range flights over oceanic or remote areas where the fuel required to cruise for long periods at lower altitudes may be limiting.

9.2.4 All the above alternates may have to be considered for some operations, whereas for shorter flights or for flights in areas where a large number of suitable enroute alternates are available the requirements may not be limiting. The appropriate guidance must be included in the operations manual.

9.2.5 The operations manual should specify the conditions for the selection of take-off alternate aerodromes when conditions at the aerodrome of departure preclude an immediate return to land in the event of an emergency.

9.3 WEATHER REQUIREMENTS FOR FLIGHT PLANNING AND IN-FLIGHT OPERATION

9.3.1 In the preceding paragraphs, alternate aerodromes are discussed without fully considering the effects of weather. In fact, the selection of alternates and factors related to weather are inextricably intertwined, as no matter what the basis of the requirement, e.g. engine failure or pressurization system failure, the specified alternate is of no operational value if the aeroplane cannot land there because of weather.

9.3.2 There is no requirement to have a destination alternate aerodrome specified if the weather at the destination aerodrome is forecast to be such that a landing can be made in visual meteorological conditions. Although the requirement to specify an alternate is related solely to the expected weather, operators normally specify some extra conditions related to the aerodrome facilities. These include number of runways, length of runways, etc. For flights conducted solely under visual flight rules it is reasonable to apply similar conditions.

9.3.3 The other occasion when an alternate is not required is when the destination is so isolated as to make it impossible to specify one. In this case, similar provisions requiring visual meteorological conditions and appropriate ground facilities should apply. Normally in these cases a predetermined point is specified at which the aeroplane can turn back or divert to another alternate. Appropriate guidance must be given in the operations manual.

9.4 FUEL AND OIL SUPPLY

9.4.1 The requirement is that, taking the weather into account and allowing for possible delays and any other contingencies, sufficient fuel and oil must be carried to safely complete the flight.

9.4.2 The regulations describe this requirement both for propeller-driven aeroplanes and for aeroplanes equipped with turbo-jet engines and for helicopters engaged in commercial operations. In each case the requirement is described where a destination alternate is required, and where a destination alternate is not required, and where no suitable alternate aerodrome is available.

9.4.3 The typical commercial air transport operator will have a policy that all flights will, where possible, be operated with a nominated destination alternate. It will be necessary to describe in the operations manual how the required minimum fuel figure is determined. Information would normally be given on how trip fuel is calculated and what portions of the flight it includes, for example, taxi, takeoff, climb, cruise, descent, and one full instrument approach. Information should also be given on standard allowances for taxiing, for approach and for missed approach, on contingency fuel, and on holding fuel. The information in the operations manual may be presented as information on the operator’s general policy followed by specific information for different aircraft types.

9.4.4 In addition to specifying the minimum requirements for fuel and oil supply, regulations requires that a number of other points be considered. These are as follows:

Meteorological conditions

This is an obvious requirement as regards head wind, tail wind, etc., but for a given flight allowance should be made for possible variations to the planned route due to thunderstorms, icing conditions, turbulence, etc. The meteorological conditions may also have a bearing on the selection of en-route and destination alternates.

Air traffic re-routings and delays

This can be a matter of judgement. However, in most cases it will be possible to assess on the basis of past experience the possibility of these delays occurring. Many operators add an extra fuel allowance for aerodromes and areas where delays are common. In fact, some operators keep records of the extra fuel used on some routes because of delays, re-routings, etc., and use this information to develop a figure for extra fuel that should be carried on flights on those routes.

One instrument approach and a missed approach at the destination
This is easily understood and is already included in the fuel requirement for turbo-jet aeroplanes.

Loss of a power-unit or pressurization system failure during the flight
The carriage of fuel to meet the performance requirements of the regulations dealing with aeroplane performance operating limitations and in the case of extended range operations with aeroplanes fitted with two turbine engines, the additional requirements of that type of operation, will meet the need to consider the fuel required following failure of one power-unit en route. In the case of pressurization failure the fuel required is that needed to cruise at low level, following failure of the pressurization system at the most critical point, to a suitable aerodrome.

Any other conditions that could delay the flight and/ or increase fuel and oil consumption
This is a matter of judgement based on the actual operation planned. However, among the factors that could increase the fuel and/or oil consumption are the use of anti-icing or de-icing systems, the use of auxiliary power-units or engine bleeds, etc. The operations manual must give guidance and specify rates of fuel and oil consumption for systems or conditions that increase the basic rate.

9.4.5 In calculating the fuel required for turbo-jet aeroplanes, a factor that is always included is "an additional amount of fuel, sufficient to provide for the increased consumption on the occurrence of any of the potential contingencies specified by the operator to the satisfaction of the Authority" in fact, all aeroplanes are required to carry a reserve to provide for contingencies. This contingency fuel is carried to account for errors in forecast wind or temperature, unforeseen ATS delays or re-routings due to weather en route, or the planned cruising level being unavailable. It seems to be generally agreed that the total extra fuel carried for unforeseen contingencies shall be about 5 per cent of the trip fuel required. Some operators specify the minimum and maximum limits for the amount of fuel to be carried as contingency fuel.

9.4.6 In many parts of the world ATS prescribe preferred routings, or international transit routes for IFR flights. In addition, operators may have their own preferred routings if, for example, experience shows that there are fewer delays using a particular routing. If there are preferred routings, the fuel required will be based on that routing and the appropriate information and guidance must be given in the operations manual. Another factor that would affect the fuel required is if it were known that a particular aeroplane's performance is below the performance used for flight planning. If this is the case, appropriate allowances must be made at the planning stage. Below-datum performance can be recognized by studying the records of fuel burned over a period. An aeroplane that is consistently using more fuel will stand out. The other method of identifying higher fuel usage is to examine the data stored in a flight management system or performance computer system, where normally a measurement of actual aeroplane performance against datum is stored. The operations manual should also include information on the minimum usable fuel and the range of fuel calibration error for each aeroplane type. This information should refer to aeroplane body angle as in many aeroplane types, with minimum fuel, over-rotation can uncover some fuel pumps. In this context, many operators specify a minimum fuel quantity that must be on board before a take-off. One other factor on which operators often give information, in an easily used format, is for "off altitude" correction. This is the amount of extra fuel that will be used if the aeroplane does not operate at the planned cruising level. The figure is usually given as extra fuel burned, depending on cruise distance and aeroplane mass, for 600 m (2 000 ft) and 1 200 m (4 000 ft) off the planned flight level.

9.5 IN-FLIGHT PROCEDURES

9.5.1 A flight shall not be continued towards the destination aerodrome unless it is believed that, at arrival time, a landing can be made there, or at an alternate, in compliance with the approved aerodrome operating minima. The operations manual must give guidance on the procedures to follow in order to comply with this requirement. In general, the requirements specified are similar to those of the planning stage. In other words, if it is necessary to divert to another aerodrome because both the intended destination and the nominated alternate(s) are unusable, the policy should be to have sufficient fuel at the re-clearance point to fly to a suitable aerodrome and to land there plus 30 minutes' holding fuel at 450 m (1 500 ft) and the contingency reserve. In a situation where the weather at destination and alternate is such that the possibility of in-flight diversion could occur, it is essential that the conditions be carefully monitored during the flight so that an early decision to divert can be made before the safety of the flight is in any way jeopardized.

9.5.2 Re-clearance procedures are also used when a flight is deliberately planned with an intention to re-clear en route from the planned destination to the final destination. This is usually done when it is not possible to carry enough fuel to plan the flight to the final destination. The advantage of nominating an intermediate destination is that if, at the time of arriving at a predetermined point en route, the contingency reserve has not been used, it is then available for onward flight planning purposes. A relatively lower quantity of fuel, including contingency fuel, will be required for the flight to the final destination so that a portion of the contingency fuel carried for the initial flight plan can now be utilized as trip fuel while still meeting all the normal fuel requirements.

9.6 PRESENTATION OF INFORMATION AND DOCUMENTATION

9.6.1 All the information required for fuel pre-flight planning purposes should be available from the aircraft operating manual. However, many operators develop their own quick reference tables or graphs for fuel requirements on the basis of that information. These charts present the fuel required for a specific flight or sector length, including fuel for taxi, take-off, climb, cruise, descent and approach. The fuel figure is presented for aeroplane mass against wind component. This figure is normally for optimum cruising level so a correction can be given for flight at other altitudes when this is significant. Also, if significant, a correction can be given for non-standard temperatures. As the operator normally plans to use certain alternates for each destination, he can, on the same chart, present information on the fuel required for diversion to each alternate. This figure includes fuel for a missed approach at destination, climb, cruise, descent, approach and landing, and holding fuel. This figure is also presented for aeroplane mass against head wind or tail wind. The operations manual will need to give the appropriate information on these points if such a system is used.

9.6.2 During the flight it will be necessary to monitor fuel usage and to record the fuel on board at stated intervals. The fuel remaining is compared against planned usage or against the amount of fuel required at destination as diversion fuel. This form is often combined in the operational flight plan, but it can be a separate form.

9.7 FUEL CONSERVATION AND ECONOMY

Fuel conservation, i.e. the carriage and use of as little fuel as possible, and fuel economy, i.e. making sure that the fuel used is the cheapest available, are topics addressed as matters of policy by most operators. In addressing these matters, it is essential that the operations manual make a statement that at no time should a flight depart with less than the required minimum fuel. Fuel conservation will normally be discussed in relation to aeroplane operating techniques, e.g. reduced thrust take-off, runway selection for take-off and landing, flap settings, best climb speeds and descent profiles, selection of cruising level, shortest route, taxiing with one engine shut down, etc. These considerations will be related to the particular aeroplane types being operated and the operations manual will give the appropriate advice. Fuel economy is a commercial matter and as such is not an operational consideration. However, as the method of determining the most economical fuel usage will affect the selection of planned fuel loads, it is essential that the operations manual contain appropriate information and guidance on these policies.

9.8 COMPUTER FLIGHT PLANS When computer-generated flight planning is used, it is mandatory that the operations manual include the necessary information on the make-up of such a plan and the factors considered. The requirements as to what must be considered in determining the required fuel are exactly the same as for a manually prepared operational flight plan. However, the operations manual must give guidance on the sources of data used in the operational flight plan. For example, information should be given on the make-up and source of the navigation data, the performance data and the weather data. It will be necessary to explain, in detail, how these data are used in the generation of the operational flight plan. Normally, certain parts of the data can be overridden, while certain other parts of the data must be entered by the flight operations officer/flight dispatcher or the pilot who is preparing the plan. Details and guidance must be given on these procedures in the operations manual. The normal requirements for operational flight plans, such as who is responsible for producing the plan and how records are to be kept, etc., are all equally applicable to computer-generated flight plans.

9.9 OXYGEN REQUIREMENTS During flight preparation, one of the items to be checked is the availability of an adequate oxygen supply for flights operated above 3 000 m (10 000 ft) in the standard atmosphere. For most large modern aeroplanes this is rarely a limiting requirement; however, it can be operationally significant when the normal full oxygen supply is not available. This can occur, for example, where the passenger oxygen supply is limited, or when normal flight deck usage has depleted the crew supply. In these circumstances it will be necessary to check that an adequate supply is available. Appropriate graphs and tables are included in the aircraft operating manual, but many operators produce simpler graphs for their own route network. This information is presented for both flight crew and passenger systems. The information is usually given as oxygen supply required for a given number of passengers or crew for specified flight times. On occasion it will be necessary to produce extra tables for flight sectors with minimum flight altitudes greater than that altitude to which the aeroplane must descend following failure of the pressurization system. Some operators identify those specific routes in their route network on which such a limitation would apply. When an operator produces graphs or tables providing information on oxygen supply requirements, appropriate guidance and information must be included in the operations manual.

Attachment A to Chapter 9 Example from an operator's guidance on selection of aerodrome alternates

Selection of alternates

Alternates will normally be selected from those listed in the route guide for each destination aerodrome. If none of these alternates can be used, any other suitable aerodrome may be selected. Alternates listed in the route guide may be indexed by the letters "C" and/or "R", as follows:

- "C" for commercial alternate (commercially preferable in case of actual diversion);
- "R" for restriction, i.e. operational limitation(s), such as closing hours — noise ban — no fuel or ground equipment; the nature of the limitation(s) to be found in Aerodrome Information.

In view of high fuel prices, carriage of unnecessary fuel should be avoided. It is therefore recommended to plan an alternate as close to destination as is justified under existing and/or forecast conditions. Selection of a nearby alternate with limited facilities is permitted and even recommended, in the case of a very good weather forecast for the destination, as the possibility of an actual diversion is in such a case remote. If the conditions at destination are such that the possibility of diversions cannot be disregarded, the following considerations should be taken into account when selecting an alternate:

a) operational requirements:

1. limitations as indicated in the route guide and/or aerodrome information;
2. weather conditions and weather minima;
3. number of usable runways;
4. runway condition and length;
5. approach facilities;
6. availability of fuel and starting equipment;
7. aircraft handling facilities;

b) commercial considerations:

1. commercial preference as may be indicated in the route guide;
2. distance from destination;
3. passenger-handling facilities;
4. final destination of disembarking passengers;
5. ground connections and/or hotel accommodation;
6. schedule regularity;
7. political aspects.

Attachment B to Chapter 9

Example from an operator's guidance on lack of alternate aerodromes

No alternate IFR operation

The terminal forecast and weather reports for at least two hours before, and the forecast for at least two hours after the expected time of arrival at the destination airport must indicate for that airport:

- no risk of freezing precipitation;
- no risk of thunderstorm, isolated or otherwise.

The airport must have more than one usable runway, provided one runway meets the approved wet landing distance requirement and one other runway meets the approved wet or dry distance as required by the weather forecast. A two-runway destination airport need not be classified as a single runway airport should the second runway be temporarily closed, provided that the closed runway is made available, on request, for operational use on arrival.

Attachment C to Chapter 9

Example from an operator's guidance on in-flight dispatch

Predetermined point procedure

If required, a flight may be planned to the intended destination aerodrome, via a suitable predetermined way-point, with an enroute alternate aerodrome. On reaching the predetermined way-point, the flight shall proceed to the intended destination aerodrome only when the latest meteorological forecast and the current reports are at or above the conditions specified. If these conditions are not fulfilled, the flight must proceed to the en-route alternate aerodrome. However, if conditions forecast for the en-route alternate are more marginal than those for the aerodrome of intended landing and if no other suitable aerodrome is available within the range as stated below, the flight may proceed to the aerodrome of intended landing. When applying the "predetermined point procedure", the minimum brake release fuel must be the highest quantity of:

a) the fuel required to fly to the aerodrome of intended landing, plus fuel for two hours' flight time based on aircraft weight and altitude overhead the aerodrome of intended landing, using the planned cruise regime;
   OR
b) the fuel required to fly to the en-route alternate aerodrome via the predetermined way-point, plus "contingency fuel" (5 per cent of this fuel), plus "holding fuel".

Attachment D to Chapter 9 Example from an operator's guidance on alternate minima

PLANNING MINIMA FOR ALTERNATES (including en-route alternates)

1. General
It should be realized that alternate minima apply only in the flightplanning phase. When a flight actually diverts to an alternate airport, that airport becomes the new destination, and consequently, published or prescribed minima apply. Alternate minima are established to provide an extra margin for weather deterioration during the flight.

2. Minima for flight planning
Criteria: ceiling and visibility. Alternate minima are normally not published on the approach charts, but are determined by adding the following values to the prescribed minima for the applicable category of operation.

Category ofoperation	Lowest ceiling	Forecast for the period up to ETA alternate Minimum visibility
ILS Cat II	Add 300 ft to published DH/A	1 200 m
ILS Cat I and non-precision	Add 300 ft to prescribed DH/A or MDH/A	Add 600 m visibility

Notes.

- *Calculation may not be based on Cat IIIA limits.*
- *Calculated ceiling values should be rounded off to the nearest multiple of 100 ft (50 ft to the next higher multiple of 100 ft).*
- *To obtain the prescribed minima in case of inoperative "visual" or "non-visual" aids, see components*-out table.

If the following conditions can be met, lower aerodrome minima of 200 ft ceiling/1000 m visibility may be used:

a) duration of flight to destination is less than two hours;
b) Cat II or Cat IIIA operation is possible at destination and at the alternate airports concerned; and
c) forecast destination for the period of one hour before, until one hour after, ETA must be 300 ft ceiling/1200 m visibility or better.

If a certain aerodrome presents unusual problems because of geographic location, local phenomena or local regulations, values not in accordance with the above-mentioned rule will be published on the approach chart. A note to that effect can be found in the "selection of alternates" of the route guide.

If no instrument approach procedure has been published for the alternate airport or the approach aid concerned is reported unserviceable, the forecast for the alternate airport must be at least:

a) visibility 10 km or more;
b) ceiling not below the lowest applicable minimum safealtitude (MSA, MORA, MOCA, etc.) and in mountainous terrain or near airports with other high obstacles, no significant clouds; and
c) no precipitation, thunderstorm, shallow fog or drifting snow.

Selection of alternates

Normally, one alternate must be available.

A second alternate airport is required if no weather forecast for the destination airport is available, or if the weather forecast destination for the period up to ETA gives:

a) visibility less than the lowest applicable prescribed visibility minimum, excluding ILS Cat II and ILS Cat IIIA; or
b) ceiling below the prescribed HAT for the approach system selected; or
c) surface wind in excess of tail and cross-wind limitations.

Attachment E to Chapter 9 Example from an operator's guidance on fuel policy

Introductory notes

The following dispatch fuel policy is intended to be used for flight planning:

- either before the flight is commenced (pre-flight dispatch);
- or during flight in order to re-plan the flight (in-flight dispatch).

The "planned operating conditions" to which the text of this policy refers, means among other things:

- anticipated meteorological conditions,
- weights,
- routings,
- delays, and
- ATS procedures as specified in the operating documents.

1. General

A flight shall not be commenced unless, taking into account the "planned operating conditions", the aeroplane carries sufficient fuel to ensure that it can safely complete the flight.

In addition, a reserve fuel shall be carried:

a) to provide for contingencies, when applicable;

b) to enable the aeroplane to reach the alternate aerodrome, when such is included in the operational flight plan.

2. Definitions and specifications

2.1 *Taxi fuel.* A standard quantity of 500 kg to cover ground manoeuvres from engine start to brake release, and APU consumption. This amount may be varied when required by local conditions.

2.2 *Trip fuel.* Fuel required to fly from the aerodrome of departure to the aerodrome to which the flight is planned, based on "planned operating conditions". This amount shall include:

a) *take-off, acceleration and climb fuel:* fuel required to takeoff, accelerate and climb from sea level to initial cruising level;

Note.— A correction for the aerodrome elevation may be applied.

b) *cruise fuel:* fuel required to fly from top-of-climb to startof-descent;

Note.— Step climb, if required, will be taken into account.

c) *descent fuel:* fuel required to descend from last cruising level to sea level at the aerodrome reference point;

Note.— A correction for the aerodrome elevation may be applied.

d) approach procedure fuel: a standard amount of 1 200 kg available to execute an instrument approach procedure.

Note.— This quantity corresponds to eight minutes' flying time in approach configuration, in level flight, at 1 500 ft above sea level in standard conditions.

2.3 Reserve fuel. Shall include:

a) contingency fuel: a quantity of fuel to cover deviations from the "planned operating conditions";

Note.— This is fixed at 5 per cent of the trip fuel (paragraph 2.2 a) + b) + c) + d)).

b) alternate fuel: fuel required to fly from the aerodrome to which the flight is planned, to the alternate aerodrome specified in the operational flight plan, based on "planned operating conditions", but calculated assuming standard temperatures. The "alternate fuel" will include:

1) missed approach, acceleration and climb fuel: fuel required to accelerate from DA/H to the normal climb-out speed, and to climb from sea level to the selected cruising level;

Note.— A correction for the aerodrome elevation may be applied.

2) cruise fuel: fuel required to fly from top of climb to start of descent, using long range settings. The flight levels adopted for the calculations will be:

For ground distances:

- equal to or less than 200NM: FL 200,
- more than 200 NM and equal to or less than 300 NM: FL 300,
- more than 300 NM: FL 350;

3) descent fuel: fuel required to descend from cruising level to the alternate aerodrome reference point at sea level;

Note.— A correction for the aerodrome elevation may be applied.

4) approach and landing fuel: a standard amount of 600 kg available to execute an approach procedure and to land;

Note.— This quantity corresponds to four minutes' flying time in approach configuration in level flight, at 1 500 ft above sea level, in standard conditions.

If an instrument approach is assumed to be executed at the alternate aerodrome, add 600 kg to the "approach and landing fuel";

5) holding: fuel required to fly for 30 minutes at holding speed at 1500 ft above the alternate aerodrome under standard temperature conditions. For pre-flight dispatching, a standard quantity of 3200 kg can be considered.

The sum of 2.3 b) + c) (alternate fuel plus holding) will never be less than 7 000 kg.

3. Policies

3.1 *Dispatch to a destination with at least one alternate*

The minimum brake release fuel is the sum of “trip fuel” (paragraph 2.2) and “reserve fuel” (paragraph 2.3).

3.2 *In-flight re-clearance to a new destination with at least one alternate*

A flight may be re-planned en route from any point along the route to a suitable aerodrome. The minimum fuel required at the re-clearance point shall consist of:

a) fuel required to fly from this point to the re-cleared destination aerodrome (paragraph 2.2 b), c), and d)); plus
b) reserve fuel consisting of:
   1) “contingency fuel” (paragraph 2.3a)) between re-clearance point and re-cleared destination aerodrome; plus
   2) “alternate fuel” (paragraph 2.3 b)); plus 3) “holding fuel” (paragraph 2.3 c)).

3.3 *Predetermined point procedure*

3.3.1 If required, a flight may be planned to the intended destination aerodrome, via a suitable predetermined way-point, with an en-route alternate aerodrome.

3.3.2 On reaching the predetermined way-point, the flight shall proceed to the intended destination aerodrome only when the latest meteorological forecast and the current reports are at or above the conditions specified in the notes at the end of paragraph 3.4. If these conditions are not fulfilled, the flight must proceed to the en-route alternate aerodrome. However, if conditions forecast for the en-route alternate are more marginal than those for the aerodrome of intended landing, and if no other suitable aerodrome is available within the range as stated below, the flight may proceed to the aerodrome of intended landing.

3.3.3 *When applying the “predetermined point procedure”,* the minimum brake release fuel must be the highest quantity of:

a) the fuel required to fly to the aerodrome of intended landing (paragraph 2.2 a), b) and c)), plus fuel for two hours’ flight time based on aircraft weight and altitude overhead the aerodrome of intended landing, using the planned cruise regime;

OR

b) the fuel required to fly to the en-route alternate aerodrome via the predetermined way-point (paragraph 2.2 a), b) and c)), plus “contingency fuel” (5 per cent of this fuel), plus “holding fuel” (paragraph 2.3 c)).

3.4 *Isolated airport procedure*

3.4.1 Where the aerodrome of intended landing is isolated and no suitable alternate is available, a flight may be planned without an alternate, provided this has been specifically authorized by KCAA for the aerodrome concerned and the route to be flown.

3.4.2 This procedure may be applied for flights planned under the conditions specified in the note hereunder.

3.4.3 When applying the "isolated airport procedure", the minimum brake release fuel shall consist of at least the fuel required to fly to the aerodrome of intended landing (paragraph 2.2 a), b) and c)) plus fuel for two hours' flight time based on estimated aircraft weight and altitude overhead the aerodrome of intended landing, using the planned cruise regime.

Notes applicable to paragraphs 3.3 and 3.4

Note 1.— The meteorological conditions referred to in paragraphs 3.3 and 3.4 must be at least equal to the landing minima prescribed by the company, increased by 100 per cent (horizontal visibility and ceiling), except for conditions of a temporary nature, such as TEMPO or INTER caused by showers or thunderstorms.

Note 2.— For paragraphs 3.3 and 3.4, the forecast landing conditions shall not exceed the prescribed limitations. By landing conditions are understood cross-wind, ice, slush or standing water on runways, etc.

Note applicable to paragraph 3 (Policies)

Note.— The minimum fuel at brake release must be sufficient to cope with any of the following events:

a) loss of pressurization;

b) one power-unit becoming inoperative.

In the case of one power-unit becoming inoperative, the fuel aboard must be sufficient to fly to any suitable aerodrome and hold for 30 minutes at 1 500 ft above the landing aerodrome. For flights on all regular routes, compliance with these requirements has been checked by the company.

4. Continuance of flight

4.1 When operating a flight to a destination or re-cleared destination in accordance with paragraph 3 "Policies", paragraphs 3.1 and 3.2, continuance of flight is only permitted if the fuel quantity calculated to remain on board, over the runway threshold at destination or re-cleared destination, is at least the amount required for diversion to a suitable aerodrome (paragraph 2.3b)) plus "holding fuel" (paragraph 2.3c)).

4.2 This quantity shall not be less than 7000 kg. It is, however, the captain's prerogative to continue the flight when the reserve fuel calculated to remain on board over the runway threshold at destination or re-cleared destination is less than the amount listed above, but not less than 6000 kg, provided the weather conditions at destination are forecast to remain equal to or better than 3000 ft and 8 km (5

NM) up to at least one hour after ETA, and provided the conditions in paragraph 1 are complied with.

Attachment F to Chapter 9 Example from an operator's guidance on in-flight planning

In-flight planning

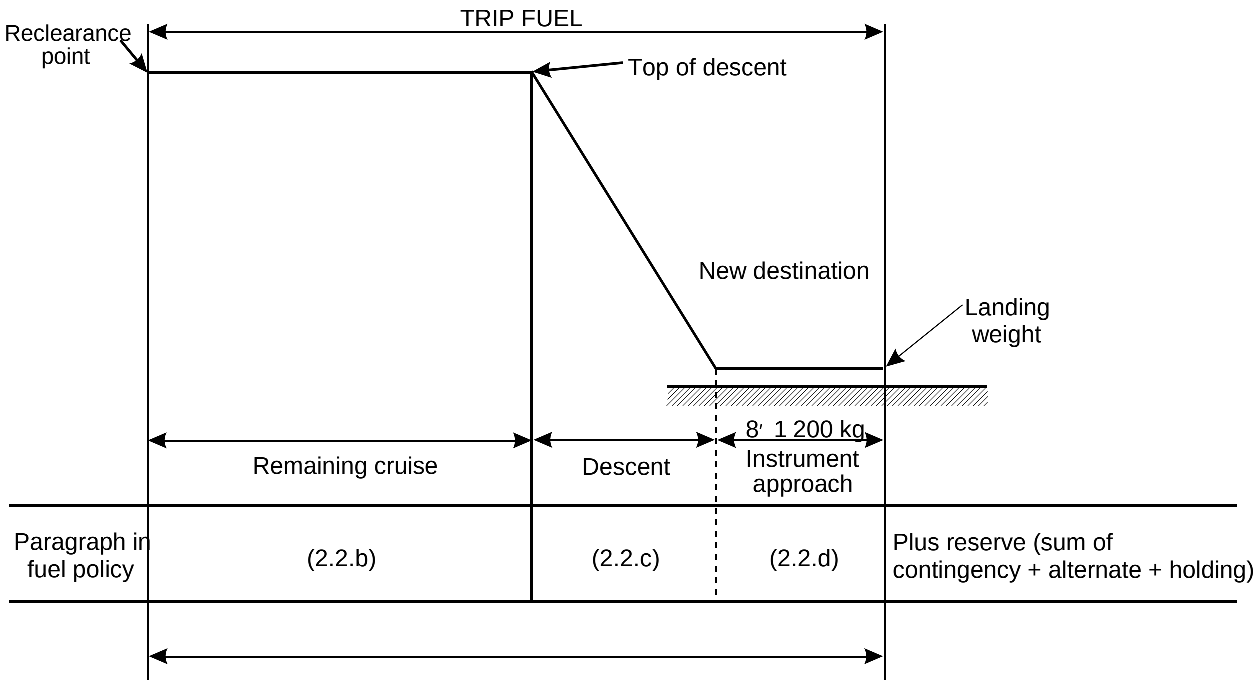
Fuel policy — in-flight dispatch

When calculating the required trip fuel quantities for a re-clearance to a new destination airfield, the company fuel policy specifies the following quantities as shown in the figure below.

Required fuel and time between the cruise point and landing are given as a function of:

a) remaining ground distance;
b) mean wind component;
c) flight level;
d) speed regime (long range, MT = .82, MT = .84).

The fuel figures include:



a) level cruise to top of descent;
b) descent fuel;
c) 1200 kg approach fuel.

The values in the tables have been calculated for an actual cruise weight of 210 T at the decision point. The last column on the right of each table gives a correction in kg per ton for cruise weight different from 210 T.

CHAPTER 10
10.0 AEROPLANE PERFORMANCE

10.1 GENERAL

The performance information required is presented in the flight manual; however, the method of presentation used in flight manuals often makes it unsuitable for day-to-day use. Operators should therefore provide simplified information from which flight crew and other operational personnel can easily extract the needed performance information.

10.2 METHOD OF PRESENTATION

10.2.1 The "simplified" data, as presented, must always produce results at least as limiting as would be obtained by using the equivalent flight manual performance data; must be comprehensive enough to provide all the necessary information; and must be capable of being easily used and interpreted in the aeroplane cockpit. Performance data may be presented in a separate volume or volumes of the operations manual, but must always be accompanied by an explanation of the certification criteria used in determining the performance presented and of the terms and symbols used, and examples should be given of the proper use of the charts, tables, etc.

10.2.2 General limitations should be tabulated at the front of the volume, such as the maximum certificated mass for taxi, take-off and landing, etc., maximum tail winds, runway slope, maximum cross-winds (wet and dry), pavement bearing strength limits, etc.

10.2.3 The method of presentation will vary depending on the particular requirement, but a common practice among are usually specific to the operator's own particular route structure, covering the aerodromes used in normal operation and the approved alternates. Cruise performance is usually provided in a simplified form and quick reference tables or charts for take-off and landing speeds are also often provided.

10.2.4 Specific runway data are derived by the operator from the flight manual data and are presented for each runway normally used. In general, the aim should be to present the runway data in easily used and understandable form, with particular emphasis on the need to make the charts or tables used in the cockpit during flight as simple as possible.

10.3 TAKE-OFF PERFORMANCE

10.3.1 Runway performance information should be given for each runway permitted for use at normal and alternate aerodromes. Runways from which take-off is forbidden must be clearly identified. For each runway from which take-off is allowed, a table or graph giving the maximum permitted mass as a function of wind and temperature, and the associated take-off speeds should be provided. A reference pressure altitude must be specified, and a method of correction for low pressure given. Where appropriate, the data should be presented for a range of allowable take-off flap settings. The individual runway performance sheets should also include details of the runway's declared distances (accelerate/stop distance available (ASDA), take-off distance available (TODA), take-off run available (TORA)), the runway slope and the presence of any obstacles. Information on obstacles is normally found on ICAO Type A charts. When these are not available, the operator is not excused from the responsibility of checking for the presence of limiting obstacles, not only within the area of the ICAO Type A chart coverage, but also distant obstacles which might be limiting throughout the climb. Where obstacles reduce the allowable take-off mass, the position and height of the critical obstacles must be stated, particularly in those cases where a higher-than-standard acceleration segment height results. When the presence of obstacles would limit the allowable take-off mass because of one-engine-inoperative net take-off flight path considerations, an operator may, in order to obtain a higher take-off mass, specify a contingency procedure. Details of the procedure, normally a turn, must be given, e.g. the acceleration segment height (especially when non-standard) and how to identify the turning point (timing DME distance/VOR radial, etc.). Turns should not be specified below 120 m (400 ft) and the appropriate ATS unit must be notified in advance of the details of the procedure. The departure route for each runway must be considered to ensure that the all-engines operating net flight path meets the minimum climb gradient, where one is specified, or clears all obstacles along the route. If the aeroplane cannot meet the required performance level then the operator must specify an alternative routing, in conjunction with ATS, or limit the aeroplane mass so that the minimum specified clearance can be ensured.

10.3.2 Other factors for which appropriate performance corrections are necessary must be considered, such as the use of engine bleeds for air conditioning or for engine anti-icing, the effects of snow, slush, ice and water on the runway, and poor braking action. If certain runway contamination conditions prohibit take-off altogether or cause performance restrictions, precise details of these conditions must be given. In addition, information must be given on the adverse effects that snow and ice on the aero-plane's wings and other surfaces can have on aerodynamic performance, and of the necessity of ensuring that engine thrust output is not affected by these phenomena either. Details of the necessary preventative actions must be given.

10.3.3 Another factor which may affect the performance of certain aeroplane types is a marked temperature inversion, resulting in a rise in temperature along the takeoff flight path. Operators should provide information on the effect which deviations from the standard temperature lapse rate and/or temperature inversions can have on aeroplane performance. Guidance on this problem and details of the performance penalty must be given when the aeroplanes being operated are WAT (weight, altitude and temperature) and obstacle limited and/or when operations take place in those areas where marked temperature deviations are liable to occur, as in arctic or desert areas.

10.3.4 Certain aeroplane types have allowable system and structural unserviceabilities which have performance penalties, e.g. anti-skid system unserviceable. Where this is the case, details of the performance penalty must be given, and it is important that the operational effect of these unserviceabilities be understood by the different personnel involved, e.g. maintenance, so that the details of such unserviceabilities can be passed to the operations section before the flight and load planning calculations are completed for a flight.

10.3.5 The maximum aeroplane mass for the ambient conditions given on a runway performance chart is normally accompanied by the associated take-off speeds (V_1, V_r, V_2). When the actual aeroplane mass is less than the maximum allowed, an alternative method of determining take-off speeds should be provided. This is typically done by the use of quick reference tables or charts with the speeds shown as a function of aeroplane mass, flap setting, temperature and pressure altitude. However, the limitations on the use of these speeds, which are normally based on the use of the balanced field length concept, should be detailed. When this method of determining take-off speeds is used, the assumption is that the take-off distance and accelerate-stop distance required are equal and are only sufficient for the take-off mass being used, i.e. equal to or less than the distance actually available. While this method has advantages, particularly in its simplicity, it cannot be used in all circumstances. In cases where stopway or clearway has been used in deriving the maximum take-off mass, or where maximum tire speed or brake-energy are limiting (in the event of a high speed abandoned take-off), means of deriving the appropriate speeds must be provided. When the use of a wet V_1 is required or permitted, the method of calculating this speed must be detailed. If a reduction from the 10.7 m (35 ft) clearance specified for the first segment of the net take-off flight path is associated with the use of the wet V_1 procedure, details of the reduction and its effect on the other segments must be given.

10.3.6 On some aeroplanes, when the maximum takeoff mass is limited by climb gradient limitations and therefore excess runway length beyond that required for that mass exists, an increase in the maximum take-off mass can be achieved by using the extra runway length to accelerate the aeroplane to a higher V_2 speed, resulting in an improved climb performance. For certain aeroplane types, a maximum increase in speeds may be specified while using the technique. If this "improved climb performance" technique is available, appropriate instructions and limits must be given.

10.3.7 When reduced thrust take-off techniques (RTOT) are permitted, instructions on their use, as well as any associated limitations, must be given. Normally, the use of RTOT on contaminated or slippery runways is prohibited.

10.3.8 An operator may wish to include a simplified method of deriving take-off and landing data for runways other than those where operations normally take place and for which specific charts are provided. While such a practice is acceptable, it should be borne in mind that it places a great onus on the user, usually the operating crew, to check that the information used on runway distances, presence of obstacles, etc., is correct.

10.3.9 Operator should provide information on the all-engines-operating performance of the aeroplane. This information is necessary, as a number of departure procedures specify a minimum climb gradient. The pilot-in-command needs to know, in these circumstances, if the specified climb gradient can be achieved for the existing conditions. Examination of this requirement, for a particular published departure, may show that for any foreseeable combination of aeroplane mass and take-off and climb conditions, the required all-engine climb gradient will be achieved. If this is the case, a simple statement to that effect attached to the performance data for that aerodrome or included in the route guide will suffice. If the aeroplane cannot always achieve the required gradient, information and guidance on determining what gradient can be achieved or on an appropriate alternative procedure, such as selecting a different routing, should be included in the operations manual, preferably with the runway performance data.

10.4 EN-ROUTE OBSTACLE CLEARANCE

10.4.1 Runway performance data include consideration of continued take-off following critical engine failure, and should include consideration of the all-engines net flight path. The en-route phase commences at the end of the net take-off flight path and ends at the commencement of the approach and landing. It is necessary to consider critical engine failure in the case of twin-engined aeroplanes and double engine failure in the case of three- and four-engined aeroplanes, to ensure that adequate clearance from terrain and obstructions exists during the climb and cruise portions of the en-route phase. If adequate clearance cannot be assured, it is necessary to restrict the mass of the aeroplanes so that clearance can be achieved. Otherwise an alternative routing must be used. It is necessary to establish critical points on routes to allow the aeroplane to make use of driftdown performance capabilities to avoid terrain or obstructions infringing the net flight path following engine failure. In the event of engine failure before the critical point, the aeroplane must turn back, while after the critical point the aeroplane must continue. In either case, the drift-down capabilities of the aeroplane, following engine failure, must be such that adequate clearance from the terrain or obstruction can be maintained.

10.4.2 Drift-down charts show the optimum speed at which to descend after engine failure. Data on distance travelled and time taken to descend to the engine-inoperative stabilized cruise level is included. This information must be readily available to the flight crew, since decisions on terrain clearance following an engine failure can be critical. Cruise control data following engine failure (typically long-range cruise) should be provided.

10.5 CRUISE CONTROL

10.5.1 Information supplied by the manufacturer covers the differing cruise regimes which may be used and from which an operator will select one or more to suit his specific requirements. For example, it may be specified that long-range cruise speeds normally be flown, but where flights are seriously delayed, high speed cruise may be used, other performance/flight planning considerations permitting.

10.5.2 For each permitted cruise technique, a cruise control chart should be provided for use in the cockpit. Typically this chart will show the engine setting required for a particular flight level and aeroplane mass, and give fuel flow and the cruise IAS/Mach number.

10.5.3 Information on buffet margins may also be presented on the cruise chart. The operator should give details of the particular buffet margins that should be maintained both in "normal" cruise flight and in areas of turbulence, and the recommended airspeed for flight in turbulent conditions should be given.

10.5.4 A chart that is often provided is a "wind-altitude trade" chart. This chart shows what increase in head wind, or decrease in tail wind can be accepted in climbing to a higher cruising level to make use of the resultant lower fuel consumption rate. Conversely, the chart shows what decrease in head wind, or increase in tail wind must be experienced at a lower level to make it worthwhile descending to that lower level and accepting the resultant higher fuel consumption rate.

10.5.5 Many other performance charts related to the climb, cruise, holding and descent are provided for use in flight planning. Discussion on their content and use is addressed in the chapters on flight planning.

10.6 LANDING PERFORMANCE

10.6.1 Information on landing performance should be published for each runway, both for destination and alternate aerodromes. The factors to be considered in determining whether a runway is suitable for landing, and the maximum mass at which an aeroplane can land on a specific runway are governed by certification requirements, but in general include the following:

a) landing distance available (LDA);
b) obstacles (both on the approach and in the missed approach);
c) landing climb gradient requirements (WAT limits);
d) ambient conditions (head wind/tail wind, temperature, pressure altitude);
e) aeroplane mass (structural limits);
f) different flap settings available for landing; and
g) runway surface condition (wet, dry, contaminated with snow/slush/ice, braking action, coefficient of friction).

10.6.2 The operator must describe in the manual how landing data are to be used and specifically what factors have been taken into consideration. It is essential that information on landing data be presented in an easily usable format, as this material must be used in the cockpit during flight. It is common practice for operators to present information on each runway authorized by the company for landing. Runways can be described as “unrestricted”, i.e. for a specified range of wind, temperature and pressure altitude conditions the aeroplane can land at maximum structural landing mass; “restricted”, i.e. the allowable landing mass must be calculated in the light of the prevailing conditions; and “forbidden”, i.e. runways on which landings are not authorized.

10.6.3 Although landing data are presented for wet and dry runway surface conditions, guidance should also be given on corrections to be applied to the allowable landing mass to account for the runways being slippery when wet, or covered with snow, ice, or slush. These corrections are often applied through the use of the coefficient of friction of the runway or the description of the braking action, good/ medium/poor, etc. The presence of these conditions normally requires that the maximum permitted cross-wind be reduced to take account of the difficulty associated with maintaining directional control on the runway.

10.6.4 Landing data should also be presented for landings with technical malfunctions, such as flap malfunctions, when these malfunctions can cause an increase in the required landing distance. Equally, engine failure can mean that the aeroplane needs to land with a lower than normal flap setting, requiring a longer landing run.

10.6.5 In determining maximum landing mass, one of the considerations is the presence of obstacles in the missed approach phase. The aerodrome authority declares an OCH or

OCA for each instrument runway and one of the criteria is that a 2.5 per cent missed-approach gradient be established which will clear all obstacles in the missed-approach path. While normally all aeroplanes can achieve this gradient, it is possible that some, particularly twin-engined aeroplane types, may not be capable of achieving it following an engine failure. This problem can be overcome by raising the OCA/H to allow the aeroplane to clear the obstacle, using a missed-approach gradient that reflects the performance capabilities of the aeroplane. Some operators examine the missed-approach flight path and, where necessary, either restrict the landing mass or specify a higher OCA/H so as to ensure obstacle clearance.

10.7 HOLDING AND DIVERSION

10.7.1 Data on holding, preferably in a simple form, should be provided. These data normally present fuel flow and airspeed as a function of mass, altitude and temperature.

10.7.2 Many operators present charts or graph showing the amount of fuel required to divert to an alternate airfield. These data are normally presented as a function of aeroplane mass and distance to the alternate with corrections for wind and temperature. Allowances for holding and approach at the alternate may be included in the diversion fuel or presented separately.

10.8 CONCLUSION

10.8.1 In conclusion, the performance information required in modern air transport operations and the amount of research and calculation needed to develop the data usually make it necessary for operators to establish units whose sole function is to monitor all the appropriate factors and produce and update the required information. As there is an obvious requirement to guarantee the quality of data produced, most operators have established operational engineering units staffed by qualified performance engineers. If it is not practical for an operator to establish such an office, it may be possible to purchase the service from another operator, commercial firms, or the aeroplane manufacturer.

Attachment A to Chapter 10

Example of an operator's explanation of the use of the prepared runway regulated take-off weight information

Regulated take-off weight (RTOW)

Tabulated weights

The regulated take-off weight tables (RTOW), which are based on the "take-off procedure — engine failure recognition at V_1" give the allowable take-off weights for a range of winds and temperatures. The tabulated weights are the lowest of the weights determined by:

1. field length (stopway and clearway taken into account);
2. second segment climb;
3. obstacle clearance;
4. brake energy; and
5. tire speed.

The tables are computed for the reference pressure altitude (feet)/ pressure (millibars) shown at the top of each table. Engine air conditioning bleeds are assumed OFF in order to achieve the best possible RTOW.

Note.— Take-off will normally be with engine air conditioning bleeds ON, unless the payload or range is restricted. If payload or range is restricted, the take-off should be with air conditioning from the APU, or with no air conditioning until obstacle clearance is assured.

Where there are obstacles in the take-off flight path, their heights and distances from the end of the take-off run are shown below the RTOW table. The minimum flap retraction height is also shown.

To allow for corrections for pressure altitude and engine bleeds, weights in excess of maximum structural limited take-off weight are given in the tables. However, the final RTOW calculated must never exceed the structural limit.

Take-off flap settings

The take-off flap settings used are:

FLAP POS 1

FLAP POS 5

FLAP POS 15

For some runways RTOW tables for two flap settings are provided to obtain the optimum take-off weight for the range of temperatures and winds. On the other runways one flap setting is sufficient.

Improved climb performance (ICP)

On runways where the field length limited weight is higher than the climb limit, it is allowable to increase the V_2 speed in order to improve climb performance. The improvement in climb performance permits an increase in the permitted runway take-off weight.

Turn procedures

Turn procedures are used to avoid restrictions on take-off weight due to:

1. limiting obstacles in the one-engine-inoperative take-offflight path;
2. limiting obstacles in the all-engines-operating take-offflight path.

Case 1 (see Figure 1-A) requires an emergency turn procedure and must be carried out in the event of an engine failure during or after take-off and in the event of an engine-inoperative overshoot.

Note.— On an engine-inoperative overshoot, the missed approach procedure (engine inoperative) on the turn procedure page of the route manual must be adhered to.

Case 2 (see Figure 1-B) requires a compulsory turn procedure and must be carried out on all take-offs.

Note.— On a normal overshoot with all-engines operating, the overshoot procedure specified in the route manual must be adhered to.

In each case it is imperative that the turn be commenced at the proper time or location, as specified in the instructions for each turn procedure (see Figure 1-C). A premature turn, with the subsequent reduction in the climb gradient, may well leave no clearance over close-in obstacles in the vicinity of the airfield and a late turn may take the aeroplane outside the area over which the terrain clearance performance has been calculated.

Turn procedures are based on the "take-off procedure — engine failure recognition at V_2".

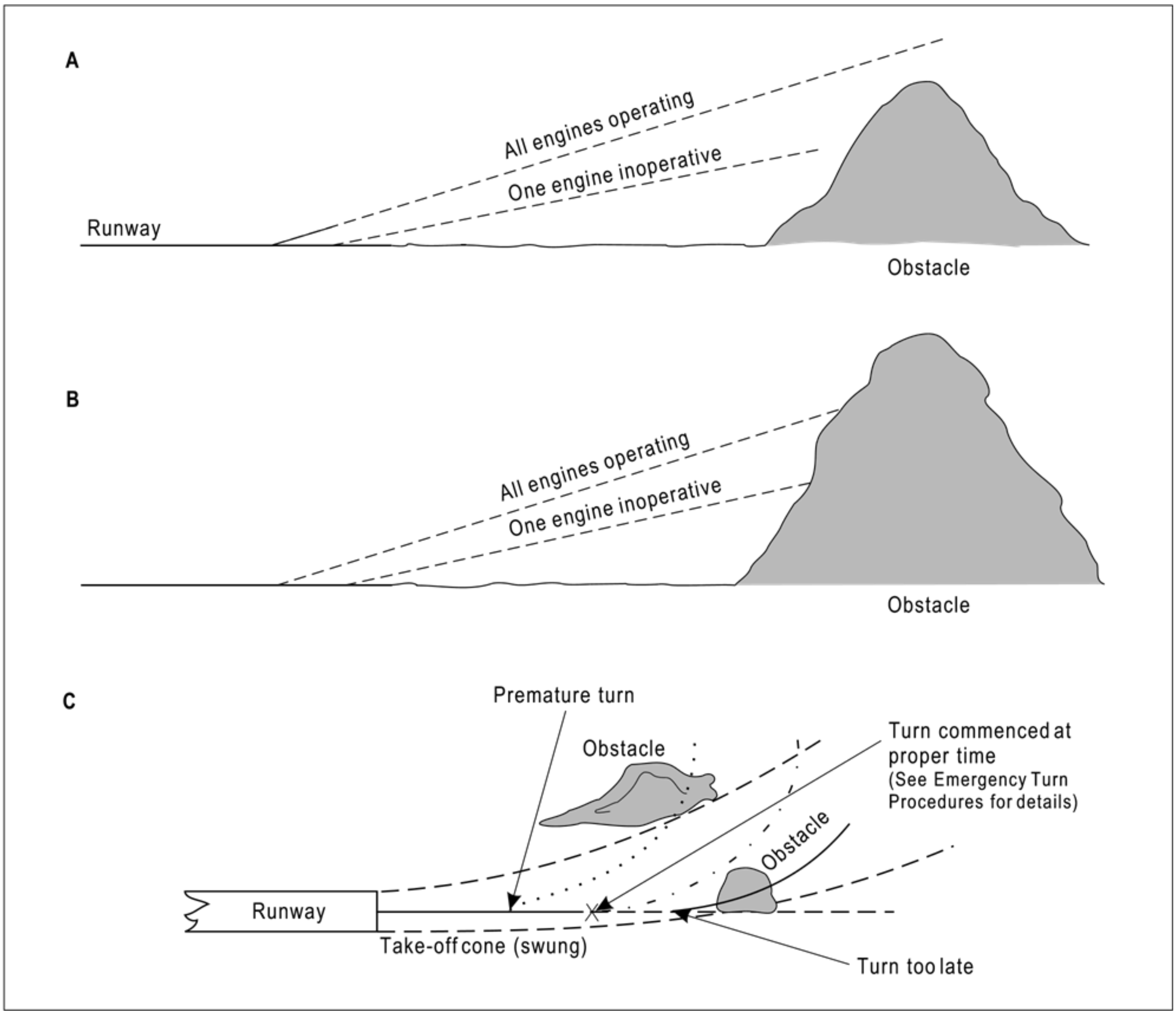
Use of turn procedures

Where a turn procedure is necessary, a note to that effect is included below the RTOW tables. Refer to the route manual to determine whether the procedure is compulsory or emergency and to follow the procedure instructions.

Note.— A compulsory turn procedure becomes an emergency turn procedure in the event of an engine failure on take-off. In that event, the procedure specified for "engine failure on take-off" must be adhered to.

If the procedure is compulsory (i.e. all-engines operating) the aeroplane is climbed on the runway heading at V_2 + 15 kt IAS until the time or location specified from the start of the turn is reached. At this point, a turn is initiated with the speed being held at V_2+15kt IAS. Maintain bank angle and speed as accurately as possible during the turn until the aeroplane is on the new heading specified in the procedure instructions.

Continue climbing at V_2+15 kt IAS until obstacle clearance is assured. Once obstacle clearance is assured, continue climbing and accelerating and retract flaps as per schedule. Then set climb thrust and climb at the recommended speed to cruising altitude.



If the procedure is emergency (i.e. engine failure on take-off) the aeroplane is climbed on the runway heading at V_2 or at a higher speed (V_2 + 15 max) if this has been achieved before engine failure until the time or location specified for the start of the turn is reached. At this point a 15° bank turn is initiated, the speed being held at V_2 or higher as stated above. Maintain this bank angle and speed as accurately as possible during the turn, until the aeroplane is on the new heading specified in the procedure instructions. At 400 ft, or at the minimum flap retraction height specified in the procedure instructions, or at the height achieved on completion of the turn, whichever is greater, the aeroplane is flown level and accelerated to the final segment climb speed. During acceleration, the flaps are retracted as per schedule. Thrust is reduced to maximum continuous at the end of the acceleration segment. The climb is continued on the new heading at the final segment speed and maximum continuous thrust.

Note 1.— In an emergency turn procedure, no attempt should be made to accelerate the aeroplane during the turn as the acceleration time in a turn is excessively long.

Note 2.— The performance used in determining turn procedures is based on the V_2 *applicable to the aeroplane maximum take-off weight or the maximum take-off weight available on the runway for the flap setting.*

Note 3.— In the emergency turn procedure, thrust should be reduced to maximum continuous at the end of the acceleration segment or at five minutes from start of take-off, whichever occurs first. (See Figure 2.)

Normal take-off — obstacle clearance

On a normal take-off (all-engines operating) where there are obstacles in the take-off flight path, the take-off procedure must be such that obstacle clearance is assured. Consequently, the initial climb-out speed should ensure adequate climb gradient until obstacles in the take-off flight path have been cleared.

The initial climb-out speed should be held to V2 + 15 kt. Once obstacle clearance is assured, accelerate and retract the flaps as per schedule.

Note.— The minimum level-off height for acceleration to climb speed is 400 ft or the minimum flap retraction height as specified below each RTOW table, whichever is the greater.

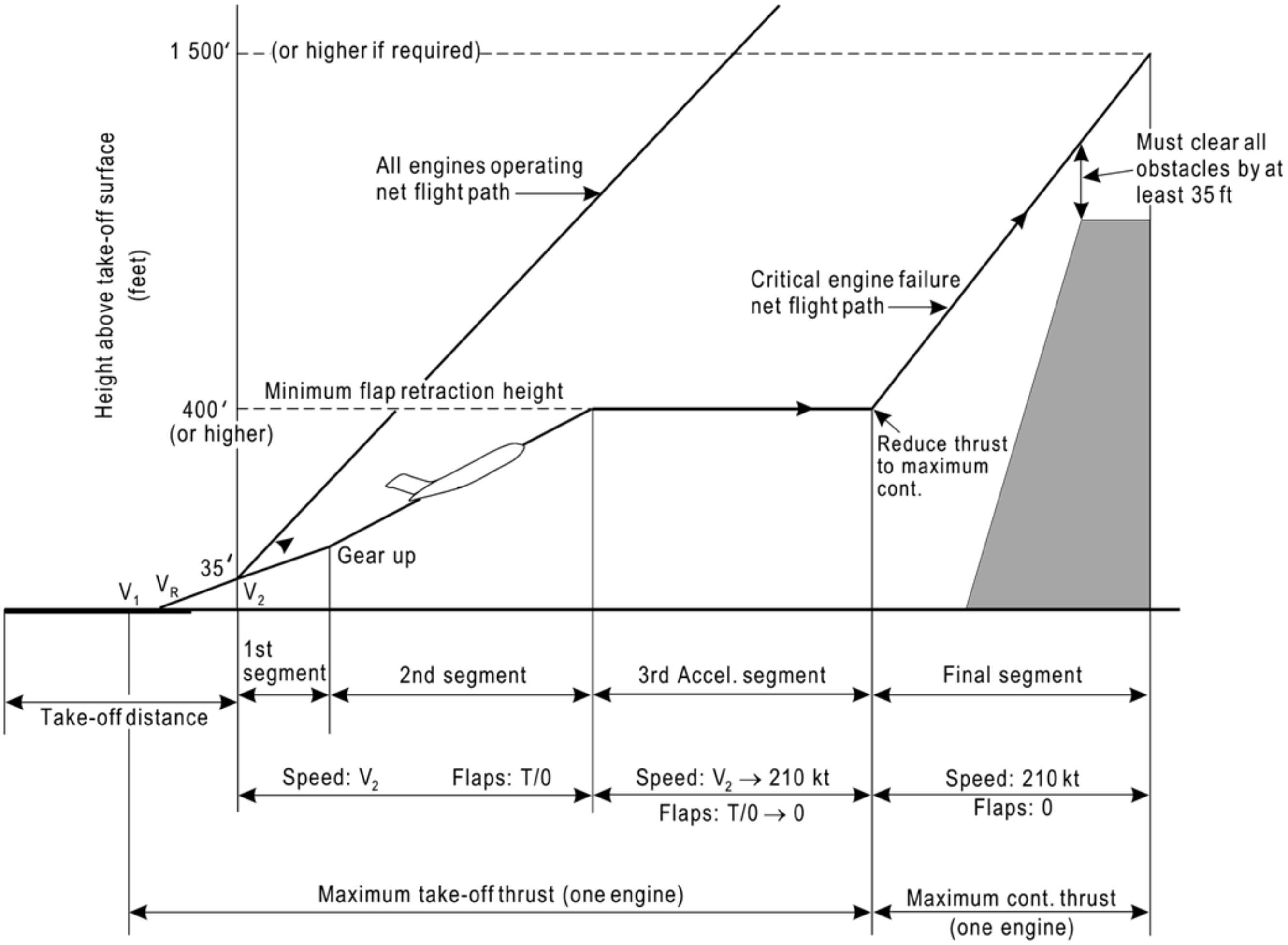


Figure 2. Take-off flight path

Attachment B to Chapter 10 Example from an operator's guidance on non-standard heights for acceleration (third segment) and on "contingency procedures both on take-off and for missed approaches"

XXXXX — AERODROME — R/W 06

TAKE-OFF

Emergency turn procedure

Seventy-five seconds after start of take-off, initiate a 15° bank turn to the LEFT onto heading 337°M to home on the "MN" locator. Declare an emergency. Continue climb-out procedure en route to the locator and await ATC instructions for landing or divert as required.

LANDING

Missed approach procedure (engine inoperative)

Use emergency turn procedure

XXXXX — AERODROME — R/W 24

TAKE-OFF

Emergency turn procedure

Seventy-five seconds after start of take-off, initiate a 15° bank turn to the RIGHT onto heading 340°M. Declare an emergency. Continue climb-out procedure on this heading and await ATC instructions for landing or divert as required.

LANDING

Missed approach procedure (engine inoperative)

Use emergency turn procedure

NON STANDARD MINIMUM FLAP RETRACTION

The MFRH for Boeing 737 aeroplane is:

RUNWAY 06 950 feet

RUNWAY 16 970 feet

RUNWAY 34 970 feet

Attachment C to Chapter 10 Example of guidance on drift-down critical points as used by an operator

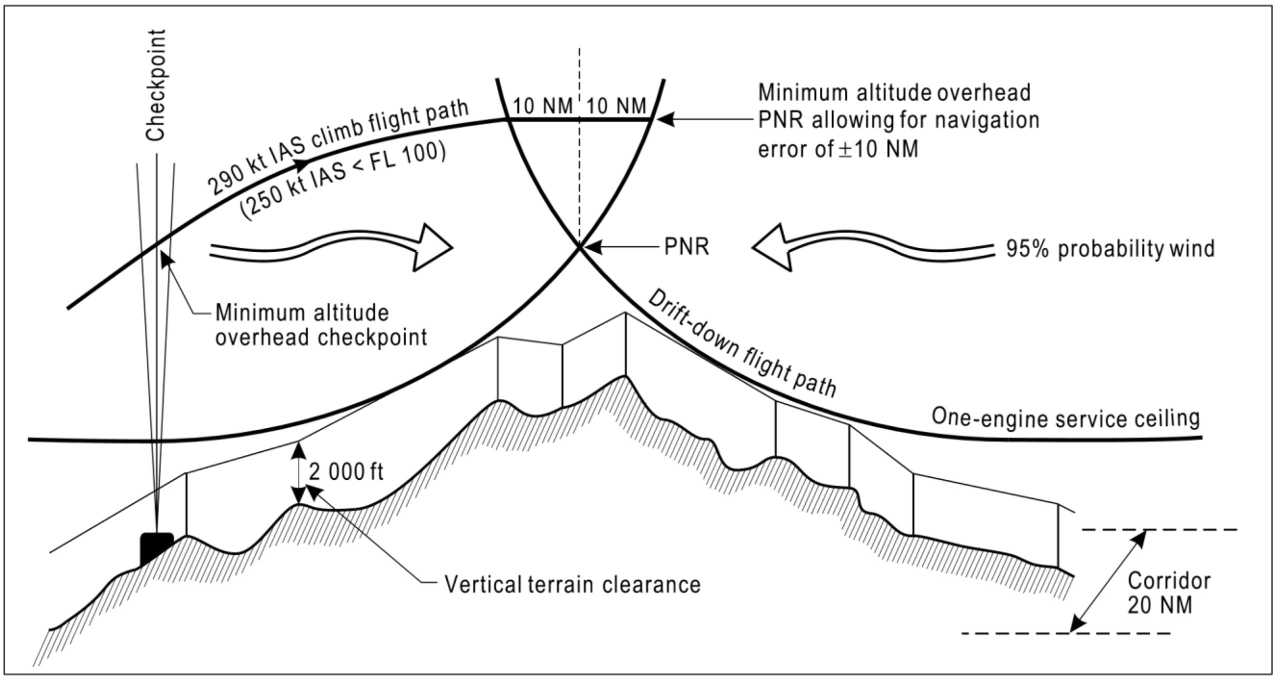
Drift-down procedures

Drift-down flight path, critical point

The drift-down procedures require the aeroplane to cross mountainous terrain at a true altitude which is high enough to permit, in case of an engine failure, a descent to the one-engine service ceiling observing a terrain clearance of 2 000 ft. The driftdown flight paths are calculated for various gross weights (GWs) and cover adverse temperatures and winds anticipated in operation. For legs where the critical point lies within the distance of the normal climb, take-off weights (TOWs) are also given. For interpolation, TOWs may be higher than the “maximum take-off weight”. The calculations are based on head winds for both directions that a drift-down flight path might take. The drift-down path is also in each point based on a gradient that is worse (by 1.1 per cent) than the one actually available. Additional distance is gained by slowing down to the drift-down speed horizontally, before starting the descent. For each routing considered, a point is established beyond which, in case of engine failure, the aeroplane will drift down on its course, but will turn back if the failure occurs before that point. To cover navigational errors, a margin of ±10 NM has been allowed for locating the critical point.

Minimum altitude overhead critical point and checkpoint

The minimum altitude over the critical point (true altitude) has to be corrected for non-standard temperature and QNH before selecting the cruise flight level. It is also necessary that a given checkpoint at the entrance to the critical leg be overflown at a minimum altitude.



CHAPTER 11

11.0 ROUTE GUIDES AND CHARTS

11.1 ROUTE GUIDES

11.1.1 Regulations states that the operations manual shall contain a route guide for the route guide which will ensure that the flight crew will have for each flight, information relating to communication facilities, navigation aids, aerodromes, instrument approaches, instrument arrivals and instrument departures as applicable for the operation, and such other information as the operator may deem necessary in the proper conduct of flight operations;

11.1.2 In addition to the items specified above, route guides typically contain other information which either falls naturally within the contents of a route guide or is placed there for ease of access and use. Subjects which normally form part of a route guide and for which requirements exist include:

a) the minimum flight altitudes for each aircraft to be flown;
b) For scheduled operators list of aerodromes including alternates;
c) aerodrome operating minima for each of the aerodromes that are likely to be used as aerodromes of intended landing or as alternate aerodromes;
d) the increase of aerodrome operating minima in case of degradation of approach or aerodrome facilities;
e) Instructions for determining aerodrome and/or heliport operating minima for instrument approaches using HUD and EVS where applicable;
f) unmanned aerodrome procedures, as applicable;
g) aerodrome categorisation for flight crew competence qualification;
h) special aerodrome limitations (performance limitations and operating procedures etc.) as applicable;
i) The necessary information for compliance with all flight profiles required by regulations, including but not limited to, the determination of:

- take-off runway length requirements for dry, wet and contaminated conditions, including those dictated by system failures which affect the take-off distance;
- take-off climb limitations;
- en-route climb limitations;
- approach climb limitations and landing climb limitations;
- landing runway length requirements for dry, wet and contaminated conditions, including systems failures which affect the landing distance; and
- supplementary information, such as tire speed limitations.

11.1.3 An operator may wish to include other information in the guide or may find that the information listed above is better placed in some other volume of the operations manual. These decisions will depend on local circumstances and are best left to the operator within the context of over-all approval by the Authority.

11.1.4 Most of the information that goes to make up the contents of a route guide is obtained from ICAO annexes and manuals and from aeronautical information publications (AIPs). It is essential that the information be kept current and that ICAO documents, AIPs, NOTAM, aeronautical information circulars, etc., be monitored so as to ensure that the route guide is amended and kept current.

11.1.5 If an operation is conducted within a relatively small geographical area or within the borders of one or two States, it is possible to produce a route guide using ICAO documents and the relevant AIP(s). When, however, an operation covers a wider area, possibly crossing a number of international boundaries, the large number of information sources that would need to be continuously monitored means that the production of a route guide becomes an increasingly difficult task. In addition, the need to make the route guide usable in the cockpit can make it necessary to extract and present the information in a more condensed form than the AIP-type presentation. These considerations have led to the greater number of operators purchasing route guides tailored to their particular requirements from commercial firms or from very large operators whose resources are such that they prepare and publish their own route guide.

Another option is for a number of operators to produce a route guide as a joint venture. Whichever method is chosen the essential factor is that the information presented reflects the true "operational status" of facilities, aerodromes, aids, etc. To achieve this, the single most important factor will be the regularity, reliability and quality of the amendment service. Handwritten amendments to a route guide must be actively discouraged, as there can be no control of such a method of amendment. Equally a system whereby the flight crew need to consult a large number of NOTAM and operational notices while using the route guide is very undesirable as there is a great potential for error. Amendments should be published on a regular basis, should be simple to incorporate, and should be numbered and recorded in the front of a route guide so as to permit the user of a guide to immediately determine the currency of a particular volume.

11.1.6 It is not possible within the constraints of this manual to give examples of the contents of a route guide and of the different methods of presentation normally used. The fact is that the range of items normally addressed in route guides is such that to give what would, of necessity, be a very limited range of examples could be seen to infer relative degrees of importance, and would be misleading as to the wide range of information normally included.

11.2 CHARTS

11.2.1 Regulations states that an aircraft shall carry current and suitable charts to cover the route of the proposed flight and any route along which it is reasonable to expect that the flight may be diverted. The required charts are normally carried as part of the route guide. The actual charts carried on a particular flight will depend on the type and extent of the operation. Typically this would include, for flight under instrument flight rules, the necessary en-route charts and all the charts published for the aerodromes of departure and arrival; for the destination alternate and the take-off alternate; and for any necessary en-route alternate. For flight under visual flight rules the charts that would be carried would include the topographical charts for the area of operation and the required visual approach charts. Some States require that all flights carry topographical charts, but even where this is not the case, operators should carry topographical charts for operations over land areas where radio navigation facilities are not well developed.

11.2.2 The operations manual must describe what charts must be carried on board, and how their validity is to be checked. Charts are subject to frequent amendment and it is necessary to have a system of ensuring that current charts are available. To achieve this, either an operations staff member is appointed to keep the charts in the route guide current, or a list of current charts is displayed so that the flight crew members can determine whether they have the appropriate charts. Normally such lists also serve as a checklist to ensure that all the required charts are carried in the route guide.

CHAPTER 12

12.0 MINIMUM FLIGHT ALTITUDES AND AERODROME OPERATING MINIMA

12.1 MINIMUM FLIGHT ALTITUDES

12.1.1 Regulations states that an operator shall be permitted to establish minimum flight altitudes for those routes flown for which minimum flight altitudes have been established by the State flown over, provided that they shall not be less than those established by that State, unless specifically approved by that State. An operator may therefore use the minimum flight altitudes determined by the Authority or he may use higher minimum altitudes. However, the specific approval must be obtained for the use of lower minimum altitudes than those established.

12.1.2 The minimum flight altitude shall be at least 300 m (1 000 ft) above the highest obstacle within the area concerned.

12.1.3 Where a State does not establish minimum flight altitudes, regulations requires the operator to do so. In all cases the approval is required.

12.1.4 An operator is required to specify the method by which he intends to determine minimum flight altitudes for operations conducted over routes for which minimum flight altitudes have not been established by the State flown over and shall include this method in the operations manual. It is further specified that the resultant minimum flight altitudes shall not be at a level lower than the minimum level for IFR flights as specified in *Rules of the Air* regulations. The minimum levels are:

a) over high terrain or in mountainous areas, at a level which is at least 600 m (2 000 ft) above the highest obstacle located within 8 km of the estimated position of the aircraft; and
b) elsewhere than as specified in a), at a level which is at least 300 m (1 000 ft) above the highest obstacle located within 8 km of the estimated position of the aircraft.

The estimated position of the aircraft will take account of the navigational accuracy which can be achieved on the relevant route segment, having regard to the navigational facilities available on the ground and in the aircraft.

12.1.5 Where minimum flight altitudes are established by appropriate authorities, an operations manual will contain information on how these minimum flight altitudes are established. Where appropriate authorities have not established minimum flight altitudes, the operations manual will give the method used to determine minimum flight altitudes. Minimum flight altitudes should be shown on the operational flight plan.

12.1.6 All such minimum flight altitudes and the method of establishing such altitudes be approved by the Authority. It also recommends that in considering such approval, certain factors must be considered. The Authority shall approve such after careful consideration of the probable effects of the following factors on the safety of the operation in question:

a) the accuracy and reliability with which the position of the aircraft can be determined;
b) the inaccuracies in the indications of the altimeters used;
c) the characteristics of the terrain along the route (e.g.sudden changes in elevations);
d) the probability of encountering unfavourable meteorological conditions (e.g. severe turbulence and descending air currents);
e) possible inaccuracies in aeronautical charts; and
f) airspace restrictions.

12.1.7 The requirements listed above are the minimum requirements and in practice operators normally go beyond these and provide more comprehensive information to their flight crews. For example, although there is no applicable requirement, many operators provide information on the minimum flight altitude at which both obstacle clearance and radio navigation and communication reception is guaranteed. In fact, the charts used by operators normally show both the minimum flight altitude and also the minimum en-route altitude which ensures acceptable navigational signal coverage and meets obstacle clearance requirements between radio fixes.

12.1.8 In addition, operators often show the minimum flight altitude on the operational flight plan for each sector (sector meaning the intended track from one reporting or turning point to the next). For each of these minimum flight altitudes, whether shown on the aeronautical charts or on the operational flight plan, the operations manual must explain how they are derived, and exactly what terrain clearance they assure. In the case of altitudes determined by applicable authorities, this is simple, but where the operator is “establishing” and “specifying a method” of determining the minimum flight altitude, it is possible that a considerably more detailed explanation will be required. In many cases, the minimum flight altitude for operations off airways will be the “grid” or area minimum altitude.

12.1.9 In addition to the description of the method of derivation of minimum flight altitudes used, many operators include additional guidance in the operations manual. Points normally addressed are the effect of lower-than standard atmospheric pressure, the effect of wind, especially in mountainous terrain and the effect of non-standard temperatures. All of these factors can significantly affect the minimum flight altitude. This is especially true when the aircraft altimeter is set to standard pressure.

12.2 AERODROME/HELIPORT OPERATING MINIMA

12.2.1 Regulations requires that an operator establish aerodrome/heliport operating minima for each aerodrome/heliport that the operator will use. It is further stated that minima may not be lower than any minima established for an aerodrome/heliport by the State of that aerodrome/heliport, unless specific approval is granted. It is a fact that in attempting to make use of the lowest operating minima, an operator will not only need the approval of the Authorit but will often need the approval of the appropriate authority in other States.

12.2.2 Regulations also lists a number of criteria which the Authority needs to consider before approving the aerodrome operating minima established by an operator.

12.2.3 The operations manual should contain guidance and information on those terms and expressions used in describing aerodrome operating minima. This would include at least the following:

- aerodrome operating minima
- heliport operating minima
- alternate aerodrome
- take-off alternate
- en-route alternate
- destination alternate
- categories of aircraft
- circling approach
- ceiling
- decision altitude/height (DA/H)
- instrument approach and landing operations:
- non-precision approach and landing operations
- precision approach and landing operations
- categories of precision approach and landing operations
- instrument approach procedure
- minimum descent altitude/height (MDA/H)
- minimum sector altitude (MSA)
- missed approach point (MAPt)
- obstacle clearance altitude/height (OCA/H)
- runway visual range (RVR)
- straight-in approach — visibility.

12.2.7 In addition, the operations manual must include guidance where regulations exist on the authority of the pilot-in-command to commence or continue an approach depending on the actual visibility conditions existing at that time. In addition, a number of States which establish operating minima for their own aerodromes also “ban” approaches to, or take-offs from, a runway when the reported conditions are worse than the minima specified. Other States “approve” operators, both their own and foreign, to operate to particular minima. The different regulations of the States in which operations are conducted must be detailed, and clear instructions must be given for the pilot-in-command.

12.2.8 Information and guidance must be given on those aerodrome ground facilities and services which can have an effect on the aerodrome/heliport operating minima, or which are necessary for a particular type of approach or take-off. Included in these would be information on the use of multiple RVR reports. While the touchdown RVR is always the limiting RVR when landing, minima for the other RVR positions, when provided, are normally specified. Some operators specify that the midpoint and roll-out RVR must be higher than the applicable take-off RVR for that runway. Other operators specify a standard minimum RVR for positions other than the touchdown zone.

12.2.9 Regulations states that aerodrome operating minima below 800 m visibility not be authorized unless RVR information is provided. When visibility is reported as meteorological visibility only, and the approved aerodrome operating minima are expressed in terms of RVR, it is common practice to provide guidance on the factoring of visibility to achieve equivalent RVR. This is necessary, as RVR and meteorological visibility are not the same.

12.2.10 Operations manuals also normally provide guidance on the visual segment that a pilot should expect to see upon reaching minima and on the use of the established minima in actual operations. In addition, the effect of unserviceability of different components of the ground aids, such as approach lights, touchdown zone lights, and runway lights, should be considered. Some operators advise their flight crews of corrections to be made to the published minima to account for these outages. However, for Category I and non-precision approaches, whenever decision altitudes or heights are raised, it is necessary to increase the RVR to allow the flight crew to assess their ability to land at the higher decision altitude/height.

12.2.11 The operations manual should emphasize that a flight never continue below the applicable operating minima or take off with less than the required visual reference. The operations manual should also state that the pilot-in-command is entitled to raise the operating minima any time he considers it necessary to do so. (Note that regulations, states that an aeroplane may not infringe aerodrome operating minima.) A topic that should be addressed in the operations manual is the need to raise the minima for engine-out or emergency conditions. Another factor which should be considered is the effect of crosswinds on minima, both for take-off and landing, and the appropriate guidance relating to aircraft type must be given. It should also be pointed out in the operations manual that it may on occasion be necessary to carry out a go-around after descending below decision altitude/height, because of some unforeseen problem, such as the runway being occupied, or unexpected loss of visual reference, etc. While aircraft are quite capable of going around from any point in the approach, there are occasions on which the operating minima are determined by the presence of obstacles in the missed approach path. In such circumstances, a go-around from below decision height may carry certain risks with failure of the critical engine, and the flight crew should be made aware of this consideration. Equally, for non-precision approaches, the operations manual must state the requirement to commence a go-around at the missed approach point (MAPt) in order to obtain suitable protection from obstacles.

12.3 PRESENTATION OF AERODROME/HELIPORT OPERATING MINIMA

12.3.1 Aerodrome/heliport operating minima is promulgated on the "Instrument Approach Chart " produced by appropriate authorities in accordance with the requirements of Annex 4. If the operator produces his own charts, he should show his own operating minima which may be the same or higher than any State minima. Lower minima must not be shown unless specific approval has been obtained. Most of the commercial chart-producing agencies also show aerodrome/ heliport operating minima on the instrument approach chart. When an operator is using commercially produced charts, the method used to determine the minima shown must form part of the guidance in the operations manual.

12.3.2 If an operator produces his own operating minima while using charts produced by other agencies, the method of presentation of the aerodrome/heliport operating minima must be explained in the operations manual. This could be in a small amendable volume of the manual, or an insert in the route guide. The minima could also be shown on the operational flight plan. There may be occasions, particularly in the case where the operator is determining his own operating minima, where it will be necessary for a flight to carry out an instrument approach procedure to a runway for which the operator has declared no minima. In these circumstances some operators have determined, for each aircraft type and type of approach, a figure that must be added to the obstacle clearance altitude/ height to determine the applicable operating minima. If an operator should determine such figures for the aircraft types operated, the guidance in the operations manual should make it clear that the resulting aerodrome/heliport operating minima are based on all the normal ground facilities being available. If necessary, the aerodrome/ heliport operating minima derived by this method should be adjusted, as is the case with pre-determined aerodrome/ heliport operating minima, by reference to components-out tables, etc.

Attachment A to Chapter 12 **A-1. Example of minimum flight altitudes from an operations manual**

MINIMUM FLIGHT ALTITUDES

1. General

It is of the utmost importance that the pilot-in-command/flight operations officer ensure that the flight is planned and performed with adequate terrain clearance. The following minimum tolerances have been established.

2. Minimum sector altitude (MSA)

A minimum sector altitude is given on the instrument approach chart and is based on a tolerance of 1 000 ft above terrain and obstructions within the sector distance (25 NM), rounded up to the nearest 100 ft.

3. Minimum flight altitude (MFA)

Minimum flight altitude may be issued by States to define the lowest permissible altitude in airways within their territory. When issued, the MFA shall be given in the en-route chart.

4. Minimum obstacle clearance altitude (MOCA)

Minimum obstacle clearance altitude is based on a tolerance of 1000 ft above terrain and obstacles up to 6000 ft, and 2000 ft above terrain and obstacles over 6000 ft, rounded up to nearest 100 ft.
MOCA, in hundreds of feet, is given in the en-route, SID and STAR charts.
MOCA is valid for a corridor of variable width as shown below.

5. Minimum off-route altitude (MORA)

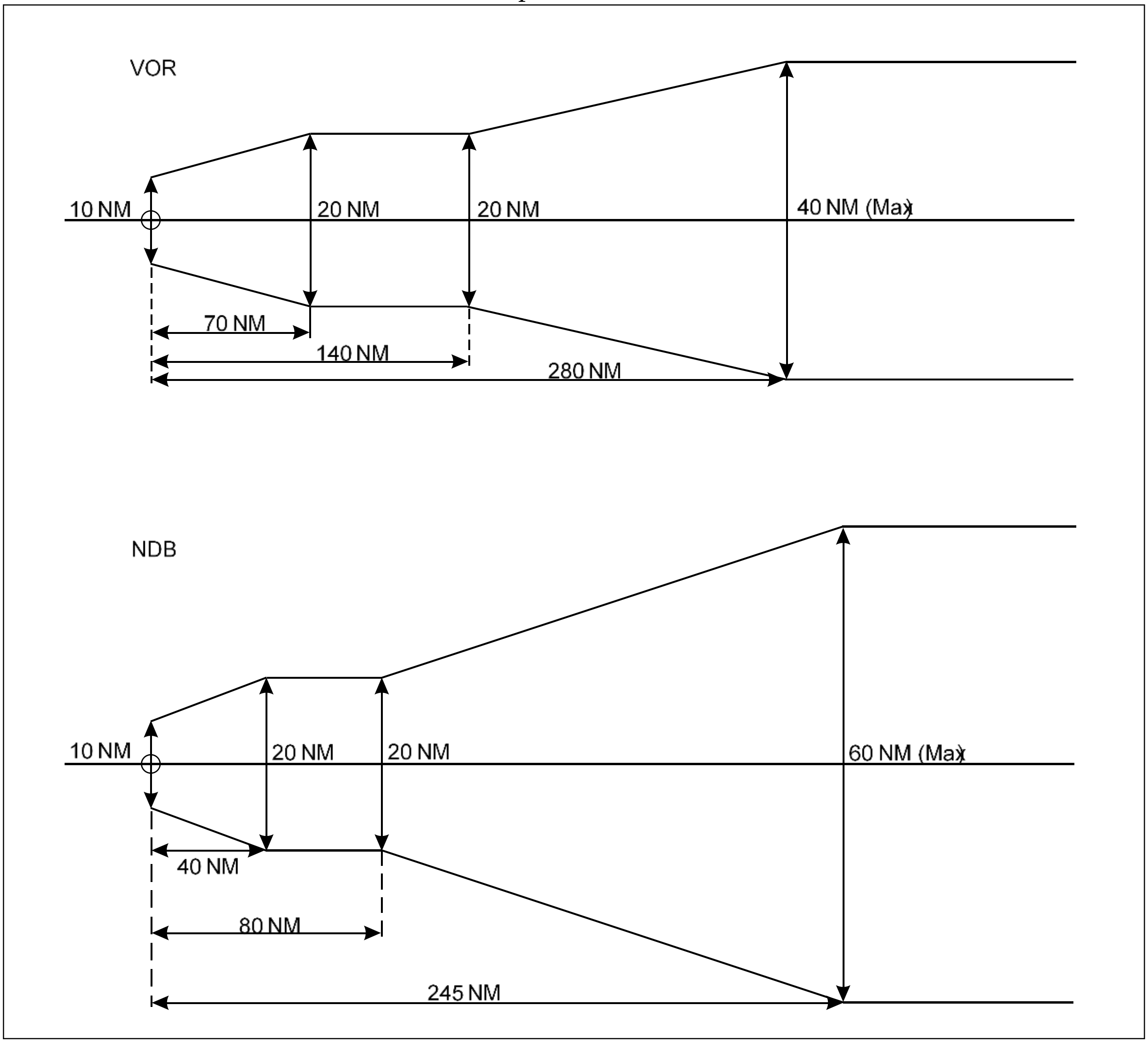
Minimum off-route altitude is based on a tolerance of 1000 ft above terrain and obstacles up to 6000 ft, and 2000 ft above terrain and obstacles over 6000 ft for one or more LAT/LONG squares in the en-route chart rounded up to the nearest 100 ft.

6. Corrections for wind, temperature and QNH

All minimum altitudes above shall be corrected for wind and temperature when altimeter is set to QNH and for wind, temperature and QNH when altimeter is set to standard.

- for wind, add 500 ft per 10 kt above 30 kt, up to a maximum 2 000 ft;
- for temperature, calculate correction on computer or add 4 per cent per 10°C below standard;
- for QNH below 1 013 mb add 30 ft per mb.

Note.— For convenience the above corrections are given in the flight level correction graphs and as a correction table in the respective checklist.



Attachment B to Chapter 12 Example of in-flight use of minimum flight altitudes from an operations manual

In-flight use of minimum flight altitudes

1. In the matter of flight levels (1 013.2 mb altimeter setting) pilots should be ever on the alert that any clearances received, or rapid descents initiated, do not take them below the safety altitude for the area in which they are flying.
2. The significance of the foregoing is the fact that the safety altitudes or lowest flight levels only pertain to the ADR, or track, or the narrow, 10 miles, confine of the airway to which they are designated. This means that if the navigation aid or the navigation of the aircraft is not up to standard, there is no guarantee that safe clearance is being maintained between the aircraft and the ground. The topographical information provided on radio navigational charts is inadequate. Pilots have accepted a spot height which is regarded as the highest obstacle in the area, without taking into account the obvious contours of high ground in which many areas abound.

3. *General guidance*

3.1 One of the main reasons for collision with terrain would appear to be complacency or lack of a sense of immediate danger in the cockpit. It is suggested that the best remedy lies in the area of cockpit procedures, particularly during initial approach. It is imperative, during descent and approach, that captain, co-pilot and third pilot independently monitor the navigation of the aircraft and thus eliminate the possibility of gross navigational errors.

3.2 Navigation, of course, is three-dimensional and height should be monitored as well as geographical position. It is important, therefore, that non-flying pilots particularly do not allow supplementary activities to reach a pitch such that they lose orientation of aircraft position or altitude. Particular attention should be paid to safety heights in the following circumstances:

a) if emergency descents have to be made;
b) if steep rates of descent are requested by ATC, en route;
c) if any deviation from standard tracks occurs;
d) when using radar positioning at airports situated nearhigh ground;
e) when using navigation aids in mountainous terrain (aids can be quite unreliable and misleading, particularly at low altitudes);
f) if ATC clearances conflict with company safety altitudes

Attachment C to Chapter 12
Example of application of RVR reports from an operations manual

Application of RVR reports

The reported RVR prevails over the reported visibility. If for a particular runway more than one RVR is reported, the usability of that runway for landing must be based on the touchdown zone (TDZ) RVR. Reported RVRs along other portions of the runway control the rollout manoeuvre and 175 m is considered to be the minimum for adequate roll-out guidance. In the event the TDZ RVR is not available, pilots must revert to the reported general visibility.

Attachment D to Chapter 12

Example of application of established minima from an operations manual

APPLICATION OF ESTABLISHED MINIMA

1. General policy

General guidance is set out below.

1.1 Minima figures of MDH/MDA and visibility are the lowest value for which landing or take-off should be attempted and, except in the case of circling minima, these figures assume the serviceability of the ground and airborne equipment. If, for any reason, the captain considers that the weather minima are too low for safe operation in a particular set of conditions, he is authorized to raise the minima accordingly.

1.2 The ICAO definition of decision height/altitude (DH/DA) means, in effect, that the pilot by reference to the visual cues available to him must have satisfied himself by the decision height that:

a) the aircraft is in the correct position;
b) the aircraft flight path is correct; and
c) there is sufficient visual reference to control the aircraftfor the remainder of the approach and landing.

1.3 If he is not satisfied that these conditions are fulfilled, he must initiate a missed approach and it is emphasized that the decision must be made by the time the aircraft arrives at decision height/altitude. It may happen that a pilot, having decided to land, must subsequently revise this decision because of loss or foreshortening of the visual segment, for example, in shallow fog conditions where the fog top is below the decision height/altitude.

2. Pitch/roll guidance

2.1 It must be stressed that whereas roll guidance is sufficient, provided one or more crossbars can be seen, the pilot’s ability to control the aircraft in pitch and maintain the correct glide path by visual reference is very limited until the runway is in view. In limiting conditions, therefore, pilots are cautioned against making other than minor corrections in pitch, during the visual phase, until the runway is positively in view.

2.2 Similarly, during an automatic approach in limiting conditions, the autopilot should not be disconnected above DH/ DA and may be used down to the limiting height specified for the aircraft. The great danger is touching down before reaching the runway. Conversely, if the pilot finds that he has not touched down by the end of the touchdown zone lights or markings, he should consider making a missed approach.

3. Visibility

3.1 The minimum visibility must be such that at DH/DA or MDH/MDA there is:

a) sufficient visual guidance to assess whether the aircraft is properly positioned for a landing; and

b) adequate visual reference for control during the remainder of the approach.

3.2 To meet requirements a) and b) above for Category I and non-precision approaches, it is considered that at least 200m of approach lights, including two crossbars, should be visible at DH/DA or MDH/MDA. In the absence of a multi-crossbar high intensity system, the runway threshold should be visible at and below 200 ft. In the absence of any type of approach light system, the threshold should be visible at the DH/DA or MDH/MDA. The minimum visibility to satisfy these criteria is therefore related to the DH/DA or MDH/MDA and approach light system, and in the case of a non-precision aid, it may also be limited by the landing distance available.

Attachment E to Chapter 12

Example of non-precision approach procedure policy from an operations manual

Non-precision approach procedure

Taking runway length and conditions into account, decide on flap configuration to be used for landing. If runway conditions permit, flap 30 is the more desirable setting as this will minimize speed, pitch and trim changes when final flap selection is made. Approach the final fix, gear down, flap 15 at 150 kt. Immediately upon passing the fix, select flap 25 and establish a rate of descent in order to maintain a 3° glide slope at either V_{ref} flap 40 + 20 kt or V_{ref} flap 30 + 15 kt, depending on final configuration decided for landing. Using V_{ref} (landing configuration) as a basis, approach speed will obviously vary according to landing weight; thus, adequate margin over V_{ref} flap 25 (approach configuration) will be assured irrespective of weight. Plan to arrive at the MDA slightly early to achieve a timely and smooth transition to a fully stabilized landing configuration in the slot. If at MDA visual ground contact has not been established, an immediate go-around must be carried out. If at the calculated time with the runway in sight and within the landing slot, select final flap and continue descent for a landing. If slightly early but with visual ground contact established, it is permissible to maintain altitude and 25° flap configuration until;

(1) runway is sighted with sufficient visual cues for landing, or

(2) missed approach point (MAPt) is reached.

In the case of (1) above, expect to be low in visual slot when runway is sighted, select landing flap and fly into the slot from below and land.

In the case of (2) above, if sufficient visual cues for landing have not been achieved, carry out a go-around. Once go-around has been initiated, it must be completed.

APPENDIX A FLIGHT SAFETY DOCUMENT SYSTEM

1. Introduction

1.1 The guidelines in this appendix address the major aspects of an operator's flight safety documents system development process, with the aim of ensuring compliance with Regulations.

1.2 The guidelines are based not only upon scientific research, but also upon current best industry practices, with an emphasis on a high degree of operational relevance.

2. Organization

2.1 A flight safety documents system shall be organized according to criteria, which ensure easy access to information, required for flight and ground operations contained in the various operational documents comprising the system and which facilitate management of the distribution and revision of operational documents.

2.2 Information contained in a flight safety documents system shall be grouped according to the importance and use of the information, as follows─

(a) time critical information, e.g., information that can jeopardize the safety of the operation if not immediately available;
(b) time sensitive information, e.g., information that can affect the level of safety or delay the operation if not available in a short time period;
(c) frequently used information;
(d) reference information, e.g., information that is required for the operation but does not fall under b) or c) above; and
(e) information that can be grouped based on the phase of operation in which it is used.

2.3 Time critical information shall be placed early and prominently in the flight safety documents system.

2.4 Time critical information, time sensitive information, and frequently used information shall be placed in cards and quick-reference guides.

3. Validation

A flight safety documents system shall be validated before deployment, under realistic conditions. Validation shall involve the critical aspects of the information use, in order to verify its effectiveness. Interactions among all groups that can occur during operations shall also be included in the validation process.

4. Design

4.1 A flight safety documents system shall maintain consistency in terminology and in the use of standard terms for common items and actions.

4.2 Operational documents shall include a glossary of terms, acronyms and their standard definition, updated on a regular basis to ensure access to the most recent terminology. All significant terms, acronyms and abbreviations included in the flight documents system shall be defined.

4.3 A flight safety documents system shall ensure standardization across document types, including writing style, terminology, use of graphics and symbols, and formatting across documents. This includes a consistent location of specific types of information, consistent use of units of measurement and consistent use of codes.

4.4 A flight safety documents system shall include a master index to locate, in a timely manner, information included in more than one operational document.

The master index must be placed in the front of each document and consist of no more than three levels of indexing. Pages containing abnormal and emergency information must be tabbed for direct access.

4.5 A flight safety documents system shall comply with the requirements of the operator’s quality system, if applicable.

5. Deployment

Operators shall monitor deployment of the flight safety documents system, to ensure appropriate and realistic use of the documents, based on the characteristics of the operational environment and in a way which is both operationally relevant and beneficial to operational personnel. This monitoring shall include a formal feedback system for obtaining input from operational personnel.

6. Amendment

6.1 Operators shall develop an information gathering, review, distribution and revision control system to process information and data obtained from all sources relevant to the type of operation conducted, including, but not limited to, the Authority, State of design, State of Registry, manufacturers and equipment vendors.

Manufacturers provide information for the operation of specific aircraft that emphasizes the aircraft systems and procedures under conditions that may not fully match the requirements of operators. Operators shall ensure that such information meets their specific needs and those of the local authority.

6.2 Operators shall develop an information gathering, review and distribution system to process information resulting from changes that originate within the operator, including─

(a) changes resulting from the installation of new equipment;
(b) changes in response to operating experience;
(c) changes in an operator's policies and procedures;
(d) changes in an operator certificate; and
(e) changes for purposes of maintaining cross fleet standardization.

Operators shall ensure that crew coordination philosophy, policies and procedures are specific to their operation.

6.3 A flight safety documents system shall be reviewed─

(a) on a regular basis (at least once a year);
(b) after major events (mergers, acquisitions, rapid growth, downsizing, etc.);
(c) after technology changes (introduction of new equipment); and
(d) after changes in safety regulations.

6.4 Operators shall develop methods of communicating new information. The specific methods shall be responsive to the degree of communication urgency.

As frequent changes diminish the importance of new or modified procedures, it is desirable to minimize changes to the flight safety documents system.

6.5 New information shall be reviewed and validated considering its effects on the entire flight safety documents system.

6.6 The method of communicating new information shall be complemented by a tracking system to ensure currency by operational personnel. The tracking system shall include a procedure to verify that operational personnel have the most recent updates.

APPENDIX B: AIRBORNE COLLISION AVOIDANCE SYSTEM (ACAS)

1.0 GENERAL

This guidance is for the industry during preparation of procedures and training programmes as well as for Flight Operations Inspectors during evaluation of such documents.

Airborne Collision Avoidance System (ACAS) indications shall be used by pilots in the avoidance of potential collision, the enhancement of situational awareness, and the active search for, and visual acquisition of conflicting traffic. Nothing in the procedures on "Use of ACAS indicators" in paragraph 4.0 below shall prevent commanders from exercising their best judgement and full authority in the choice of the best course of action to resolve a traffic conflict or avert a potential collision. The ability of ACAS to fulfil its role of assisting pilots in the avoidance of potential collisions is dependent on the correct and timely response by pilots to ACAS indications. Operational experience has shown that the correct response by pilots is dependent on the effectiveness of the initial and recurrent training in ACAS procedures.

2.0 OPERATIONAL PROCEDURES AND TRAINING

An operator shall establish procedures to ensure that;

a) When ACAS is installed and serviceable, it shall be used in flight in a mode that enables Resolution Advisories (RA) to be produced unless to do so would not be appropriate for conditions existing at the time
b) When undue proximity to another aircraft (RA) is detected by ACAS, the commander or pilot to whom conduct of the flight has been delegated shall ensure that corrective action is initiated immediately to establish safe separation unless the intruder has been visually identified and has been determined not to be a threat.
c) Pilots operating ACAS equipped aircraft shall be given ACAS academic and recurrent training before operational duties and at periodic interval

3.0 USE OF ACAS INDICATORS

The indications generated by ACAS shall be used by pilots in conformity with the following safety considerations:

a) Pilots shall not manoeuvre their aircraft in response to traffic advisories (TAs) only;
b) On receipt of a TA, pilots shall use all available information to prepare for appropriate action if an RA occurs; and
c) In the event of an RA, pilots shall:

- Respond immediately by following the RA as indicated, unless doing so would jeopardize the safety of the aeroplane;
- Follow the RA even if there is a conflict between the RA and an air traffic control (ATC) instruction to manoeuvre;
- Not manoeuvre in the opposite sense to an RA; As soon as possible, as permitted by flight crew workload, notify the appropriate ATC unit of the RA, including the direction of any deviation from the current ATC instruction or clearance;
- Promptly comply with any modified RAs;

- Limit the alterations of the flight path to the minimum extent necessary to comply with the RAs;
- Promptly return to the terms of the ATC instruction or clearance when the conflict is resolved; and
- Notify ATC when returning to the current clearance.

4.0 ACAS II CHANGE 7.1

4.1 Safety issues with ACAS II Change 7.0

Safety issues with Change 7.0 were identified as follows:

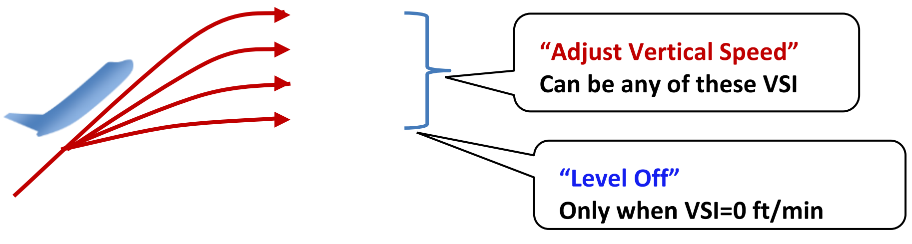
a) Unintentional opposite pilot response to an "adjust vertical speed, adjust (AVSA)" RA where the pilot increased the rate of change rather than reducing it;
b) Level busts following AVSA RAs whereby the increased rate of level change contributed to a level bust which may otherwise not have occurred; and
c) Flaws in the reversal logic,

4.2 Safety issues addressed in ACAS II Change 7.1

ACAS II Change 7.1 addresses these safety issues by:

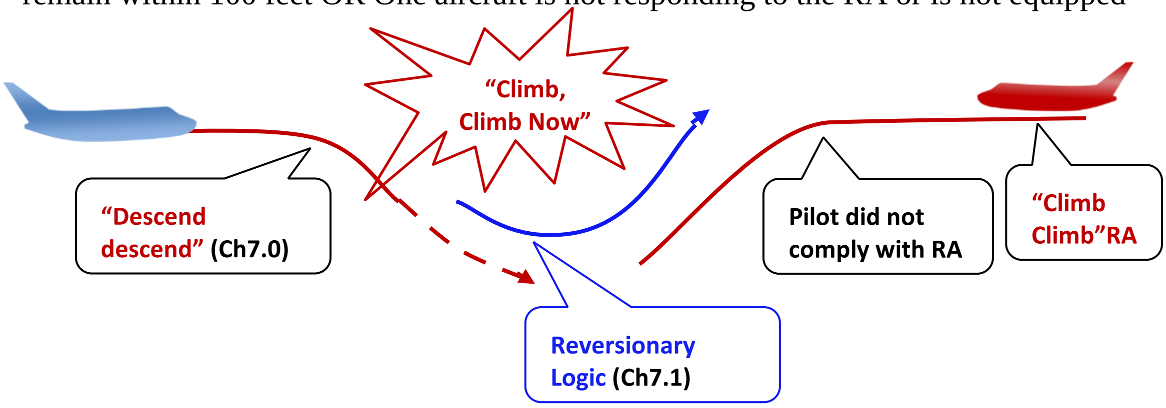
a) Replacing confusing “Adjust Vertical Speed” with “Level Off “(Change 7.1)

2000ft/min
1000ft/min
500ft/min
0ft/min



b) Improving the reversal logic

Change 7.1's improved reversal logic recognizes situations when two converging aircraft is remain within 100 feet OR One aircraft is not responding to the RA or is not equipped



4.3 Operator Responsibility

Operators who are required by regulations to be equipped with an airborne collision avoidance system (ACAS II) should ensure:

a) that personnel such as flight crews, instructors or examiners are trained on ACAS II
b) Change 7.1 and the differences with ACAS II Change 7.0;
c) Compliance with Change 7.1 for its fleet of aircraft and FSTD; and
d) Required documentations and training are in place.

4.4. Reporting to the Authority when not compliant with Change 7.1

Non-compliance with ACAS II Change 7.1 shall be notified to the Authority at fops@kcaa.or.ke.

5.0 ACAS TRAINING FOR PILOTS

5.1 ACAS Training Objectives for pilots should cover:

- theory of operation; pre-flight operations;
- general in-flight operations;
- response to traffic advisories (TAs); and
- response to resolution advisories (RAs).

The training objectives should be further divided into the areas of:

- ACAS academic training;
- ACAS manoeuvre training;
- ACAS initial evaluation; and
- ACAS recurrent qualification.

5.2 ACAS academic training material should be divided into items that are considered essential training and those that are considered desirable. Those items that are deemed to be essential are a requirement for each ACAS operator. In each area, a list of objectives and acceptable performance criteria is defined. All manoeuvre training is considered essential.

5.3 This guidance does not attempt to define how the training programme should be implemented. Instead, objectives are established to define the knowledge a pilot operating ACAS is expected to possess and the performance expected from a pilot who has completed ACAS training. Therefore, all pilots who operate ACAS equipment should receive the ACAS training described below.

6.0 ACAS ACADEMIC (GROUND) TRAINING

6.1 General

This training is typically conducted in a classroom environment. The knowledge demonstrations specified in this section may be achieved through the successful completion of written tests or providing correct responses to non-real time computer-based training (CBT) questions.

6.2 Essential items

6.2.1 *Theory of operation.*

The pilot must demonstrate an understanding of ACAS operation and the criteria used for issuing TAs and RAs. This training should address the following topics:

6.2.1.1 *System operation*

OBJECTIVE: Demonstrate knowledge of how ACAS functions.
CRITERIA: The pilot must demonstrate an understanding of the following functions:
a) Surveillance:

1) ACAS interrogates other transponder-equipped aircraft within a nominal range of 26 km (14 NM); and
2) ACAS surveillance range can be reduced in geographic areas with a large number of ground interrogators and/or ACAS-equipped aircraft. A minimum surveillance range of 8.5 km (4.5 NM) is guaranteed for ACAS aircraft that are airborne.

Note: If the operator's ACAS installation provides for the use of the Mode S extended squitter, the normal surveillance range may be increased beyond the nominal 14 NM. However, this information is not used for collision avoidance purposes.

b) Collision avoidance:

1) TAs can be issued against any transponder-equipped aircraft that responds to ICAO Mode C

2) interrogations, even if the aircraft does not have altitude-reporting capability;

Note: SSR transponders having only Mode A capability do not generate TAs. ACAS does not use Mode A interrogations; therefore, the Mode A transponder codes of nearby aircraft are not known to ACAS. In ICAO SARPs, Mode C minus the altitude is not considered Mode A because of the difference in the pulse intervals. ACAS uses the framing pulses of replies to Mode C interrogations and will track and may display aircraft equipped with an operating Mode A/C transponder whether or not the altitude-reporting function has been enabled

.

3) RAs can be issued only against aircraft that are reporting altitude and in the vertical plane only;
4) RAs issued against an ACAS-equipped intruder are coordinated to ensure that complementary RAs are issued;
5) failure to respond to an RA deprives the aircraft of the collision protection provided by its ACAS.
6) Additionally, in ACAS-ACAS encounters, it also restricts the choices available to the other aircraft's ACAS and thus renders the other aircraft's ACAS less effective than if the first aircraft were not ACAS-equipped; and
7) manoeuvring in a direction opposite to that indicated by an RA is likely to result in further reduction in separation. This is particularly true in the case of an ACAS-ACAS coordinated encounter.

6.2.1.2 *Advisory thresholds*

OBJECTIVE: Demonstrate knowledge of the criteria for issuing TAs and RAs.
CRITERIA: The pilot must be able to demonstrate an understanding of the methodology used by
ACAS to issue TAs and RAs and the general criteria for the issuance of these advisories to include:

a) ACAS advisories are based on time to closest point of approach (CPA) rather than distance. The time must be short and vertical separation must be small, or projected to be small, before an advisory can be issued. The separation standards provided by air traffic services are different from those against which ACAS issues alerts;
b) thresholds for issuing a TA or RA vary with altitude. The thresholds are larger at higher altitudes;
c) TAs generally occur from 20 to 48 seconds prior to CPA. When ACAS is operated in TA-only mode, RAs will be inhibited;
d) RAs occur from 15 to 35 seconds before the projected CPA; and
e) RAs are chosen to provide the desired vertical separation at CPA. As a result, RAs can instruct a climb or descent through the intruder aircraft's altitude.

6.2.1.3 *ACAS limitations*

OBJECTIVE: To verify that the pilot is aware of the limitations of ACAS.
CRITERIA: The pilot must demonstrate a knowledge and understanding of the ACAS limitations including:

a) ACAS will neither track nor display non-transponder-equipped aircraft, nor aircraft with an inoperable transponder, nor aircraft with a Mode A transponder;
b) ACAS will automatically fail if the input from the aircraft's barometric altimeter, radio altimeter, or transponder is lost;

Note: In some installations, the loss of information from other on-board systems such as an inertial reference system (IRS) or attitude and heading reference system (AHRS) may result in an ACAS failure. Individual operators should ensure that their pilots are aware of what types of aircraft system failures will result in an ACAS failure.

c) some aircraft within 116 m (380 ft) above ground level (AGL) (nominal value) will not be displayed. If ACAS is able to determine that an aircraft below this altitude is airborne, it will be displayed;
d) ACAS may not display all proximate transponder-equipped aircraft in areas of high-density traffic; however, it will still issue RAs as necessary;
e) because of design limitations, the bearing displayed by ACAS is not sufficiently accurate to support the initiation of horizontal manoeuvres based solely on the traffic display;
f) because of design limitations, ACAS will neither display nor give alerts against intruders with a vertical speed in excess of 3 048 m/min (10 000 ft/min). In addition, the design implementation may result in some short-term errors in the tracked vertical speed of an intruder during periods of high vertical acceleration by the intruder; and
g) stall warnings, ground proximity warning system (GPWS) warnings and wind shear warnings take precedence over ACAS advisories. When either a GPWS or wind shear warning is active, ACAS will automatically switch to the TA-only mode of operation except that ACAS aural annunciations will be inhibited. ACAS will remain in TA-only mode for 10 seconds after the GPWS or wind shear warning is removed.

6.2.1.4 *ACAS inhibits*

OBJECTIVE: To verify that the pilot is aware of the conditions under which certain functions of ACAS are inhibited.
CRITERIA: The pilot must demonstrate a knowledge and understanding of the various ACAS inhibits including:

a) increase descent RAs are inhibited below 442 (±30) m (1 450 (±100) ft) AGL;
b) descend RAs are inhibited below 335 (±30) m (1 100 (±100) ft) AGL;
c) all RAs are inhibited below 305 (±30) m (1 000 (±100) ft) AGL;

d) all ACAS aural annunciations are inhibited below 152 (±30) m (500 (±100) ft) AGL. This includes the aural annunciation for TAs; and
e) altitude and configuration under which climb and increase climb RAs are inhibited. ACAS can still issue climb and increase climb RAs when operating at the aircraft=s maximum altitude or certified ceiling. However, if aeroplane performance at maximum altitude is not sufficient to enable compliance with the climb rate required by a climb RA, the response should still be in the required sense but not beyond the extent permitted by aeroplane performance limitations.

Note: In some aircraft types, climb or increase climb RAs are never inhibited.

6.2.2 *Operating procedures*.

The pilot must demonstrate the knowledge required to operate ACAS and interpret the information presented by ACAS. This training should address the following topics:

6.2.2.1 *Use of controls*

OBJECTIVE: To verify that the pilot can properly operate all ACAS and display controls.
CRITERIA: Demonstrate the proper use of controls including:

a) aircraft configuration required to initiate a self-test;
b) steps required to initiate a self-test;
c) recognizing when the self-test is successful and when it is unsuccessful. When the self-test is unsuccessful, recognizing the reason for the failure, and, if possible, correcting the problem;
d) recommended usage of traffic display range selection. Low ranges are used in the terminal area, and the higher display ranges are used in the en-route environment and in the transition between the terminal and en-route environment;
e) if available, recommended usage of the AAbove/Below@ mode selector. AAbove@ mode should be used during climb, and ABelow@ mode should be used during descent;
f) recognition that the configuration of the traffic display, i.e. range and AAbove/Below@ selection, does not affect the ACAS surveillance volume;
g) selection of lower ranges on the traffic display to increase display resolution when an advisory is issued;
h) if available, proper selection of the display of absolute or relative altitude and the limitations of using the absolute display option if a barometric correction is not provided to ACAS; and
i) proper configuration to display the appropriate ACAS information without eliminating the display of other needed information.

Note: The wide variety of display implementations makes it difficult to establish more definitive criteria. When the training programme is developed, these general criteria should be expanded to cover specific details for an operator=s specific display implementation.

6.2.2.2 *Display interpretation*

OBJECTIVE: To verify that a pilot understands the meaning of all information that can be displayed by ACAS.

CRITERIA: The pilot must demonstrate the ability to properly interpret information displayed by ACAS including:

a) other traffic, i.e. traffic within the selected display range that is not proximate traffic, or causing a TA or RA to be issued;
b) proximate traffic, i.e. traffic that is within 11 km (6 NM) and ∀366 m (1 200 ft);
c) non-altitude reporting traffic;
d) no bearing TAs and RAs;
e) off-scale TAs and RAs. The selected range should be changed to ensure that all available information on the intruder is displayed;
f) traffic advisories. The minimum available display range that allows the traffic to be displayed should be selected to provide the maximum display resolution;
g) resolution advisories (traffic display). The minimum available display range of the traffic display that allows the traffic to be displayed should be selected to provide the maximum display resolution;
h) resolution advisories (RA display). Pilots should demonstrate knowledge of the meaning of the red and green areas or the meaning of pitch or flight path angle cues displayed on the RA display. For displays using red and green areas, pilots should demonstrate knowledge of when the green areas will and will not be displayed. Pilots should also demonstrate an understanding of the RA display limitations, i.e. if a vertical speed tape is used and the range of the tape is less than 762 m/min (2 500 ft/min), how an increase rate RA will be displayed; and
i) if appropriate, awareness that navigation displays oriented Track-Up may require a pilot to make a mental adjustment for drift angle when assessing the bearing of proximate traffic.

Note: The wide variety of display implementations will require the tailoring of some criteria. When the training programme is developed, these criteria should be expanded to cover details for an operator=s specific display implementation.

6.2.2.3 *Use of the TA-only mode*

OBJECTIVE: To verify that a pilot understands the appropriate times to select the TA-only mode of operation and the limitations associated with using this mode.

CRITERIA: The pilot must demonstrate the following:

a) knowledge of the operator=s guidance for the use of TA-only mode;
b) reasons for using this mode and situations in which its use may be desirable. These include operating in known close proximity to other aircraft such as when visual

approaches are being used to closely spaced parallel runways or taking off towards aircraft operating in a VFR corridor. If TA-only mode is not selected when an airport is conducting simultaneous operations from parallel runways separated by less than 366 m (1 200 ft), and to some intersecting runways, RAs can be expected. If an RA is received in these situations, the response should comply with the operator=s approved procedures; and

c) the TA aural annunciation is inhibited below 152 m (∀30) m (500 ft (∀100 ft)) AGL. As a result, TAs issued below 152 m (500 ft) AGL may not be noticed unless the TA display is included in the routine instrument scan.

6.2.2.4 *Crew coordination*

OBJECTIVE: To verify that pilots adequately brief other crew members on how ACAS advisories will be handled.

CRITERIA: Pilots must demonstrate that their pre-flight briefing addresses the procedures that will be used in responding to TAs and RAs including:

a) division of duties between the pilot flying and the pilot not flying, including a clear definition of whether the pilot flying or the pilot-in-command will fly the aircraft during a response to an RA;
b) expected call-outs;
c) communications with ATC; and
d) conditions under which an RA may not be followed and who will make this decision.

Note 1. Different operators have different procedures for conducting pre-flight briefings and for responding to ACAS advisories. These factors should be taken into consideration when implementing the training programme.

Note 2. The operator must specify the conditions under which an RA need not be followed, reflecting advice published by States Civil Aviation Authorities. This should not be an item left to the discretion of a crew.

Note 3. This portion of the training may be combined with other training such as crew resource management (CRM).

6.2.2.5 *Reporting requirements*

OBJECTIVE: To verify that the pilot is aware of the requirements for reporting RAs to the controller and other authorities.

CRITERIA: The pilot must demonstrate the following:

a) the use of the phraseology (see Appendix A) contained in the *Procedures for Air Navigation Services C Air Traffic Management* (PANS-ATM, Doc 4444); and

b) where information can be obtained regarding the need for making written reports to various States when an RA is issued. Various States have different reporting requirements and the material available to the pilot should be tailored to the airline's operating environment.

6.3 Desirable items

6.3.1 *Advisory thresholds*
OBJECTIVE: Demonstrate knowledge of the criteria for issuing TAs and RAs.
CRITERIA: The pilot must be able to demonstrate an understanding of the methodology used by ACAS to issue TAs and RAs and the general criteria for the issuance of these advisories to include:

a) the TA altitude threshold is 259 m (850 ft) below FL 420 and 366 m (1 200 ft) above FL 420;
b) when the vertical separation at CPA is projected to be less than the ACAS-desired separation, an RA requiring a change to the existing vertical speed will be issued. The ACAS-desired separation varies from 91 m (300 ft) at low altitude to a maximum of 213 m (700 ft) above FL 300;
c) when the vertical separation at CPA is projected to be greater than the ACAS-desired separation, an RA that does not require a change to the existing vertical speed will be issued. This separation varies from 183 to 244 m (600 to 800 ft); and
d) RA fixed-range thresholds vary between 0.4 km (0.2 NM) at low altitude and 2 km (1.1 NM) at high altitude. These fixed-range thresholds are used to issue RAs in encounters with slow closure rates.

7.0 ACAS MANOEUVRE TRAINING

7.1 When training pilots to properly respond to ACAS-displayed information, TAs and RAs are most effective when accomplished in a flight simulator equipped with an ACAS display and controls similar in appearance and operation to those in the aircraft. If a simulator is utilized, CRM aspects of responding to TAs and RAs should be practised during this training.

7.2 If an operator does not have access to an ACAS-equipped simulator, the initial ACAS evaluation should be conducted by means of an interactive CBT with an ACAS display and controls similar in appearance and operation to those in the aircraft the pilot will fly. This interactive CBT should depict scenarios in which real-time responses must be made. The pilot should be informed whether or not the responses made were correct. If the response was incorrect or inappropriate, the CBT should show what the correct response should be.

7.3 The scenarios in the manoeuvre training should include initial RAs that require a change in vertical speed; initial RAs not requiring a change in vertical speed; maintain rate RAs; altitude crossing RAs; increase rate RAs; RA reversals; weakening RAs; RAs issued while the aircraft is at a maximum altitude, and multi-aircraft encounters. In all scenarios, excursions should be limited to the extent required by the RA. The scenarios should be concluded with a return to the original flight profile. The scenarios should also include demonstrations of the consequences of not responding to RAs, slow or late responses, and manoeuvring opposite to the direction called for by the displayed RA as follows:

7.3.1 *TA responses*

OBJECTIVE: To verify that the pilot properly interprets and responds to TAs.
CRITERIA: The pilot must demonstrate:
a) proper division of responsibilities between the pilot flying and the pilot not flying. The pilot flying should

- a) continue to fly the aeroplane and be prepared to respond to any RA that might follow. The pilot not flying should provide updates on the traffic location shown on the ACAS traffic display and use this information to help visually acquire the intruder;
- b) proper interpretation of the displayed information. Visually search for the traffic causing the TA at a location shown on the traffic display. Use should be made of all information shown on the display, note being taken of the bearing and range of the intruder (amber circle), whether it is above or below (data tag), and its vertical speed direction (trend arrow);
- c) other available information is used to assist in visual acquisition. This includes ATC Aparty-line@ information, traffic flow in use, etc.;
- d) because of the limitations described in 2.2.1.3 e), that no manoeuvres are made based solely on the information shown on the ACAS display; and
- c) when visual acquisition is attained, right of way rules are used to maintain or attain safe separation. No
- e) unnecessary manoeuvres are initiated. The limitations of making manoeuvres based solely on visual acquisition are understood.

7.3.2 *RA responses*

OBJECTIVE: To verify THAT the pilot properly interprets and responds to RAs.
CRITERIA: The pilot MUST demonstrate:

- a) proper division of responsibilities between the pilot flying and the pilot not flying. The pilot flying should respond to the RA with positive control inputs, when required, while the pilot not flying is providing updates on the traffic location, checking the traffic display and monitoring the response to the RA. Proper CRM should be used. If the operator's procedures require the pilot-in-command to fly all RAs, transfer of aircraft control should be demonstrated;

b) proper interpretation of the displayed information. The pilot recognizes the intruder causing the RA to be issued (red square on display). The pilot responds appropriately;
c) for RAs requiring a change in vertical speed, initiation of a response in the proper direction within five seconds of the RA being displayed. Pilot actions must focus on tasks related to manoeuvring the aeroplane in response to the RA and flight crew coordination, avoiding distractions that may interfere with a correct and timely response. After initiating the manoeuvre, and as soon as possible, as permitted by flight workload, ATC is notified using the standard phraseology if the manoeuvre requires a deviation from the current ATC instruction or clearance;

Note: In the event of an RA, pilots should respond immediately and manoeuvre as indicated, unless doing so would jeopardize the safety of the aeroplane.

d) for RAs not requiring a change in vertical speed, focus on tasks associated with following the RA, including preparedness for a modification to the initially displayed RA where a change in vertical speed may be required. Distractions that may interfere with a correct and timely response must be avoided;
e) recognition of and the proper response to modifications to the initially displayed RA:
    1) for increase rate RAs, the vertical speed is increased within 2 1/2 seconds of the RA being displayed;
    2) for RA reversals, the manoeuvre is initiated within 2 1/2 seconds of the RA being displayed;
    3) for RA weakenings, the vertical speed is modified to initiate a return towards level flight within 2 ½ seconds of the RA being displayed; and
    4) for RAs that strengthen, the manoeuvre to comply with the revised RA is initiated within 2 1/2 seconds of the RA being displayed;
f) recognition of altitude crossing encounters and the proper response to these RAs;
g) for RAs that do not require a change in vertical speed, the vertical speed needle or pitch angle remains outside the red area on the RA display;
h) for maintain rate RAs, the vertical speed is not reduced. Pilots should recognize that a maintain rate RA may result in crossing through the intruder's altitude;
i) that if a justified decision is made to not follow an RA, the resulting vertical rate is not in a direction opposite to the sense of the displayed RA;
j) that the deviation from the current clearance is minimized by levelling the aircraft when the RA weakens and when "Clear of Conflict" is annunciated, executing a prompt return to the current clearance; and notifying ATC as soon as possible, as permitted by flight crew workload;
k) that when possible, an ATC clearance is complied with while responding to an RA. For example, if the aircraft can level at the assigned altitude while responding to a reduce climb or reduce descent RA, it should be done;

l) that when simultaneous conflicting instructions to manoeuvre are received from ATC and an RA, the RA is followed and, as soon as possible, as permitted by flight crew workload, ATC is notified using the standard phraseology;

m) a knowledge of the ACAS multi-aircraft logic and its limitations, and that ACAS can optimize separation from two aircraft by climbing or descending towards one of them. For example, ACAS considers as intruders only aircraft that it finds to be a threat when selecting an RA. As such, it is possible for ACAS to issue an RA against one intruder, which results in a manoeuvre towards another intruder that is not classified as a threat. If the second intruder becomes a threat, the RA will be modified to provide separation from that intruder;

n) a knowledge of the consequences of not responding to an RA and manoeuvring in the direction opposite to the RA; and

o) that a prompt response is made when a climb RA is issued while the aircraft is at the maximum altitude.

8.0 ACAS INITIAL EVALUATION

8.1 The pilot's understanding of the academic training items should be assessed by means of a written test or interactive CBT that records correct and incorrect responses to questions.

8.2 The pilot's understanding of the manoeuvre training items should be assessed in a flight simulator equipped with an ACAS display and controls similar in appearance and operation to those in the aircraft the pilot will fly, and the results assessed by a qualified instructor, inspector, or check pilot.

The range of scenarios should include: initial RAs requiring a change in vertical speed; initial RAs that do not require a change in vertical speed; maintain rate RAs; altitude crossing RAs; increase rate RAs; RA reversals; weakening RAs; RAs issued while the aircraft is at the maximum altitude, and multi-aircraft encounters. In all scenarios, excursions should be limited to the extent required by the RA. The scenarios should be concluded with a return to the original flight profile. The scenarios should also include demonstrations of the consequences of not responding to RAs, slow or late responses, and manoeuvring opposite to the direction called for by the displayed RA.

8.3 If an operator does not have access to an ACAS-equipped simulator, the initial ACAS evaluation should be conducted by means of an interactive CBT with an ACAS display and controls similar in appearance and operation to those in the aircraft the pilot will fly. This interactive CBT should depict scenarios in which real-time responses must be made, and a record should be made of whether or not each response was correct. The CBT should include all types of RAs.

9.0 ACAS RECURRENT TRAINING

9.1 ACAS recurrent training ensures that pilots maintain the appropriate ACAS knowledge and skills. ACAS recurrent training should be integrated into and/or conducted in conjunction with other established recurrent training programmes. An essential item of recurrent training is the discussion of any significant issues and operational concerns that have been identified by the operator.

9.2 ACAS monitoring programmes periodically publish findings from their analyses of ACAS events. The results of these analyses typically discuss technical and operational issues related to the use and operation of ACAS. This information is available from ICAO or directly from the monitoring programmes. ACAS recurrent training programmes should address the results of monitoring programmes in both the academic and simulator portions of recurrent training visits.

9.3 Recurrent training should include both academic and manoeuvre training and address any significant issues identified by line operating experience, system changes, procedural changes, or unique characteristics such as the introduction of new aircraft/ display systems or operations in airspace where high numbers of TAs and RAs have been reported.

9.4 Pilots should fly all scenarios once every four years.

9.5 Pilots should complete all scenarios once every two years if CBT is used.

10.0 ACAS HIGH VERTICAL RATE (HVR) ENCOUNTERS

ACAS PERFORMANCE DURING HIGH VERTICAL RATE (HVR) ENCOUNTERS

10.1 Modern aircraft and their flight guidance systems (autopilots, flight management systems, and autothrottles) are designed to fly specific flight profiles that provide fuel and time-efficient flight paths. An integral concept of the design of the flight guidance systems includes allowing an aircraft to quickly climb to higher, more efficient operating altitudes and to remain at these altitudes as long as possible, which results in descents also being made with high vertical speeds. For economic benefits, the high vertical speeds used in a climb or descent are retained as long as feasible before initiating a smooth capture of the aircraft's assigned altitude.

10.2 The design of the flight guidance systems can result in vertical speeds in excess of 15 m/s (or 3 000 ft/min) until they are within 150 m (or 500 ft) of the aircraft's assigned altitude. When a climbing or descending aircraft maintains a vertical speed in excess of 15 m/s (or 3 000 ft/min) until it is within 150 m (or 500 ft) of the aircraft's assigned altitude, it is less than 30 seconds away from being at the adjacent IFR altitude, which may be occupied by an ACAS-equipped aircraft flying level at that altitude. If the intruder aircraft is horizontally within the protected area provided by ACAS, there is a high probability that an RA against the climbing or descending aircraft will be issued just as the intruder aircraft begins to reduce its vertical speed to capture its assigned altitude.

10.3 Figure 1 provides a representation of the encounter geometry of this scenario. ACAS typically issues a climb RA, which calls for a climb at 8 m/sec (or 1 500 ft/min). Depending on the altitude of the level aircraft, this RA will typically be issued when the intruder aircraft is approximately 150 m (or 500 ft) below its assigned altitude and the vertical speed of the intruder is in excess of 15 m/s (or 3 000 ft/min).

10.4 ACAS in the level aircraft is tracking a climbing/descending (intruder) aircraft and is using replies to its interrogations to determine the intruder's altitude and its vertical speed. The ACAS track is updated once per second.

The intruding aircraft's track information, along with the track of the level ACAS aircraft (own aircraft), is used within ACAS to determine if the intruder aircraft is currently a threat or will be in the near future.

10.5 In determining whether the intruder aircraft will be a threat in the future, ACAS projects the existing vertical speed of the intruder and own aircraft, to estimate the vertical separation that will exist at the closest point of horizontal approach during the encounter. These projections use the current vertical speed of both aircraft, and ACAS is not aware of the intruder aircraft's intent to level at an adjacent altitude above or below its own aircraft's current altitude. Should this projection be less than the ACAS desired vertical separation, an RA will be issued.

10.6 Should the intruder aircraft continue to climb/descend with the high vertical speed until it is 15 to 25 seconds from being at the same altitude as the level ACAS aircraft (again depending on the ACAS aircraft's altitude), ACAS will issue an RA calling for the own aircraft to manoeuvre to increase vertical separation from the intruder aircraft.

11.0 OPERATIONAL IMPACTS OF RAs RESULTING FROM HVR ENCOUNTERS

11.1 Shortly after ACAS issues the RA (climb RA for the encounter geometry shown in Figure 1), the intruder aircraft begins reducing its vertical rate to capture its assigned altitude.

11.2 While the intruder aircraft is initiating its level-off, the ACAS aircraft has started responding to its RA and may have left its assigned altitude. Both pilots and controllers agree that RAs issued in this encounter geometry are unwelcome. The RAs can be disruptive to a controller's current traffic flow and plans, and thus represent an increase in their workload. The response to the RA can also result in a loss of standard ATC separation if another aircraft is above the ACAS aircraft.

11.3 Pilots have reported that these types of RAs decrease their confidence in the performance of ACAS. These RAs typically occur repeatedly in the same geographic area, and repeated RAs of this type result in pilots being reluctant to follow the RA. This can be potentially hazardous in the event that the intruder aircraft passes through its assigned altitude.

12.0 FREQUENCY OF OCCURRENCE

12.1 ACAS monitoring shows that the frequency of occurrence is dependent on how airspace is structured and managed. Data collected during 2001 indicate that up to 70 per cent of the RAs issued are caused by the intruder aircraft maintaining a high vertical speed while approaching its assigned altitude. Depending on the airspace structure and the flow of traffic, it is possible to have several of these RAs issued within one hour, although airspace containing a lower density of traffic will have relatively few RAs of this type. Some air traffic service providers have been able to change their traffic flows and/or operational procedures to reduce the occurrence of these types of RAs, but these types of RAs continue to occur with a high degree of regularity in airspace throughout the world.

12.2 HVR RAs have been observed in both terminal and en-route airspace, although because of the previously higher vertical separation above FL 290 in non-RVSM airspace, very few RAs of this type have been observed above FL 290 in the past. With the current reduced separation, it is possible that HVR RAs may occur more frequently above FL 290 in RVSM airspace. Many HVR RAs occur in close proximity to large airports where departures are kept below arriving aircraft until some distance from the airport before being allowed to climb to higher altitudes, and a large percentage of these RAs occur in geographic areas where there is a concentration of climbing and descending aircraft.

13.0 ACAS FEATURES THAT REDUCE THE LIKELIHOOD OF RAs BEING ISSUED IN THESE SITUATIONS

13.1 ACAS recognizes HVR encounters, such as that shown in Figure 1. When this encounter geometry is detected, the issuance of RAs can be delayed by up to ten seconds. This delay allows additional time for the intruder aircraft to initiate a level-off and for ACAS to then detect this level-off. However, when the intruder aircraft maintains a vertical speed in excess of 15 m/s (or 3 000 ft/min) until it is within 150 m (or 500 ft) of its assigned altitude, even this 10-second delay may be insufficient for ACAS to detect the level-off, and an RA may be issued. Safety studies have shown that further delays in issuing the RA result in unacceptable degradation in the safety provided by ACAS.

13.2 Consideration has also been given to providing ACAS with information regarding the intruder aircraft's intent. However, this is not considered to be a viable approach to reducing these types of RAs while retaining the existing level of safety provided by ACAS.

13.3 A solution to the problem of HVR encounters has been found and implemented in some aircraft. This solution comprises

a) the coupling of the autopilot with ACAS; and
b) the introduction of a new altitude capture logic. The first item will provide the detection of an intruder (e.g. issuance of a traffic advisory (TA)).

The second item will enable the aircraft's auto-flight system to adjust the vertical profile in order to prevent the issuance of RAs. In combination, these two improvements should provide a significant reduction of the disruptive RAs occurring during HVR encounters.

14.0 OPERATOR-SPECIFIED PROCEDURES

14.1 Due to the operational impacts on pilots and controllers caused by these types of RAs, and the continued existence of these RAs and the constraints on further modifications to ACAS, operators should specify procedures by which an aeroplane climbing or descending to an assigned altitude or flight level with an autopilot engaged may do so at a rate less than 8 m/sec (or 1 500 ft/min) within 300 m (or 1 000 ft) of the assigned level. Such procedural changes should provide an immediate operational benefit to both pilots and controllers by reducing the occurrence of HVR RAs.

14.2 The implementation of such procedures will not completely eliminate these RAs, but in the absence of other solutions, such as the redesign of airspace, their implementation will reduce the frequency of these undesirable RAs until a technical solution can be developed. Options that operators should consider include flying the entire climb or descent at a preselected rate, modifying the climb or descent in the latter stage and employing use of less than economic climb thrust in lower airspace.

14.3 A recommended procedure would call for a climbing or descending aircraft to adjust its vertical rate when approaching an assigned altitude or flight level, *and* when the pilot is aware that there is an aircraft at or approaching an adjacent altitude or flight level. The crew can be made aware of the presence of that aircraft by several means, including information provided by an air traffic controller, an ACAS TA or by visual acquisition. When a crew of an intruder aircraft becomes aware that another aircraft is at or approaching an adjacent altitude or flight level, it is recommended that the vertical speed of the intruder aircraft be reduced to less than 8 m/s (or 1 500 ft/min) when approaching an altitude that is 300 m (or 1 000 ft) above or below the assigned altitude or flight level.

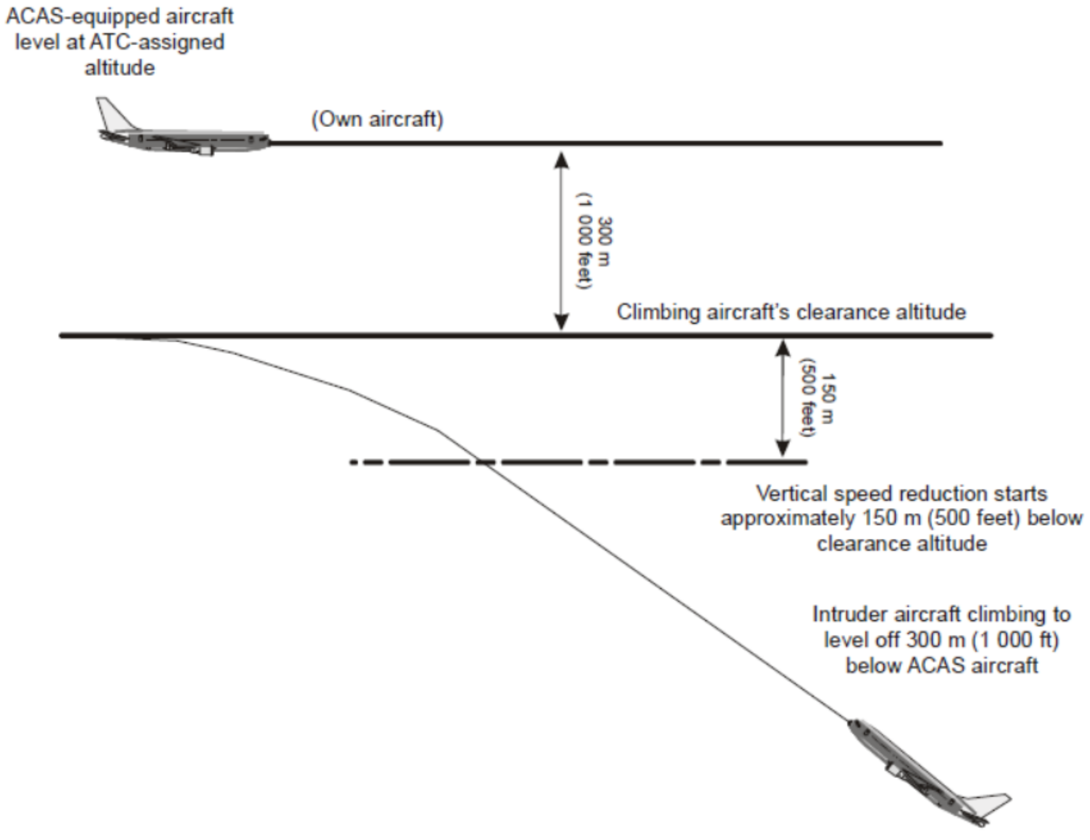
Note: There is no intent in this recommendation to require a modification in vertical speed for every level-off. This is not necessary and would introduce a significant increase in pilot workload.

14.4 When the autopilot is in the altitude capture mode, subsequent vertical mode changes such as the selection of a vertical speed mode may cause some autopilots either to cancel the altitude capture or to not properly capture the selected altitude. Altitude deviations represent a significant percentage of pilot deviations, and the performance of the autopilot during any altitude capture should be closely monitored in accordance with existing procedures.

14.5 Additional tasks may be required during some level-off manoeuvres. However, the procedure is a recommendation, not a requirement. Further, the procedure does not suggest that adjustments to the aircraft's vertical speed be made unless the pilot is aware that traffic is at an adjacent altitude.

14.6 The operator should specify procedures that the pilot may use to reduce vertical speed when an autopilot is engaged, as appropriate for the type of aircraft. Also, the operator should consider authorizing pilots to use a modest vertical speed throughout a climb or descent when the vertical interval is not large — such as a change of altitude in a holding pattern — specifying how this should be accomplished.

Figure 1.



ATC PHRASEOLOGIES

Circumstances	Phraseologies
... after a flight crew starts to deviate from any ATC clearance or instruction to comply with an ACAS resolution advisory (RA) (Pilot and controller interchange)	**Pilot** - TCAS RA **Controller** - ROGER
... after the response to an ACAS RA is completed and a return to the ATC clearance or instruction is initiated (Pilot and controller interchange)	**Pilot** - CLEAR OF CONFLICT, RETURNING TO (assigned clearance); **Controller** - ROGER (or alternative instructions);
… after the response to an ACAS RA is completed and the assigned ATC clearance or instruction has been resumed (Pilot and controller interchange)	**Pilot** - CLEAR OF CONFLICT (assigned clearance) RESUMED; **Controller** - ROGER (or alternative instructions);
… after an ATC clearance or instruction contradictory to the ACAS RA is received, the flight crew will follow the RA and inform ATC directly (Pilot and controller interchange)	**Pilot** - UNABLE, TCAS RA; **Controller** - ROGER;

APPENDIX C: STANDARD OPERATING PROCEDURES, CHECKLISTS AND CREW BRIEFINGS

1.0 THE MISSION OF SOPs/CREW BRIEFINGS AND CHECKLISTS

To achieve consistently safe flight operations through adherence to SOPs that are clear, comprehensive, and readily available to flight crewmembers. Operators shall establish standard operating procedures (SOPs) that provide guidance to flight operations personnel to ensure safe, efficient, logical and predictable means of carrying out flight procedures. Crew briefings form an integral part of SOPs. Operators also provide checklists such as Emergency and Abnormal Checklists to assist the flight crew manage and contain system faults and other situations that adversely affect flight safety. As this must be achieved in a timely fashion, accuracy, clarity, consistency and brevity are essential design drivers for checklists.

2.0 SOPs OBJECTIVES

2.1 SOPs specify a sequence of tasks and actions to ensure that flight procedures can be carried out. To achieve these objectives, SOPs should unambiguously express:

a) what the task is;
b) when the task is to be conducted (time and sequence);
c) by whom the task is to be conducted;
d) how the task is to be done (actions);
e) what the sequence of actions consists of; and
f) what type of feedback is to be provided as a result of the actions (verbal call out, instrument indication, switch position, etc.).

3.0 SOPs DESIGN

3.1 To ensure compatibility with specific operational environments and compliance by flight operations personnel, SOPs design should take into consideration:

a) the nature of the operator's environment and type of operation;
b) the operational philosophy, including crew coordination;
c) the training philosophy, including human performance training;
d) the operator's corporate culture, including the degree of flexibility to be built into SOPs design;
e) the levels of experience of different user groups, such as flight crews, aircraft maintenance engineers and cabin attendants;
f) resource conservation policies, such as fuel conservation or wear on power plants and systems;
g) flight deck automation, including flight deck and systems layout and supporting documentation;
h) the compatibility between SOPs and operational documentation; and
i) procedural deviation during abnormal/unforeseen situations.

3.2 Flight operations personnel should be involved in the development of SOPs.

4.0 SOPs IMPLEMENTATION AND USE

Operators should establish a formal process of feedback from flight operations personnel to ensure standardization, compliance and evaluation of reasons for non-compliance during SOPs implementation and use.

5.0 CHECKLISTS

5.1 GENERAL

Operators shall establish checklists as an integral part of standard operating procedures (SOPs). Checklists should describe the actions relevant to specific phases of operations (engine start, taxi, take-off, etc.) that flight crews must perform or verify and which relate to flight safety. Checklists should also provide a framework for verifying aircraft and systems configuration that guards against vulnerabilities in human performance. The operator is responsible for ensuring that the Emergency and Abnormal Checklists provided by the manufacturer are appropriate to their operation and do not compromise the safety of the aircraft. It is the responsibility of operators to ensure that appropriate and current Emergency and Abnormal Checklists are placed on each aircraft. The operator should establish a system of controlled documentation in relation to Emergency and Abnormal Checklists. An amendment number and date must be available on each page of the document.

The manufacturers' checklists, if unchanged by the operator, will generally be acceptable to the CAA if they meet the guidelines of this document.

5.2 CHECKLIST OBJECTIVES

5.2.1 Normal checklists should aid flight crews in the process of configuring the aircraft and its systems by:

a) providing logical sequences of coverage of the flight deck panels;
b) providing logical sequences of actions to meet both internal and external flight deck operational requirements;
c) allowing mutual monitoring among flight crew members to keep all flight crew members in the information loop; and
d) facilitating crew coordination to assure a logical distribution of flight deck tasks.

5.2.2 Checklists for use in abnormal situations and those for emergency situations should aid flight crews in coping with malfunctions of aircraft systems and/or emergency situations. They should also guard against vulnerabilities in human performance during high workload situations by fulfilling the objectives in 5.2.1 and, in addition, by:

a) ensuring a clear allocation of duties to be performed by each flight crew member;
b) acting as a guide to flight crews for diagnosis, decision making and problem solving, (prescribing sequences of steps and/or actions); and

c) ensuring that critical actions are taken in a timely and sequential manner.

5.3 CHECKLIST DESIGN

5.3.1 Order of checklist items

5.3.1.1 The following factors should be considered when deciding the order of the items in checklists:

a) the operational sequence of aircraft systems so that items are sequenced in the order of the steps for activation and operation of these systems;
b) the physical flight deck location of items so that they are sequenced following a flow pattern;
c) the operational environment so that the sequence of checklists considers the duties of other operational personnel such as cabin crew and flight operations officers;
d) operator policies (for example, resource conservation policies such as single-engine taxi) that may impinge on the operational logic of checklists;
e) verification and duplication of critical configuration-related items so that they are checked in the normal sequence and again immediately before the phase of flight for which they are critical; and
f) sequencing of critical items in abnormal and emergency checklists so that items most critical are completed first.

5.3.1.2 Critical items should appear no more than twice on a given checklist (see 5.3.1.1 e)). Critical items should be verified by more than one flight crew member.

5.3.2 Number of checklist items

The number of items in checklists should be restricted to those critical to flight safety.

Note.— The introduction of advanced technology in the flight deck, allowing for automated monitoring of flight status, may justify a reduction in the number of items required in checklists.

5.3.3 Checklist interruptions

SOPs should include techniques to ensure a step-by-step, uninterrupted sequence of completing checklists. SOPs should unambiguously indicate the actions by flight crews in case of checklist interruptions.

5.3.4 Checklist ambiguity

Checklist responses should portray the actual status or the value of the item (switches, levers, lights, quantities, etc.). Checklists should avoid non-specific responses such as “set”, “checked” or “completed”.

5.3.5 Checklist coupling

Checklists should be coupled to specific phases of flight (engine start, taxi, take-off, etc.). SOPs should avoid tight coupling of checklists with the critical part of a phase of flight (for example, completing the take-off checklist on the active runway). SOPs should dictate a use of checklists that allows buffers for detection and recovery from incorrect configurations.

5.3.6 Typography

5.3.6.1 Checklist layout and graphical design should observe basic principles of typography, including at least legibility of print (discriminability) and readability under all flight deck lighting conditions.

5.3.6.2 If colour coding is used, standard industry colour coding should be observed in checklist graphical design. Normal checklists should be identified by green headings, system malfunctions by yellow headings, and emergency checklists by red headings.

5.3.6.3 Colour coding should not be the only means of identifying normal, abnormal and emergency checklists.

6.0 CREW BRIEFINGS

6.1 GENERAL

6.1.1 Operators shall establish crew briefings as an integral part of standard operating procedures (SOPs). Crew briefings communicate duties, standardize activities, ensure that a plan of action is shared by crew members and enhance crew situational awareness.

6.1.2 Operators shall establish both individual and combined crew briefings for flight crew and cabin crew.

6.2 OBJECTIVES

Crew briefings should aid crews in performing safety-critical actions relevant to specific phases of flight by:

a. refreshing prior knowledge to make it more readily accessible in real-time during flight;
b. constructing a shared mental picture of the situation to support situational awareness;
c. building a plan of action and transmitting it to crew members to promote effective error detection and management; and
d. preparing crew members for responses to foreseeable hazards to enable prompt and effective reaction.

Note.— Without briefings, and under the pressure of time constraints and stress, retrieving information from memory may be an extremely unreliable process.

6.3 PRINCIPLES

6.3.1 The following principles should be considered when establishing crew briefings:

a. crew briefings should be short and should not include more than ten items. If more than ten items are necessary, consideration should be given to splitting the briefing into sequential phases of the flight;
b. crew briefings should be simple and succinct, yet sufficiently comprehensive to promote understanding of the plan of action among all crew members;
c. crew briefings should be interactive and where possible should use a question-and-answer format;
d. crew briefings should be scheduled so as not to interfere with, and to provide adequate time for, the performance of operational tasks; and
e. crew briefings should achieve a balance between effectiveness and continual repetition of recurring items.

Note.— Crew briefings that become routine recitations do not refresh prior knowledge and are ineffective.

6.3.2 Any intended deviation from SOPs required by operational circumstances should be included as a specific briefing item.

6.4 APPLICATION

6.4.1 Operators shall implement flight and cabin crew briefings for specific phases of operations to include actual conditions and circumstances, as well as special aspects of operations.

6.4.2 Flight crew briefings shall be conducted for, but not be limited to, the following phases of operations:

a) pre-flight;
b) departure; and
c) arrival.

6.4.3 Cabin crew briefings shall be conducted for, but not be limited to, the following phases of operations:

a) pre-flight; and
b) first departure of the day.

6.4.4 Cabin crew briefings should be conducted following changes of aircraft type or crew and before flights involving a stop of more than two hours.

6.5 SCOPE

6.5.1 Pre-flight briefings shall include both flight crew and cabin crew.

6.5.2 Pre-flight briefings should focus on crew coordination as well as aircraft operational issues. They should include, but not be limited to:

a. any information necessary for the flight, including unserviceable equipment or abnormalities that may affect operational or passenger safety requirements;
b. essential communications, and emergency and safety procedures; and
c. weather conditions.

6.5.3 Flight crew departure briefings should prioritize all relevant conditions that exist for the take-off and climb. They should include, but not be limited to:

a. runway in use, aircraft configuration and take-off speeds;
b. taxi-out route and relevant hot spots;
c. departure procedures;
d. departure routes;
e. navigation and communications equipment set-up;
f. aerodrome, terrain and performance restrictions, including noise abatement procedures (if applicable);
g. take-off alternates (if applicable);
h. any item(s) included in the minimum equipment list (if applicable);
i. review of applicable emergency procedures; and
j. applicable standard call-outs.

6.5.4 Flight crew arrival briefings should prioritize all relevant conditions that exist for the descent, approach and landing. They should include, but not be limited to:

a) terrain restrictions and minimum safe altitudes during descent;
b) arrival routes;
c) instrument or visual approach procedures and runway in use;
d) operational minima, aircraft configuration, and landing speeds;
e) navigation and communications equipment set-up;
f) taxi-in route and relevant hot spots;
g) missed approach procedures;
h) alternate aerodromes and fuel considerations;
i) review of applicable emergency procedures;
j) applicable standard call-outs; and
k) cold temperature correction

6.5.5 Cabin crew briefings should prioritize all relevant conditions that exist for the departure. They should include, but not be limited to:
a) assignment of take-off/landing positions;
b) review of emergency equipment;
c) passengers requiring special attention;
d) the silent review process;

Note.— The silent review process is the self-review of individual actions in the event of emergencies.

e) review of applicable emergencies;

f) security or service-related topics that may impact on passenger or crew safety; and

g) any additional information provided by the operator, including review of new procedures, equipment and systems.

Stabilized Approach: Concepts And Terms

A **stabilized approach** is one of the key features of safe approaches and landings in air carrier operations, especially those involving transport category airplanes. A stabilized approach is characterized by a **constant-angle, constant-rate of descent** approach profile ending near the touchdown point, where the landing maneuver begins. A stabilized approach is the safest profile in all but special cases, in which another profile may be required by unusual conditions. All appropriate **briefings and checklists** should be accomplished before 1000' height above touchdown (HAT) in instrument meteorological conditions (IMC), and before 500' HAT in visual meteorological conditions (VMC). Flight should be **stabilized by 1000'** HAT in IMC, and by 500' HAT in VMC.

An approach is stabilized when all of the following **criteria** are maintained from 1000 HAT (or 500 HAT in VMC) to landing in the touchdown zone:

- The airplane is on the correct track.
- The airplane is in the proper landing configuration.
- After glide path intercept, or after the final approach fix (FAF), or after the derived fly-off point (per Jeppessen) the pilot flying requires no more than normal bracketing corrections to maintain the correct track and desired profile (3° descent angle, nominal) to landing within the touchdown zone. Level-off below 1000' HAT is not recommended.
- The airplane speed is within the acceptable range specified in the approved operating manual used by the pilot.
- The rate of descent is no greater than 1000 feet per minute (fpm).

If an expected rate of descent greater than 1000 fpm is planned, a special approach briefing should be performed. If an unexpected, sustained rate of descent greater than 1000 fpm is encountered during the approach, a missed approach should be performed. A second approach may be attempted after a special approach briefing, if conditions permit power setting is appropriate for the landing configuration selected, and is within the permissible power range for approach specified in the approved operating manual used by the pilot.

When no vertical guidance is provided: Vertical guidance may be provided to the pilot by way of an electronic glideslope, a computed descent path displayed on the pilot's navigation display, or other electronic means. On approaches for which no vertical guidance is provided, the flight crew should plan, execute, and monitor the approach with special care, taking into account traffic and wind conditions. To assure vertical clearance and situation awareness, the pilot not flying should announce crossing altitudes as published fixes and other points selected by the flight crew are passed. The pilot flying should promptly adjust descent angle as appropriate. A constant-angle, constant-rate descent profile ending at the touchdown point is the safest profile in all but special cases.

Visual contact. Upon establishing visual contact with the runway or appropriate runway lights or markings, the pilot should be able to continue to a safe landing using normal bracketing corrections, or, if unable, should perform a missed approach.

No visual contact. The operator may develop procedures involving an approved, standard MDA buffer altitude or other approved procedures to assure that descent below MDA does not occur during the missed approach. If no visual contact is established approaching MDA or an approved MDA buffer altitude, or if the missed approach point is reached, the pilot should perform the published missed approach procedure. (OpSpecs provides for special authorization under certain conditions to go below the MDA while executing a missed approach.) Below 1000’ HAT (AFE), leveling off at MDA (or at some height above MDA) is not recommended, and a missed approach should be performed.

Note 1: *A **correct track** is one in which the correct localizer, radial, or other track guidance has been set, tuned, and identified, and is being followed by the pilot.*

***Note 2: Normal bracketing corrections** relate to bank angle, rate of descent, and power management. Recommended ranges are as follows (operating limitations in the approved airplane flight manual must be observed, and may be more restrictive):*

Bank angle. Maximum bank angle permissible during approach is specified in the approved operating manual used by the pilot, and is generally not more than 30°; the maximum bank angle permissible during landing may be considerably less than 30°, as specified in that manual.

Rate of descent ± 300 fpm deviation from target

Power management: Permissible power range is specified in the approved operating manual used by the pilot

Overshoots: Normal bracketing corrections occasionally involve momentary overshoots made necessary by atmospheric conditions. Such overshoots are acceptable. Frequent or sustained overshoots caused by poor pilot technique are not normal bracketing corrections.

(Examples of callouts)

Callouts: shown in '**BOLD TEXT" – Actions:** shown with bullets(•) in plain text		
Initial Approach	**PF**	**PNF**
	"FLAPS 1, REF 60"	Select flaps 1 Set command airspeed cursor to V_{REF} 30+80
	"FLAPS 5, REF 40"	Select flaps 5 Set command airspeed cursor to V_{REF} 30+80
When Cleared for the Approach	• • Verify Nav radio tuned to appropriate ILS frequency • Select APP mode	• Verify LOC and G/S annunciates white (armed on ADI
LOC Alive	• Verify localizer indication	**"LOCALIZER ALIVE"**
LOC Capture	•• Verify LOC annunciates green (captured) on ADI	
GS Alive	• Verify G/S indication **"GEAR DOWN, FLAPS 20, V_{REF} 20+5, SINGLE ENGINE LANDING CHECKLIST"**	**"GLIDE SLOPE ALIVE"** Position gear lever DOWN Select flaps 20 Set command airspeed cursor to V_{REF} 20+5 Complete Single Engine Landing Checklist
GS Capture		**"GLIDE SLOPE CAPTURE"**

CHECKLISTS TOOL

The purpose of this tool is to help operators determine whether their checklist complies with best human factors practice as required by KCARs.

No.	Title	Attribute	Y	N	N/A	Comments
Physical Characteristics						
1.1	**Document size**	Is the size of the document appropriate to the stowage space available?				The checklist must be able to be stowed in an accessible location and easily retrieved in an emergency.
		Can the document be used without interfering with the controls or obscuring the displays?				This check needs to be carried out on the flight deck. The document should be reduced in size if there is any interference or obscuration.
1.2	**Binding**	Can the document be opened through 360º?				Access to required page(s) needs to be accomplished without requiring the crew to hold the pages open. Thus ideally the checklist will be able to fold back on itself. Recommend change if this cannot be achieved.
		Can amendment pages be easily inserted?				Ring binders are recommended.
		Is binding robust?				Can it fall apart? If the binding is loose, pages could be lost. Recommend change binding.
1.3	**Cover**	Is the cover robust to protect pages within?				
		Is the colour significantly different to minimise incorrect checklist selection?				The Emergency and Abnormal operation should be easy to distinguish. Recommend change colour of cover.
		Is the cover easily distinguishable from the pages within?				If the checklist is folded back on a particular page when stowed it may not be easy to locate. Recommend change the colour or size.
		Does the title of the checklist and aircraft type appear on the front cover?				In a multi fleet operation this could result in the wrong checklist being used. Recommend change cover.

No.	Title	Attribute	Y	N	N/A	Comments
		Is the checklist stowed out of proximity of drink containers?				Drink stains could render the checklist unusable. Recommend protecting checklist in some manner (e.g. using laminated pages).
1.4	**Tabs and dividers**	Are the tabs clearly identified?				Tabs are used to assist in the location of drill. If they are not clearly identified this will cause delay in finding the correct drill. Recommend change tab numbering to be consistent throughout document.
		Are the tabs logically linked to the index?				If they are not logically linked this will cause delay in locating the correct drill. Recommend change tabs to provide logical linking
		Are the tabs wide enough to place a thumb on?				If the tabs are too small access to the correct drill will be more difficult. Recommend changing the size of the tabs.
		Are the tabs and dividers consistent in colour?				Where colour coding has been used to discriminate drills the colour coding should be consistent. Recommend changing the colours of the tabs and dividers to maintain consistency.
1.5	**Font type**	Does the font type used provide clear differentiation between characters?				Difficulty in reading the text may cause errors to be made. Recommend sans serif fonts (without tails) such as Helvetica, Gill Medium or Arial fonts are used.
		Is lower case with upper case initial letters used for blocks of text?				Research has shown that lower case text is easier to read than uppercase. Recommend change text to lower case. Upper case can be used for titles and attention getting warnings and alerts.
1.6	**Print size**	Is the checklist legible at arms' length?				Text must be legible under all lighting conditions at arms length (approximately 600mm). Smaller text will cause eye fatigue and may not be legible particularly in low visibility conditions. Recommend increase font size until it is legible at 600mm.
		Are the smoke procedures in large print? (Also consider any procedures that may be carried out under poor lighting conditions.)				Font size should be large to be legible in a smoke filled cabin. Recommend increase size of font.
1.7	**Margins**	Is there at least 19mm space between the binder and the text?				The binding should not hide the text. Recommend changing margin to typically 19mm.

No.	Title	Attribute	Y	N	N/A	Comments
		Can you use your thumb as a cursor to keep track of drill progress?				It should be possible to hold the list using the thumb as a cursor without obscuring the text. Recommend changing margin to typically 19mm.
1.8	**Emphasis and differentiation**	Are similar action items on the checklist clearly differentiated?				Similar lines of text could result in an action item being missed. Recommend highlighting the difference in the sentence using bold type.
1.9	**Contrast and colour**	Has black text on a white or yellow background been used?				Coloured backgrounds provide a poor contrast ratio, which is difficult to read. Recommend using white or yellow background. If other colours are used check legibility under low ambient lighting.
		Is all the text in black?				Coloured text is difficult to read particularly under low ambient lighting conditions and should be avoided. Recommend changing coloured text back to black. Alert cues may be coloured.
		When the Emergency and Abnormal procedures are in the Operating Manual are the pages distinguished from the main drills?				It is important to be able to quickly and accurately locate the correct drill. Recommend using colour tabs - red for emergency and amber for abnormal procedures.
		Where colour shading has been used to discriminate actions or notes, is there sufficient contrast between the text and background?				Colour shading provides a good method of discrimination but must be used with care. Recommend the use of pastel colours (low saturation) for shading.
1.10	**Contents list and index**	Does the checklist have a tabbed content list at the beginning of the checklist?				The checklist is unusable without a contents list. Recommend adding a contents list.
		Does the contents list clearly identify the sub-systems?				The pilots should be trained to know in which sub-system the fault has occurred. Recommend clearly listing each sub- system.
		Are critical drills highlighted in the index?				Recommend highlighting in some manner to make these drills easier to find. Alternatively put the critical drills at the top of the index.
						The critical drills need to be attended to very rapidly.

No.	Title	Attribute	Y	N	N/A	Comments
		Does the checklist have an index of all fault captions covered in the checklist?				An alphabetical index will provide a quick route to the correct drill particularly when the Pilot is unfamiliar with the fault and does not know which sub-system to try first. Recommend including an alphabetical index.
		Is there a contents list at the beginning of each sub-system section of the checklist?				Lack of a list can make the checklist unusable. Recommend putting an index at the beginning of each sub-system section.
1.11	**Numbering**	Within each sub-system section do the page numbers correspond to the tab numbers?				Lack of numbering, incorrect or confusing numbering can make the checklist unusable. Recommend numbering each page in correspondence with the tab number or other logical manner.
		Is the number clearly identified on the page?				Lack of a page number can make the checklist unusable. Recommend putting the number at the bottom or top of the page. Large font size is recommended.
		Are actions consecutively numbered in the drill?				Research has shown that numbering actions assists in place keeping. Recommend consideration be given to numbering actions.
Checklist Content						
2.1	**Structure**	Have the number of action items been minimised to take account of time available to complete the drill? For example, landing gear problems are likely to be discovered when fuel is low.				It is essential that the minimum number of actions be carried out to establish a safe aircraft state. Consider carefully whether diagnostic actions that attempt to eliminate the source of the problem are essential when there are likely to be time constraints.
2.2	**Checklist Instructions**	Is a set of notes outlining the checklist coding philosophy contained in the checklist?				The notes should detail the coding and presentation philosophy used throughout the checklist. Recommend including instructions in the checklist or providing easy access to the instructions in the documentation suite.
		Do they adequately describe the presentation and philosophy principles used in the checklist?				The notes should provide explicit details on how to interpret the information contained within the checklist. They should also define terminology such as **land as soon as possible** and **land as soon as practicable**.

No.	Title	Attribute	Y	N	N/A	Comments
2.3	**Title**	Is a title prominently displayed at the start of each drill?				Lack of a title will make the checklist unusable. The drill must have a title
		Does the title fully reflect the failure condition?				A misleading title could result in the incorrect drill being carried out. An unambiguous and practical title should be used.
		Is the title completely distinguishable from the rest of the drill?				The title must stand out from the action items and notes on the drill. Recommend using a method like boxing and/or bold font.
2.4	**Failure condition**	Does the checklist contain a description of the failure condition(s)?				A repeat of the warning captions and failure states provides a useful confirmation that the correct checklist has been selected. Recommend including a description of the failure conditions.
		Does the checklist contain an illustration of the alerting trigger captions?				A repeat of the warning captions in the checklist (using the same colour as it appears on the flight deck) provides a useful confirmation that the correct checklist has been selected.Recommend including an illustration of the relevant warning captions.
2.5	**Objective**	Does the checklist contain an objective?				An objective statement serves as a useful confirmation that the correct checklist has been selected and the expected outcome of the drill. Recommend including an objective statement where appropriate in the checklist.
2.6	**Memory items**	Are the memory items listed at the beginning of the drill?				Memory items should be carried out first and verified on the checklist. When they exist they must be the first set of action items.
		Are the memory items clearly distinguished from the other action items?				It is recommended that the memory items be distinguished in some fashion - boxing, shading, line marking, numbering (M1, M2),etc.
		Are there six or less memory items on a single drill				It is recommended that the memory items should be kept to a minimum - preferably four or less. Recall can be impaired under stressful situations.

No.	Title	Attribute	Y	N	N/A	Comments
2.7	**Cautionary Notes**	Are cautionary notes clearly discriminated on the checklist?				Cautionary notes highlight resultant performance constraints and should be differentiated from ordinary explanatory notes. It is recommended that appropriate colour shading highlights caution notes. Ideally they should be accompanied by the word 'caution'.
		Are the cautionary notes printed above the action item that they relate to?				It is essential that the crew are aware of the implications of any action item before they carry it out. Recommend moving the cautionary note to precede the action that it relates to.
2.8	**Action items**	Are the action items distinguishable from the notes in the checklist?				It is important to identify the 'do' list items in the list. Recommend that they are distinguished from other items in the checklist (e.g. text font size, font type or bold font are potential candidates).
		Are the 'read' and 'do' items clearly linked?				The items should be linked to avoid the possibility of associating the wrong challenge and response. Recommend using dots or dashes to link challenge and response items.
		Are the critical items (e.g. actions resulting in the deactivation of the flight controls) discriminated?				Critical items which could create a hazardous situation require positive verification by the monitoring crewmember and therefore it is important that these actions are clearly discriminated from other action items. Recommend changing presentation of critical items to provide discrimination.
2.9	**Explanatory Notes**	Are the explanatory notes clearly distinguished from action items?				The notes should not clutter the action items. It is recommended that they are visually distinguishable.
		Are the notes linked to the action item that they relate to?				It is essential that the notes either precede or follow the action item. It is recommended that notes are consistently placed close to the action items that they refer to.
2.10	**Decision items**	Are conditional steps clearly laid out?				An error prone situation exists with complicated conditional statements particularly when action items are embedded within them. It is recommended that decision items are discriminated either by using special bullets or line marking or choice directives.

No.	Title	Attribute	Y	N	N/A	Comments
2.11	**Review of System status**	Is a review of system status and operational capability provided on the checklist?				A system status review provides the crew with diagnostic information regarding system capability. They are useful in dealing with a failure situation, which cannot be rectified. It is recommended that consideration be given to including a table or list detailing system failures and alternate operational capability in the checklist.
2.12	**Deferred items**	Are deferred items clearly identified?				Actions, which will be carried out at a later phase of flight, should be at the end of the checklist and should be clearly labelled. It is recommended that a label such as 'deferred item' precedes the final deferred action items.
		Are they grouped accordingly?				Deferred items are easier to use if they are clearly grouped according to phase of flight or an environmental condition. It is recommended that grouping techniques are used.
		Is there sufficient information to carry out the deferred step?				When returning to a checklist to carry out items that have been deferred it is necessary to recall the system deficiencies and carry out the actions correctly. To aid recall it is recommended that 'do' actions be spelt out explicitly.
2.13	**Crew responsible**	Where appropriate does the checklist indicate who is responsible for carrying out the drill?				The instructions should indicate who is responsible for carrying out the drill but if this changes for any of the drills it should be specifically stated as to who is responsible for specific actions.
Layout and Format						
3.1	**Drills per page**	If the drill runs onto a second page is it split at a logical place in the drill?				Drills should be split into logical sections and the logical sections should not be split at a page break as it impacts continuity of the drill.
3.2	**Start and finish**	Does the drill have a clearly defined start?				The drill will be unusable if it is not clear where the drill starts. It must have a clearly defined start.
		Does the drill have a defined end?				The end of drill must be indicated with an 'end of xxx drill' indication or graphical equivalent.
		Are the end of drill indications provided in every place on the drill where it is complete, including decision steps?				The end of drill must be included at all places in the drill when it is complete.

No.	Title	Attribute	Y	N	N/A	Comments
3.3	**Continuation pages**	Is it clear when the drill continues onto another page?				The drill may not be completed if it is not clear that it continues onto another page. It is recommended that a clear indication be provided at the bottom of the page and top of the continuing page.
3.4	**Order**	Does the order of the action items ensure that the failure is fixed at the earliest opportunity?				The design of the drill must ensure that priority items, i.e. those that will deal with the fault in the most time efficient way, are in the appropriate order.
		Are the action items listed in a logical, functional or physical cockpit layout pattern?				Procedures that are logically listed will be completed in a timely fashion.
3.5	**Cross-referencing**	Where cross-referencing is used within a drill is it clear as to which step should be carried out?				An error-prone situation exists with internal cross-referencing if it is not clear which step it refers to. It is recommended that the use of cross-referencing is minimised and that steps are numbered when cross-referencing is used.
		Where cross-referencing to other material is it clear which page and document it refers to?				It is not ideal to have to refer to other documents because it could result in the crew losing their place. However if it is necessary it is recommended that a place keeper symbol be used to aid return to the right place in the drill. It is also recommended that the document and page number if possible are clearly referenced.
3.6	**Figures and tables**	Are the figures and tables clearly linked to the drills they are associated with?				Errors will occur if the wrong figures or tables are referred to. It is recommended that the figures and tables should be clearly labelled to allow correct referencing.
		Are the figures legible and usable?				Performance data contained in graphs will not be usable if the presentation is too small particularly in low visibility situations. Ensure that performance data is legible under operational conditions.
3.7	**Abbreviations and consistency**	Do all captions and labels used in the drill correspond exactly to the labels used on the flightdeck				It is essential that exact correspondence is achieved and any differences must be corrected.
		Does the checklist identify clearly aircraft type, model, variant and modification state?				This could result in the wrong checklist or wrong drill being used. It is recommended that all checklists visually highlight any differences in variants relating to the drills. It is recommended that the checklist relates to the individual aircraft tail.

3.8	**Special cases**	Is the emergency evacuation drill easy to locate?				It should be on the cover of the Emergency Checklist and/or on a separate quick access card.
		Are the rejected take-off and overrun drills easy to locate?				They should be located on a cover of the Emergency Checklist.

APPENDIX D: FLIGHT DATA ANALYSIS PROGRAMME

1.0 INTRODUCTION

Regulations requires that a Kenyan air operator certificate holder operating an aeroplane with a maximum total weight of more than 27,000 kg shall include a flight data monitoring programme as part of its safety management system. An operator's flight data analysis programme is required to be non-punitive and to contain adequate safeguards to protect the source(s) of the data. The operator may contract the operation of a flight data analysis programme to another party while retaining overall responsibility for the maintenance of such a programme. Further to the above requirements ICAO Annex 6 Part I also recommends that an operator of an aeroplane of a certificated take-off mass in excess of 20,000 kg should establish and maintain a flight data analysis programme. In addition ICAO Annex 6 Part III recommends that an operator of a helicopter of a certified take-off mass in excess of 7,000 kg or having a passenger seating configuration of more than 9 and fitted with a flight data recorder should establish and maintain a flight data analysis programme as part of its safety management system. This guidance is for air operators in the process of implementing the programme. The guidance targets both those operators required by regulations and those voluntarily implementing the programme.

2.0 TERMINOLOGY

2.1 Definitions

Exceedence Detection: This looks for deviations from flight manual limits and standard operating procedures (SOPs). A set of core events should be selected to cover the main areas of interest to the operator. A sample list is provided at the end is this appendix.The event detection limits should be continuously reviewed to reflect the operator's current operating procedures.

Flight Data Recorder: This may sometimes be referred to as DFDR (Digital Flight Data Recorder).

Flight Data Analysis: A process or (programme) of analysing recorded flight data in order to improve the safety of flight operations. The programme is sometimes also referred to as Flight Operations Quality Assurance (FOQA) or Flight Data Monitoring.

Quick Access Recorder: A secondary recorder with a removable recording medium, optical disk or solid state (tape in early models) installed in the aircraft for capturing the data.

2.2 Acronyms and Abbreviations

ACAS	Airborne collision avoidance system
ACARS	Aircraft Communication Addressing and Reporting System
ADRS	Aircraft data recording system
ASR	Air safety report
ATC	Air traffic control
Doc	Document
FDA	Flight data analysis
FDAP	Flight data analysis programme
FDAPM	Flight data analysis programme manual
FDR	Flight data recorder
FOQA	Flight Operational Quality Assurance
GPWS	Ground proximity warning system
ICAO	International Civil Aviation Organization
LOSA	Line operations safety audit
QAR	Quick access recorder
SDCPS	Safety data collection and processing system
SOP	Standard operating procedures
SMM	Safety management manual
SMS	Safety management system(s)

3.0 AIMS AND OBJECTIVES OF AN OPERATOR'S FDA

3.1 A Flight data analysis programme will allow an operator to:

- identify areas of operational risk and quantify current safety margins;
- identify and quantify operational risks by highlighting when non-standard, unusual or unsafe circumstances occur;
- use FDA information on the frequency of occurrence, combined with an estimation of the level of severity, to assess the safety risks and to determine which risks may become unacceptable if the discovered trend continues;
- put in place appropriate procedures for remedial action once an unacceptable risk, either flight safety risk actually present or predicted by trending, has been identified; and
- confirm the effectiveness of any remedial action by continued monitoring.

3.2 FDA, sometimes referred to as Flight Data Monitoring or Flight Operational Quality Assurance (FOQA), provides a systematic tool for the proactive identification of hazards. FDA is a predictive complement to hazard and incident reporting, and also to a line operations safety audit (LOSA) where applicable.

3.3 The FDAP may be described as a non-punitive programme for routine collection and analysis of flight data to develop objective and predictive information for advancing safety, e.g. through improvements in flight crew performance, training effectiveness, operational procedures, maintenance and engineering or air traffic control (ATC) procedures.

3.4 FDA involves:

- capturing and analyzing flight data to determine if the flight deviated from a safe operating envelope;
- identifying trends; and
- promoting action to correct potential problems.

3.5 Periodically, flight data are transferred from the aircraft and analysed by the ground analysis system at a centralized location. Deviations of more than certain predetermined values, called "exceedances", are flagged and evaluated. The FDA team will propose and evaluate corrective actions, as well as produce exceedances aggregation over time to determine and monitor trends. FDA also allows for early identification of aircraft system degradation for maintenance action.

3.6 FDA offers a wide spectrum of applications for safety management. Furthermore, it also offers the benefit to improve operational efficiency and economy that compensate the needed investment.

The objective is to:

- determine operating norms;
- identify potential and actual hazards in operating procedures, fleets, aerodromes, ATC procedures, etc.;
- identify trends;
- monitor the effectiveness of corrective actions taken;
- feed data to conduct cost/benefit analysis;
- optimize training procedures; and
- provide actual rather than presumed performance measurement for risk management purposes.

4.0 PROGRAMME DESCRIPTION

4.1 Programme Overview

The quality and capability of an operator's FDAP will be dependent on the selection, availability of flight parameters, and the quick access recorder's (QAR's) availability. The selected flight parameters should be relevant and appropriate to reflect the safety, quality or risk level of the process thereby providing a performance track. It is important to note that the programme description herewith provides baseline components. Therefore, depending on availability of resources, technology, complexity and size of operation the programme will need to be modified to suit the needs of the operator.

4.2 FDA Equipment

FDAPs generally involve systems that capture flight data, transform the data into an appropriate format for analysis and generate reports and visualization to assist in assessing the data. The level of sophistication of the equipment can vary widely.

- Typically, the following equipment capabilities are required for effective FDAPs:

- an on-board device to capture and record data on a wide range of flight parameters. These flight parameters should include, but not be limited to the flight parameters recorded by the flight data recorder (FDR) or aircraft data recording systems (ADRS). The flight parameter performance (range, sampling rate, accuracy, and recording resolution) should be as good as or better than the performance specified for FDR parameters;
- a means to transfer the data recorded on board the aircraft to a ground-based processing station. In the past, this largely involved the physical movement of the memory unit from the QAR. To reduce the physical effort required, later transfer methods utilize wireless technologies;
- a ground-based computer system (using specialized software) to analyze the data (from single flights and/or in an aggregated format), identify deviations from expected performance, generate reports to assist in interpreting the read-outs, etc.; and
- optional software for a flight animation capability to integrate all data, presenting it as a simulation of in-flight conditions, thereby facilitating visualization of actual events for analysis and crew debriefing.

4.2.1 Airborne equipment

Modern glass-cockpit and fly-by-wire aircraft are equipped with the necessary digital data buses from which information can be captured by a recording device for subsequent analysis. Older, non-digital, aircraft are capable of capturing a limited set of data, but may be retrofitted to record additional parameters. Nevertheless, a limited parameter set will allow for a useful, basic FDAP. The flight parameters recorded by the FDR or ADRS may determine a minimum set for an FDAP. In some cases the flight parameters and FDR/ADRS recording duration required by law to support accident and incident investigations may be insufficient to support a comprehensive FDAP. Thus many operators are opting for additional recording capacity, capable of being easily downloaded for analysis.

QARs are optional non-crash protected recorders installed on the aircraft and record flight data in a low- cost removable medium. They are more accessible and record the same parameters for a longer duration than the FDR. New technology QARs and new flight data acquisition systems offer the possibility to capture and record thousands of flight parameters. They also allow for increasing the sampling rate or the recording resolution of specific flight parameters to values appropriate for advanced flight data analysis. The expanded data frame greatly increases the resolution and accuracy of the output from ground analysis programmes. However the data frame definition is one of the more difficult parts of setting up a FDAP. For example in a mixed fleet, it may be expensive to obtain the necessary capability to read different data sets.

An increasing number of aircraft being fitted with light-weight flight recorders as standard equipment, these units will provide a source of flight data for operators of smaller aircraft. This will enable such operators to implement a FDAP commensurate with the size of their operations even if there are no provisions requiring them to institute FDAPs. The light-weight recorders make use of low-cost removable memory cards which may simplify the process to download and analyze the flight data. To eliminate the task of moving the data from the aircraft to the ground station by physically removing the recording medium of the QAR, newer systems automatically download the recorded information via secure wireless systems when the aircraft is in the vicinity of the gate. In other systems, the recorded data is analyzed on board while the aircraft is airborne. The relevant encrypted data is then transmitted to a ground station using satellite communications. Fleet composition, route structure and cost considerations will determine the most cost-effective method of removing the data from the aircraft.

4.2.2 Ground-based computer system for flight data analysis

Flight data are downloaded from the aircraft recording device into a ground-based computer system including analysis software, where the data are held securely to protect this sensitive information. Such computer systems are commercially available; however, the computer platform will require appropriate front-end interfaces to cope with the variety of recording inputs available today.FDAPs generate large amounts of data requiring specialized analysis software. This analysis software facilitates the routine analysis of flight data in order to identify situations that may require corrective action. The analysis software checks the downloaded flight data for abnormalities. The exceedance detection typically includes a large number of trigger logic expressions derived from a variety of sources such as flight performance curves, SOPs, engine manufacturers' performance data, airfield layout and approach criteria. Trigger logic expressions may be simple exceedances such as redline values. The majority, however, are composites which define a certain flight mode, aircraft configuration or payload-related condition. Analysis software can also assign different sets of rules dependent on aerodrome or geography. For example, noise sensitive aerodromes may use higher than normal glide slopes on approach paths over populated areas. The set of trigger logic expressions is normally user-defined. Exceedances and routine measurements can be displayed on a ground computer screen in a variety of formats. Recorded flight data are usually shown in the form of color-coded traces and associated engineering listings, cockpit simulations or animations of the external view of the aircraft.

4.3 Processing FDA Data

4.3.1 Exceedance detection

Exceedance detection, such as deviations from flight manual limits or SOPs is one way of extracting information from flight data. A set of core events/parameters establishes the main areas of interest to an operator. *See the end of this appendix for sample FDA Event List*

Examples: High lift-off rotation rate, stall warning, ground proximity warning system (GPWS) warning, flap limit speed exceedance, fast approach, high/low on glide slope and heavy landing.

Exceedance data provides factual information which complement crew and engineering reports.

Examples: Reduced flap landing, hard landings, emergency descent, engine failure, rejected take-off, go around, airborne collision avoidance system (ACAS) or GPWS warning and system malfunctions.

Operators may also modify the standard set of core events to account for unique situations they regularly experience or for the SOPs they use.

4.3.2 Routine measurements

Data can be retained from all flights, not just the ones producing significant events. A selection of parameters is retained that is sufficient to characterize each flight and allow a comparative analysis of a wide range of operational variability. Emerging trends and tendencies are monitored before the trigger levels associated with exceedances are reached.

Examples of flight parameters monitored: Take-off weight; flap setting; temperature; rotation and lift off speeds versus scheduled speeds; maximum pitch rate and attitude during rotation; and gear retraction speeds, heights and times.

Examples of comparative analyses: pitch rates from high versus low take-off weights; unstable approaches; and touchdowns on short versus long runways.

4.3.3 Incident investigation

FDAPs provide valuable information for incident investigations and for follow-up of other technical reports. Quantifiable recorded data have been useful in adding to the impressions and information recalled by the flight crew. The FDAP data also provide an accurate indication of system status and performance, which may help in determining cause and effect relationships.

- Examples of incidents where recorded flight data could be useful: High cockpit workload conditions as corroborated by such indicators as:
- late descent;

- late localizer and/or glide slope interception;
- large heading change below a specific height; and
- late landing configuration;
- unstabilized and rushed approaches, glide path excursions, etc.;
- exceedances of prescribed operating limitations (such as flap limit speeds, engine over- temperatures); and
- wake vortex encounters, low-level wind shear, turbulence encounters or other vertical accelerations.

4.3.4 Continuing airworthiness

Both routine measurements and exceedances can be utilized to assist the continuing airworthiness function. For example, engine-monitoring programmes look at measures of engine performance to determine operating efficiency, predict impending failures and assist in maintenance schedule.

Examples of continuing airworthiness uses:

- engine thrust level and airframe drag measurements;
- avionics and other system performance monitoring;
- flight control performance;
- monitoring on-condition systems and engine deterioration; and
- brake and landing gear usage.

4.3.5 Integrated safety analysis

All the data gathered in an FDAP should be integrated in a central safety database. By linking the FDAP database to other safety databases (such as incident reporting systems and technical fault reporting systems), a more complete understanding of events becomes possible through cross-referencing the various sources of information. Care should be taken, however, to safeguard the confidentiality of FDA data when linking the data to identified data.

Example of integration: A heavy landing results in a flight crew report, an FDA exceedance and an engineering report. The flight crew report provides the context, the FDA exceedance provides the quantitative description and the engineering report provides the result.

4.4 Analysis and Follow-up

Overviews and summaries of FDA data are compiled on a regular basis, usually weekly or bi-weekly, whilst individual significant events would be expected to be more timely followed up. All data should be reviewed to identify specific exceedances and emerging undesirable trends and to disseminate the information to flight crews. If deficiencies in the flight technique are recognized, the information is de-identified in order to protect the identity of the flight crew. The information on specific exceedances is passed to a flight crew contact person or ‘gate keeper’. This person provides the necessary contact with the flight crew in order to clarify the circumstances, obtain feedback and give

advice and recommendations for appropriate action, such as flight crew re-training (carried out in a positive and non-punitive way), revisions to operating and flight manuals or changes to ATC and aerodrome operating procedures.
All events are archived in a database. The database is used to sort, validate and display the data in easy- to-understand management reports. Over time, this archived data can provide a picture of emerging trends and hazards which would otherwise go unnoticed.

Lessons learned from the FDAP may warrant inclusion in the company's safety promotion activities. Care is required, however, to ensure that any information acquired through FDA is de-identified before using it in any training or promotional initiative unless permission is given by all the crew members involved. Care should also be taken that, in order to avoid an exceedance, flight crews do not attempt to "fly the FDA profile" rather than follow SOPs. Such a behavior would have a negative impact on safety.
A proper value should be programmed for trigger and exceedance and designed to include an acceptable buffer that will disregard minor deviation, spurious events, as well as introduce an adequate operational margin to fly the plane through SOPs, instead of leading the flight crew to focus on FDA parameters in order to avoid deviations.
As in any closed-loop process, follow-up monitoring is required to assess the effectiveness of any corrective actions taken. Flight crew feedback is essential for the identification and resolution of safety problems. All successes and failures should be recorded, comparing planned programme objectives with expected results. This provides a basis for review of the FDAP and the foundation for future programme development.

5. 0 MPLEMENTING FDAP

5.1 Integrity and Protection

The integrity of a FDAP rests upon protection of the FDA data. Any disclosure for purposes other than safety management can compromise the required cooperation of the affected flight crew for clarifying and documenting an event. Thus, preventing the misuse of FDA data is a common interest of the State, the operator and the flight crews. Data protection can be optimized by:

- adhering to the agreement between management and the flight crews, where available;
- strictly limiting data access to selected individuals;
- maintaining tight control to ensure that data identifying a specific flight are kept securely;
- ensuring that operational problems are promptly addressed by management;
- to the extent possible, non-reversible de-identification of the flight data files after a time appropriate for their analysis, and
- developing a policy on data retention

An important prerequisite is the existence of an effective non-punitive reporting policy in the organisation. This should be supported by requirements and procedures that protect captured safety data from inappropriate use.

5.2 Implementation Plan

Initial implementation may focus on one aircraft type and then move on to the other aircraft types.

Typically, the following steps are required to implement an FDAP:

- management approval of the programme;
- implementation of a formal agreement between management and flight crews;
- identification of an FDAP implementation committee, including the future FDA team members; this committee should be involved in all of the following steps;
- development of a business plan, including processes, software and hardware and assignment of adequate resources;
- establishment and verification of operational and security procedures;
- development of a FDAP procedures manual;
- assessment of possible interfaces between the FDAP and other safety data sources (i.e. SDCPS) and of integration of the FDAP into the SMS;
- selection of equipment (airborne, ground-based computer system, interface with other data sources and the SMS);
- selection and training of the FDA team members, according to their respective roles;
- testing of data transfer; testing of the ground-based computer system (including data acquisition, definition of trigger logic expressions, data analysis and visualization, data de-identification, final storage of data);
- testing of data security, including security procedures;
- identification of areas of interest that should be first looked at in the data;
- checking of the proper decoding and of the quality of flight parameters used by the FDAP; and
- start of data analysis and validation, focused on key areas in operation.

It would be expected that a start-up airline would take about two years to adequately implement an effective monitoring program. Data analysis will commence earlier where analysis services are outsourced to an experienced service provider. It is also considered essential that the FDA is integrated seamlessly within the SMS to maximise safety benefits. The data provided by the program will provide quantitative information to support investigations that would be otherwise based on subjective reports.

A pre-planned phased approach is recommended so that the foundations are in place for future expansion into other areas. A building block approach will allow expansion, diversification and evolution of the program through experience.

Initially to prove the program's effectiveness it is useful to start with a modest monitoring schedule by targeting areas of known interest or safety concerns. A focused and disciplined approach is more likely to achieve the early aims and goals of the program that will lead to its success. For example, difficult approaches at certain airports, rough or short runways, high fuel usage on particular flight segments. Analysis of known problem areas is likely to generate useful monitoring methods for other locations and flight segments.

In the short term it will be necessary to establish data download frequency and procedures and test replay the software as well as identify any defects. Validation and investigation of exceedance data would then commence. It will also be necessary to establish a routine report format that highlights individual exceedance events and facilitates the acquisition of relevant statistics.

6.0 THE FDA TEAM

6.1 Experience has shown that the "team" required to run a FDAP can vary in size from one person for a small fleet, to a dedicated section for large fleets. The descriptions below identify various functions to be fulfilled, not all of which need a dedicated position since some functions may be combined for one position.

6.1.1 Team leader. It is essential that the team leader earns the trust and full support of both management and flight crews. He/she acts independently of others in line management to make recommendations that will be seen by all to have a high level of integrity and impartiality. The individual requires good analytical, presentation and management skills. He/she should be the safety manager or placed under the authority of the safety manager.

6.1.2 Flight operations interpreter. This person is usually an experienced pilot in the type and operation who knows the operator's route network and aircraft. This team member's in-depth knowledge of SOPs, aircraft handling characteristics, airports and routes will be used to place the FDA data in a credible context.

6.1.3 Technical interpreter. This person interprets FDA data with respect to the technical aspects of the aircraft operation and is familiar with the power plant, structures and systems departments' requirements for information and any other engineering monitoring programmes in use by the operator.

6.1.4 Flight crew contact person. This is a person usually assigned by the operator for this responsibility (safety officer, agreed flight crew representative, or a mutually acceptable substitute), for confidential discussion with flight crews involved in events highlighted by FDA. The position requires good people skills and a positive attitude towards safety education. The flight crew contact person should be the only person permitted to connect the identifying data with the event and is sometimes referred to as the 'gate keeper'. The flight crew contact person requires the trust of both flight crew members and managers for his/her integrity and good judgment.

6.1.5 Engineering technical support. This person is usually an avionics specialist, involved in the supervision of FDR serviceability. Indeed, the FDAP can be used to monitor the quality of flight parameters sent both to the FDR and to the FDA recorder, and thus ensure the continued serviceability of the FDR. This team member should be knowledgeable about FDA and the associated systems needed to run the programme.

6.1.6 Air safety coordinator. This person cross-references FDA information with other safety data sources (such as the company's mandatory or confidential incident reporting programme and LOSA) and with the operator's SMS, creating a credible integrated context for all information. This function can reduce duplication of follow-up investigations.

6.1.7 Replay operative and administrator. This person is responsible for the day-to-day running of the system, producing reports and analysis. Methodical, with some knowledge of the general operating environment, this person keeps the programme moving. Operators may utilize the services of a specialist contractor to operate the FDAP.

6.2 All FDAP team members need appropriate training or experience for their respective area of data analysis and should be subject to a confidentiality agreement.

6.3 Each team member should be allocated a realistic amount of time to regularly spend on FDA tasks. With insufficient human resources, the entire programme will underperform or even fail.

7.0 CONTINUOUS IMPROVEMENT

7.1

7.1 New safety challenges to flight operations that are identified and published by other organizations, such as safety investigation reports, safety bulletins by the aircraft manufacturer or safety issues identified by aviation authorities, should be assessed for inclusion in a corresponding monitoring activity of the FDAP.

7.2 The FDA processes and procedures will need to be amended when the FDAP matures and each time there are changes in the operations, the internal organization of the aircraft operator or the interface with other data sources and processes.

7.3 In order to assess the general effectiveness of the FDAP, a periodic review or an audit may be beneficial. Such a review could determine:

- if anticipated safety benefits are being realized;
- if the FDA procedures reflect the actual operation of the FDAP, and if they have been followed;
- whether the information provided to FDAP users is accurate, timely, and usable; and
- if the tools employed to collect and present data are still adequate and if other technology would be more effective.

SAMPLE FDA EVENT LIST

These operational events are typical of those found in most software packages. FDA event sets should be tailored to the specific requirements of the operator and the specific aircraft types. The event list should be expanded with the maturity of the programme. A detailed list that includes the event trigger parameters should be developed and presented to the authority.

EVENT GROUP	**DESCRIPTION**
Taxi Speed	High speed during taxi – straight High speed during taxi - turn
Rejected Takeoff	High speed Rejected Takeoff
Takeoff Pitch	Pitch rate high on take-off Pitch attitude high during take-off
Takeoff Speed (Unstick)	Unstick speed high Unstick speed low
Height loss in climb-out	Initial climb height loss 20 ft to 400 ft AGL Initial climb height loss 400 ft to 1500 ft AGL
Slow climb out	Excessive time to 1000 ft AAL after take-off
High rate of descent	High rate of descent below 2500 feet AGL High rate of descent below 1000 feet AGL
Low approach	Low on approach
Deviation from glide slope	Deviation under glide slope below 1000 ft Deviation above glide slope below 1000 ft
Approach power	Low power on approach
Approach speeds	Approach speed high below 500 ft AGL Approach speed high below 50 ft AGL
Landing Flaps	Late landing flaps (below 1000 ft) Reduced flap landing Flap load relief system operations
Landing	Hard Landing
Landing Pitch	Pitch attitude high on landing Pitch attitude low on landing
Go Around	Go around below 1000 ft

Bank Angles	Excessive Bank above 1000 ft AGL Excessive bank below 500 ft AGL Excessive bank below 50 ft AGL
Abnormal Configuration	Take off configuration warning Early configuration change after take-off Speed brake selection with landing flaps Speed brakes on approach below 1000 feet Landing gear configuration below 1000 feet
EGPWS Warning	EGPWS Operation – hard warning EGPWS Operation – soft warning Windshear warning
TCAS warning	TCAS RA Operation
Margin to stall/buffet	Stick shaker operation in flight
	False stick shaker Reduced lift margin during flight Reduced lift margin at take-off Low buffet margin (above 20,000 ft)
Flight Manual Limitations	VMO exceedence MMO exceedence Flap speed exceedence Gear down speed exceedence Gear selection speed exceedence Maximum operating altitude exceedence Maximum landing weight exceedence
High Cabin Altitude	Cabin Altitude Warning
Engine Parameters	Engine start EGT Take off EGT