Doc 7192-AN/857
Part E-3

TRAINING MANUAL

Part E-3
AERONAUTICAL INFORMATION SERVICES PERSONNEL

PRELIMINARY EDITION — 2005

International Civil Aviation Organization

Approved by the Secretary General
and published under his authority

INTERNATIONAL CIVIL AVIATION ORGANIZATION

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FOREWORD

The need, role and importance of aeronautical information/data has changed significantly with the evolution/implementation of the Communication, Navigation and Surveillance/Air Traffic Management (CNS/ATM) systems. The implementation of area navigation (RNAV), required navigation performance (RNP) and airborne computer-based navigation systems brought with them more stringent requirements for quality (accuracy, resolution and integrity) of aeronautical information/data. Corrupted or erroneous aeronautical information/data can potentially affect the safety of air navigation

The airline industry recognizes that in terms of safety, navigation performance and accuracy, technological needs and economic efficiencies, existing and evolving navigation systems require and are dependent upon the quality of State aeronautical information/data. Rapidly evolving technologies in the aviation environment are causing airlines to be more and more dependent on efficiency, accuracy completeness and timeliness of the Aeronautical Information Service. The Air Traffic Services also have a dependency on aeronautical information and, to ensure the commonality and integrity of that information/data, many States operate their automated air traffic control and aeronautical information service systems from a common (AIS) database.

In the Standards and Recommended Practices related to the Quality System in Annex 15 it is noted that the International Organization for Standardization (ISO) 9000 series of quality assurance standards provide a basic framework for the development of a quality assurance program. (Note to Annex 15 paragraph 3.2.1).

It has been noted that, when formulating a quality assurance program, an organization may tend to limit its focus of attention to the processes and procedures that are involved in the provision of the service. However, it is also essential that the quality program is able to demonstrate, on a continuing basis, that the personnel providing the service possesses and utilizes the skills and competencies necessary to operate within the quality system as a whole.

In the context of the Quality System, the objectives of skills and competency management must include:

(a) identification of the functions to be performed;

(b) establishment of the knowledge and skills required for each step of the processes; and,

(c) assurance that the personnel assigned to those functions have the required knowledge and skills and that they are competent to perform those functions.

Additionally, as with all other components of the quality system, appropriate records of skills need to be kept so that the qualifications of personnel assigned to perform specific procedures can be confirmed. Checks must be undertaken periodically to ensure that personnel continue to meet the required standards and if shortfalls in knowledge, skills or competencies are detected a means must exist to take corrective measures.

It is therefore appropriate that States place emphasis on the human component in their quality management program for the provision of aeronautical information services. In considering that the human component in the quality system plays an extremely important role, it is appropriate that corresponding emphasis be placed on the development of an ICAO training program by establishing uniform standards for the qualifications and scope of knowledge which must be met by aeronautical information services/aeronautical charts (AIS/MAP) technical officers world-wide.

In the past guidance on appropriate training material has been provided to States through:

(a) ICAO Doc 7192-AN/857, *Training Manual Part E-3, Aeronautical Information Services Personnel. (First Edition 1980)*; and

(b) ICAO Technical Assistance Guidelines, Training Guideline Incorporating a Syllabus Model, *Course 021 - Aeronautical Information Officer* (Issued May 1981 and Re-issued 1987).

However, it will be noted that these documents are now outdated due to more recent developments, particularly with the increasing use of automation within aeronautical information services and aeronautical charting.

Amendment 29 to Annex 15 - *Aeronautical Information Services* introduced requirements for a quality system into AIS. Amendment 30 to Annex 15 introduced new provisions concerning the Quality system, exchange of aeronautical information/data and Human Factors considerations, whereas Amendment 31 to Annex 15 introduced provisions for automated pre-flight information systems to make aeronautical information/data available for self briefing, flight planning and flight information service purposes.

The second edition of Doc. 7192, Part E 3 - *Aeronautical Information Services Officer* has been developed taking into consideration the changed conditions/requirements mentioned above. It contains training syllabi for AIS/MAP officers covering knowledge requirements and job specific applied practical training. Subject matter that must be addressed is indicated in Table 1-1, which includes the approximate duration of the course and the degree of expertise required in each subject.

Details of training and syllabi included in this manual are not all-inclusive and are provided as a guideline to the minimum requirement for the training of AIS/MAP Officers.

It will be recalled that ICAO developed a methodology for the evolution and production of training material under the TRAINAIR program. Within this program, member organizations of TRAINAIR work collectively to produce training course material with each individual member undertaking to produce one or more different Standard Training Packages (STPs). Whilst each STP deals with a different topic, they are all prepared to a common standard and subject to quality control processes. Upon completion, these STPs are then distributed amongst the TRAINAIR membership, thus providing a common training syllabus and material.

This Manual has been prepared by the Personnel Licensing and Training Section of ICAO, with support, and input from the ICAO Aeronautical Information and Charts Section, and replaces ICAO Doc. 7192 - Training Manual Part E-3 – *Aeronautical Information Services Personnel* (First Edition 1980) and ICAO Course 021 – *Aeronautical Information Officer* (May 1981).

Comments on this manual, particularly with respect to its application, usefulness and scope of coverage, would be appreciated from States and ICAO Technical Cooperation Field Missions. These will be taken into consideration in the preparation of subsequent editions. Comments concerning this manual should be addressed to:

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(Editorial: To be completed after finalizing the document)

ABBREVIATIONS
(used in this manual)

Editorial: (To be checked and finalized)

ACARS	Aircraft communications addressing and reporting system
ACC	Area control centre or area control
ACN	Aircraft classification number
ADF	Automatic direction finder
ADS	Automatic dependent surveillance
AFS	Aeronautical fixed service
AFTN	Aeronautical fixed telecommunication network
AIC	Aeronautical Information Circular
AIP	Aeronautical information publication
AIRAC	Aeronautical information regulation and control
AIREP	Air-report
AIRMET	Information concerning en-route weather phenomena which may affect the safety of low-level aircraft operations
AIS	Aeronautical information service
AMDAR	Aircraft meteorological data relay
AMSS	Aeronautical mobile satellite system
APP	Approach control office or approach control or approach control service
ARM	Resource management for AIS/MAP
ASDAR	Aircraft to satellite data relay
ASHTAM	A special series NOTAM notifying by means of a specific format, change in activity of a volcano, a volcanic eruption and/or volcanic ash cloud that is of significance to aircraft operations
ASM	Airspace management
ATC	Air traffic control
ATIS	Automatic terminal information service
ATM	Air traffic management
ATN	Aeronautical telecommunication network
ATS	Air traffic service
AWOS	Automated weather observing system
BOW	Basic operating weight (mass)
CADC	Central air-data computer
CAVOK	Visibility, cloud and present weather better than prescribed values or conditions
CCTV	Closed circuit television
CDU	Control and display unit
CG	Centre of gravity
CNS	Communication, navigation and surveillance
CofA	Certificate of airworthiness
CP	Critical point

CPDLC Controller-pilot data link communications
CRC Cyclic redundancy check
CRM Crew resource management
D-ATIS Data link automatic terminal information service
DME Distance measuring equipment
DOW Dry operating weight (mass)
DoE Degree of expertise
DSB Double sideband
D-VOLMET Data link VOLMET

ETD Estimated time of departure
ETOPS Extended range operations by aeroplanes with two turbine power-units
FANS Future Air Navigation Systems
FIC Flight information centre
FIR Flight information region
FIS Flight information service
FMS Flight management system
FOO/FD Flight operations officer/flight dispatcher
GAMET Area forecast for low-level flights
GNSS Global navigation satellite system
GRIB Processed meteorological data in the form of grid point values expressed in binary form
HF High frequency
HSI Horizontal situation indicator
IAS Indicated airspeed
IATA International Air Transport Association
IAVW International airways volcano watch
ICAO International Civil Aviation Organization
ILS Instrument landing system
INS Inertial navigation system
IRS Inertial reference system
ISO International Organization for Standardization
ITCZ Inter-tropical convergence zone
ITRS International terrestrial reference system
KM Kilometres
LF Low frequency
LMC Last-minute change
LOFT Line-oriented flight training
MAC Mean aerodynamic chord
MAP Aeronautical maps and charts
MAT Mass/altitude/temperature
MEL Minimum equipment list
METAR Aviation routine weather report
MF Medium frequency

MNPS Minimum navigation performance specifications
MPTOW Maximum permissible take-off operating weight (mass)
MPZFW Maximum permissible zero-fuel operating weight (mass)
MTT Minimum time track
MWO Meteorological watch office
NDB Non-directional radio beacon
NM Nautical mile
NOF International NOTAM office
NOTAM Notices to airmen
OSI Open systems interconnection
PANS Procedures for air navigation services
PCN Pavement classification number
PIB Pre-flight information bulletin
PNR Point of no return
QFE Atmospheric pressure at aerodrome elevation
QNH Altimeter sub-scale setting to obtain elevation when on the ground
RM Resource management
RMI Radio magnetic indicator
RNAV Area navigation
RNP Required navigation performance
RVR Runway visual range
SARPS Standards and recommended practices
SID Standard instrument departure
SIGMET Information concerning en-route weather phenomena which may affect the safety of aircraft operations
SIGWX Significant weather
SNOWTAM A special series NOTAM notifying the presence or removal of hazardous conditions due to snow, ice, slush or standing water associated with snow, slush and ice on the movement area, by means of a specific format
SPECI Aviation selected special weather report (in aeronautical meteorological code)
SPECIAL Special meteorological report (in abbreviated plain language)
SSB Single sideband
SSR Secondary surveillance radar
STAR Standard instrument arrival
SUPPS Regional Supplementary Procedures
SVR Slant visual range
TACAN UHF tactical air navigation aid
TAF Aerodrome forecast
TAS True airspeed
TCAC Tropical cyclone advisory centres
TOW Take-off weight (mass)
TWR Aerodrome control tower or aerodrome control
UHF Ultra high frequency
UIR Upper flight information region

UTC	Coordinated universal time
VAAC	Volcanic ash advisory centres
VFR	Visual flight rules
VHF	Very high frequency
VLF	Very low frequency
VOLMET	Meteorological information for aircraft in flight
VOR	VHF omnidirectional radio range
WAFC	World area forecast centre
WAFS	World area forecast system
WGS-84	World geodetic system-1984
WMO	World Meteorological Organization
ZFW	Zero-fuel weight (mass)

CHAPTER 1. TRAINING PRINCIPLES

1.1 INTRODUCTION

1.1.1 ICAO Annex 15 to the Convention on International Civil Aviation (Chapter 1) states:

"*The object of the Aeronautical Information Service is to ensure the flow of information necessary for the safety, regularity and efficiency of international air navigation. The role and importance of aeronautical information/data changed significantly with the implementation of area navigation (RNAV),required navigation performance (RNP) and airborne computer-based navigation systems. Corrupt or erroneous aeronautical information/data can potentially affect the safety of air navigation.*

To satisfy the uniformity and consistency in the provision of aeronautical information that is required for the operational use by computer-based navigation systems, States shall, as far as practicable, avoid standards and procedures other than those established for international use."

1.1.2 Although the operational environment in which AIS/MAP personnel work, and the tasks they may be required to perform, may vary between States, there is nevertheless a need to establish a common standard for the depth and scope of knowledge and skills which must be met by all AIS/MAP technical officers. Increasing emphasis should be placed on quality systems and data management, in addition to the "traditional" skills.

1.1.3 In order to satisfy these fundamental criteria, it is essential that ICAO define the necessary knowledge and skill requirements and prescribe a training program for AIS/MAP technical officers engaged in the provision of aeronautical information services and aeronautical charts.

1.1.4 The successful application of regulations concerning the safety and regularity of aircraft operations and the achievement of regulatory 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 involved with aircraft operations. AIS/MAP technical officers play a significant role to ensure the safe operation of aircraft and must therefore be appropriately trained.

1.2. TRAINING REQUIREMENTS

1.2.1 Principal duties

1.2.1.1 To ensure that AIS/MAP technical officers are properly qualified and competent to perform their tasks, not only must they be conversant with the provisions of Annex 15 - *Aeronautical Information Services*, Annex 4 - *Aeronautical Charts*, and the relevant guidance material that is contained in the accompanying ICAO Doc 8126 - *Aeronautical Information Services Manual* and ICAO Doc 8697 - *Aeronautical Chart Manual*, they must also have a thorough understanding of the user needs to ensure that the user receives all relevant information which is of good quality, concise, complete, unambiguous and timely.

1.2.1.2 In order to achieve this, the AIS/MAP technical officer requires competency and skills in the day-to day management and manipulation of aeronautical information/data and an understanding of the

nature of the information being handled and the uses to which it will be put. The precise knowledge and skills will depend on the specific AIS/MAP function the technical officer is performing at the time.

1.2.1.3 In accordance with the international Standards and Recommended Practices (SARP) contained in ICAO Annex 15, [3.1.7]: "*An aeronautical information service shall receive and/or originate, collate or assemble, edit, format, publish/store and distribute aeronautical information/data concerning the entire territory of the State as well as areas in which the State is responsible for air traffic services outside its territory. Aeronautical information shall be published as an Integrated Aeronautical Information Package"*. Paragraph 3.1.2 adds that *"An aeronautical information service shall, in addition, obtain information to enable it to provide pre-flight information service and to enable it to meet the need for in-flight information: .....*".

1.2.1.4 To meet the requirements in paragraph 1.2.1.3 above, the State's Aeronautical Information Services have been divided into the following AIS/MAP functional areas of responsibility:

- AIS/MAP Aerodrome Unit/ARO
- AIS/MAP International NOTAM Office (NOF)
- AIS/MAP Database Unit
- AIS/MAP Publications/Editing/Text producing Unit
- AIS/MAP Aeronautical Cartographic Unit

1.2.1.5 Consequently, when determining the scope and depth of skills required of AIS/MAP personnel, it is necessary to analyse the duties and tasks required of them. A summary of the *principal* tasks are:.

AIS Aerodrome Unit/ARO

Prepare and maintain briefing material;

Prepare pre-flight information for aircrew and aircraft operators;

Provide face to face briefing to aircrew and aircraft operators;

Operate remote briefing equipment;

Maintain briefing office displays and wall charts;

Clarify publications;

Provide in-flight information to air traffic control;

Receive post-flight information from aircrew and take appropriate action;

Maintain AIS/MAP library of reference material; and

Provide on the job training.

Where pre-flight and post-flight services are combined with the ATS Reporting Office (ARO) a number of additional functions are required.

International NOTAM Office

Collect, collate and verify NOTAM information;

Originate NOTAM/ SNOWTAM/ ASHTAM;

Receive and re-distribute incoming NOTAM/SNOWTAM/ASHTAM;

Maintain NOTAM database;

Prepare and issue trigger NOTAM;

Originate and maintain NOTAM checklists; and

Prepare and issue list of valid NOTAM.

AIS/MAP Database Unit

Collect, compile and validate static (AIP) data;

Prepare static (AIP) data for database;

Collect, compile and validate dynamic data;

Prepare dynamic data for database;

Maintain database;

Perform data quality and integrity checks.

AIS/MAP Publication, Editing and Text producing Unit

Operate the desk-top publishing system;

Prepare, edit and compile the Aeronautical Information Publication (AIP), AIP Amendments, AIP Supplements, Aeronautical Information Circulars (AIC) and Checklists;

Print and distribute elements of the Integrated Aeronautical Information Package (IAIP)(except NOTAM);

Air Navigation Commission

Maintain central AIS/MAP library of national and international IAIPs.;

AIS/MAP Cartographic Unit

Collect and collate source data for preparation of aeronautical charts;

Compile and prepare aeronautical charts, maps (and instrument procedures as required);

Amend aeronautical charts, maps and instrument procedures;

Pre-and post-press proofing;

Prepare chart elements/material ready for printing.

Note 1.- The functions of AIS/MAP management and administration are not considered in this context.

Note 2.- More detailed information on AIS/MAP duties is provided in Phase II - Specialization.

1.2.1.6 The actual means by which these functions are performed will depend on the State's working environment which may vary from fully manual systems to automated systems which are capable of output, ranging from traditional (paper) copy to the direct provision of data to users by electronic means.

1.2.1.7 To undertake the required duties and responsibilities, AIS/MAP personnel must be appropriately trained in all the subjects required. As a specialist, an AIS/MAP technical officer needs to demonstrate a high sense of responsibility, dependability, the ability to work with great accuracy, to think clearly and to make appropriate decisions as required. The training of AIS/MAP technical officers should include several stages of selection in order to eliminate trainees lacking the necessary qualities.

1.2.1.8 In addition to AIS/MAP technical officers, a State may employ AIS/MAP clerical/specialist/technical support staff. The allocation of general duties to clerical support staff may include collecting, recording and distributing aeronautical information and amending foreign AIS/MAP documentation. In addition, specialist support staff may be employed in cartographic drafting and translation of aeronautical information.. Their duties are supervised by AIS/MAP technical officers.

1.2.1.9 Training of AIS/MAP clerical support staff, involved in collecting, recording, distributing aeronautical information and amending of AIS/MAP documentation and of specialist support staff employed in cartographic operations and in translation of aeronautical information is not included in this training manual, and is to be arranged by individual States according to their needs.

1.2.2 Minimum qualifications

1.2.2.1 The trainee AIS/MAP technical officer must meet certain training pre-requisites which indicate a prior level of education, personal maturity and an aptitude for the work concerned. In this regard the trainee requires:

(a) a minimum age of 18 years at the time he or she will commence the training;

(b) a minimum of 11 years of successful schooling including the subjects of Mathematics, Physics and Geography (Secondary school or more). Basic automation/computer knowledge will be an asset;

c) a medical fitness appropriate for AIS/MAP duties; and

(d) a level of proficiency in speaking and understanding English language at Level 3, as specified in ICAO Annex 1 - *Personnel Licensing*, Attachment - *ICAO Language Proficiency Rating Scale*.

Note 1.- Proficiency will be demonstrated on a standardized test, many of which are available commercially. common English language reading and writing skills are of primary importance with speaking skills also of importance.

Note 2.-If the required language proficiency level is not achieved at the recruitment phase, English language courses should be included in the course syllabus to ensure that the required language proficiency level is reached before AIS/MAP duties will be performed.

Note 3.- During the course, trainees should gain a level of proficiency in written Aeronautical English language.

Note 4.- Before performing the duties of AIS/MAP Aerodrome Unit/ARO Specialist, trainees should demonstrate proficiency in aeronautical English language at Level 4 (Operational) as specified in the above mentioned ICAO Annex 1 - Attachment.

1.2.3 Types of training

1.2.3.1 For someone working in any AIS/MAP function, it is essential to have an aviation background, because the aeronautical information he or she has to deal with, covers a broad field of aviation activities. As the principal end-user of the aeronautical information provided by AIS/MAP is the aviation community at large, including flight crews, the AIS/MAP technical officer should have a thorough understanding/knowledge of aviation in its many aspects.

1.2.3.2 There are various forms of past aviation experience that are adequate for the AIS/MAP technical officer, and some States may select their AIS/MAP technical officer trainees from personnel who have had such aviation experience/background. However, persons who do not have an aviation background/experience must be trained from the very beginning and must obtain the necessary aviation background during their training. It is obvious that the training requirements of these two groups of trainees are different.

1.2.3.3 To cover the various backgrounds of trainees, AIS/MAP training should cover:

Prerequisite/minimum qualification test, which includes some Mathematics, Physics, Geography subjects and proficiency in the English language

*Aviation specific knowledge requirements,,*which provides the trainee with the aviation knowledge necessary for the performance of AIS/MAP duties.

AIS/MAP specific knowledge requirement, which covers the course material specific to Aeronautical Information Services and Aeronautical Charts.

AIS/MAP Specialization, which provides Job Specific and Applied Practical training for the different AIS/MAP functions

1.2.3.4 Trainees who do not have previous aviation experience will have to undergo the complete training programme. Trainees who have had suitable aviation experience, however, may not need to undertake this complete programme; for example, candidates who received training as a professional pilot, a flight navigator or an air traffic controller can be assumed to have, at least, partially completed the General knowledge and Aviation Specific Training parts of the course, if they have been actively employed in these occupations within the past few years. In such cases, training institutes, with the approval of the State authorities, are encouraged to apply the necessary flexibility in arranging appropriate training courses, emphasizing subjects of particular concern to AIS/MAP Officers. The same flexibility can also be applied during re-qualification or recurrent classroom training.

Table 1-1 provides an approximate duration for the training of the AIS/MAP Officer. It also contains a proposed shortened training duration to serve as a guideline for the training of personnel with aviation experience/background and for the re-qualification of AIS/MAP Officers.

1.2.3.5 In using the curriculum recommended in this manual, local considerations may dictate the advisability of changing the sequence of subjects. However, the relative importance accorded to each subject should, as much as possible, remain unchanged. The multiplicity of types of aircraft, navigation aids and operational practices throughout the world makes it undesirable to define too rigidly many of the headings of the syllabus, and it is necessary to leave some flexibility to those in charge of the training course. Instructors must, however, ensure that all items in the training manual syllabus are adequately covered and any requirements relevant to individual authorities should be treated as additional subjects and not as substitutions for the syllabus recommended in this manual. Instructors must also ensure that all items required in their State's examinations are adequately covered. Any choices in the examination itself should be confined to the additional subjects dealing with those practices and procedures which the trainee is most likely to use in the first period of his or her duties as an AIS/MAP technical officer.

1.2.4 Standard of accomplishment

1.2.4.1 Each training objective in this manual is described with reference to the establishment of conditions, performance and a standard of accomplishment. The conditions describe the scenario where trainee performance will be developed and tested while indicating whether actual equipment, mock-ups, or simulators, etc., are to be used. The standard of accomplishment establishes the level of trainee performance that must be attained and may differ from school to school depending on the training equipment available.

1.2.4.2 In measuring the standard of accomplishment, the use of only two grades, *pass* and *fail*, is recommended. It must, however, be noted that many training establishments prefer to use a numerical grading system.

1.2.4.3 The training program should aim at a quality assurance level in accordance with the ISO 9000 principles. It should be ensured that AIS/MAP personnel possess the knowledge, skills and competencies required to perform the specific assigned AIS/MAP functions at a level required by the provisions of ISO 9001:2000 Quality Management System.

1.2.5 Training reference guide

1.2.5.1 Table 1-1 presents the recommended duration of the various subjects that need to be covered. In appreciation of the fact that differences in requirements may necessitate changes in the suggested syllabus to allow completion of the course within the period allotted for training, the total hours required for the completion of a subject are given. Instructors must, however, ensure that all sections of the syllabus are adequately covered to the necessary degree in order to meet the desired level of accomplishment.

1.2.5.2 In addition, the various parts of the course have been marked with a coding from 1 to 4 indicating an increasing degree of expertise (DoE) to clarify understanding of the desired level of accomplishment, as follows:

1 – denotes a basic knowledge of a subject. Trainees should have a basic understanding of the subject but are not expected to apply that knowledge.

2 – denotes knowledge of the subject and the ability, where applicable, to apply it in practice with the help of reference materials and instructions.

3 – denotes a thorough knowledge of the subject and the ability to apply it with speed and accuracy.

4 – denotes extensive knowledge of the subject and the ability to apply procedures derived from it with judgement appropriate to the circumstances.

Subject matter	*Recommended duration (hours)*		***Degree of expertise***
	*Trainees **without** previous aviation experience*	*Trainees **with** previous aviation experience*	
Pre-requisites/minimum qualifications/test for AIS/MAP Officers	**...**	**...**	
Mathematics	...	...	
- Arithmetic			3
- Algebra			3
- Trigonometry			3
Physics			
- Motion			3
- Temperature			3
- Pressure			3
Geography	...	...	
- The earth and time			3
- Topography and major transport routes			2
English			
- English language proficiency rating			3
- Written test			3
- Oral test			3[1]
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Chicago Convention)			
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- International agreements/conventions ratified by the State	2		2
- Flight documents to be carried on aircraft	2		1
Aviation Terminology. Flight Operation and Aircraft Systems	**8**	**4**	
- Aviation terminology and terms common to aircraft operations	4		2
- Theory of flight and flight operations	2		1
- Aircraft (including helicopter) systems	2		1
Navigation	**24**	**15**	
-Position and distance	5		3
- True and magnetic directions	3		3
- Time-UTC	1		3
- Gyroscopes	1		1
- Chart projections	4		2
- Charts used by a typical aircraft operator	1		1
- Measurement of aircraft speed	1		1
- Track and ground speed	2		1
- Altimetry and altimeters	3		1
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- Critical point (equal time point)	1		1
- General determination of an aircraft position	2		2
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- Basic mass and speed limitations	1		1
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-Thunderstorms	1		1
-Aircraft icing	2		1
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-Volcanic ash	1		1
-Aeronautical meteorological observations	1		1
- Sources of meteorological observations	1		1
-Meteorological service for international air navigation	2		1
-Aeronautical meteorological reports	5		1
-Prognostic charts	1		1
-Aeronautical forecasts and warnings	3		1
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- Definitions, applicability and availability			2
- General specifications			3
- Specifications for aeronautical charts			3
Aeronautical Charts - Production	**25**	**20**	
- General			2
- Requirements for aeronautical charts			2
- Maintenance of charts			2
- Cartographic techniques			2
- Reproduction			2
- Chart distribution			2
World Geodetic System - 1984 (WGS-84)	**15**	**10**	
- Introduction			1
- Accuracy resolution and integrity of aeronautical data			2
- The global WGS-84 Coordinate system			2
- A guide to obtain WGS-84 coordinates			1
- Surveying guidance			1
- Quality assurance			2
- Deliverables			1

- The Global Positioning System			1
- Principles of Geodesy			1
- The international terrestrial reference system (ITRS)			1
- Datum transformation formulae			1
- Surveying and photogrammetric methods			1
- Map projections			1
ICAO Abbreviations and Codes	**25**	**20**	
-Principles for the formulation of abbreviations			2
-Abbreviations - Decode/Encode			3
-Abbreviations for identifying Aeronautical Fixed Service (AFS) Messages			2
Abbreviations and terms to be transmitted as spoken words when used in radio telephony			2
Abbreviations and terms to be transmitted using the individual letters in non-phonetic form when used in radiotelephony			2
Designation of typical radiocommunication emissions			2
The NOTAM Code			4
Location Indicators	**15**	**10**	
- Definitions			3
- Formulation and assignment of location indicators			3
- Addresses of centres in charge of FIR/UIR			3
- Location indicators - Encode/Decode			3
Regional Supplementary Procedures	**6**	**4**	
- Criteria to be satisfied in the development of SUPPS			1
- Status of SUPPS			1
- Application of SUPPS			1

- SUPPS published in National AIP			2
- SUPPS published in AIPs of neighbouring States			1
Quality System	**15**	**10**	
-Annex 15 - Definitions			3
-Annex 15, Chapter 3.2, Quality System and Appendix 7 Aeronautical data quality requirements			3
-Annex 4, Appendix 6, Aeronautical data quality requirements			3
-Annex 11, Appendix 5, Aeronautical data quality requirements			3
-Annex 14, Volume 1-Aerodrome design and operations, Appendix 5 - Aeronautical data quality requirements; Volume 2, Heliports, Appendix 1 - Aeronautical data quality requirements			3
-Doc 9839 - Quality management system manual for AIS/MAP services			3
Aeronautical Information Services provided by States	**10**	**6**	
- ICAO requirements for aeronautical information			2
- AIS areas of responsibility			2
- Aeronautical Information Services available from States			2
- Current international exchange of NOTAM			1
- International Airports			2
Aeronautical Chart Catalogue	**3**	**2**	
- List of Aeronautical Charts			1
- Indices to aeronautical chart series			1
- Aeronautical charts published by State recognized agencies			1

Flight plans	**3**	**2**	
Introduction to flight planning			1
The final phases			1
Human factors (Overview)	***3***	***2***	***1***
Units of measurement to be used in Air and Ground operations	**2**	**1**	
- Definitions			1
-Applicability			1
- Standard application of Units of Measurement (selection)			2
- Attachments to ICAO Annex 5			1
Aircraft Type Designators	**4**	**2**	
- Document structure			1
- Formulation of aircraft type designators and additional information			1
- Action to be taken by States			1
- Aircraft type designators listed in ICAO Doc 8643			1
Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services	**3**	**2**	
- Use of thre letter designators			1
- Rules for the registration of or change in designators			1
- Three letter designators listed in ICAO Doc 8585			1
Aeronautical English (written)			**4**[1]

[1]In accordance with ICAO Annex 1 - *Personnel Licensing*, Attachment - *ICAO Language Proficiency Rating Scale,* Level 4 (Operational).

Other ICAO documents	**1**	**1**	
- Review of other ICAO documents listed in the Appendix to this manual			1
PHASE II - SPECIALIZATION **KNOWLEDGE, SKILL AND PERFORMANCE REQUIREMENTS FOR AIS/MAP SPECIALISTS**			
AIS/MAP SPECIALIZATION:			
AIS/MAP Aerodrome Unit/ARO Specialist	**150**	**100**	
-Details concerning the aerodrome			
-ICAO Annex 15, Chapter 8			
- Pre-flight briefing			
- NOTAM			
- NOTAM production			
- Storage of NOTAM			
- NOTAM database			
- NOTAM for special purposes			
- List of valid NOTAM			
- Messages in connection with NOYAM			
- Fall back procedures			
- SNOWTAM			
- ASHTAM			
- Post-flight information			
- Coordination			
- ATS reporting office (ARO)			
- Aircraft type designators			
- Designators for aircraft operating agencies, aeronautical authorities and services			
- Flight planning (Annex 2)			
- Flight plan and related messages			
- Quality control			
- Aeronautical English (oral)			4[1]
International NOTAM office (NOF) Specialist	**120**	**75**	**3 - 4**
- NOTAM			
- NOTAM production			

- Incoming NOTAM			
- Storage of NOTAM			
- NOTAM database			
- NOTAM for special purposes			
- List of valid NOTAM			
- Messages in connection with NOTAM			
- Fall back procedures			
- Quality control			
AIS/MAP data base specialist	**160**	**110**	**3 - 4**
- Automated AIS/MAP system			
- Storage of AIS/MAP information/data			
- Distribution			
- Fall back procedures			
- Electronic terrain and obstacle data			
- Quality control			
AIS/MAP documentation/editing/text producing specialist	**150**	**100**	**3 - 4**
- Aeronautical information services			
- Basic steps for publication			
- Aeronautical Information Publication (AIP)			
- Aeronautical Information Circular (AIC)			
- List of valid NOTAM			
- Quality control			
- Regional Supplementary procedures (SUPPS)			
- SUPPS in the Aeronautical Information Publication (AIP)			
Aeronautical cartography specialist	**180**	**120**	**3 - 4**
- Chart projections			
- Aeronautical charts			
- Preparation of aeronautical charts			
- Quality control			
Additional subjects	**10**	**10**	**3**

Table 1-1. Recommended duration and degree of expertise for training of AIS/MAP Technical Officer.

CHAPTER 2. GENERAL RECOMMENDATIONS

2.1 ACCOMMODATION AND EQUIPMENT FOR CLASSROOM-BASED TRAINING

2.1.1 General

2.1.1.1 The *TRAINAIR Training Management Guideline (TMG)*, developed by the ICAO TRAINAIR Programme, provides detailed information on training support functions, training delivery, administrative support functions, planning and design of training facilities, etc. Another manual, the *TRAINAIR Training Development Guideline (TDG)*, details the development methodologies of training courses for aviation personnel and provides guidelines on training techniques, validation, revision and implementation of course ware, design of tests, post-training evaluation, etc. Although the majority of the material included in both manuals may not be directly applied to the training of Aeronautical Information/Aeronautical Charts (AIS/MAP) Officers, the aim of both the TMG and TDG is to provide civil aviation training managers with the tools they need to effectively manage their training organizations, and the providers of AIS/MAP Officer's training can effectively benefit from utilizing these tools. Both the TMG and TDG contain detailed information on the issues discussed in this chapter.

2.1.2 Classrooms and equipment

2.1.2.1 Opinions differ on the amount of classroom space required for each trainee. The range of "ideal" space for each adult in a classroom varies from a low of 1.4 m^2 to a high of 6.7 m^2. The reason for the wide range in "ideal" figures is that classroom designers either envision different classroom environments or account for certain spaces within the classroom, such as aisles and front setback, differently.

2.1.2.2 The sizes of classrooms are affected by:

— number of trainees in a class;

— trainee workstation size;

— class configuration;

— size of aisles; and

— use of media/simulation.

Note.— ICAO recommends that the ratio of trainees per instructor be taken into account when planning the classroom size. In order to provide for sufficient supervision and control for group instruction, a ratio of one instructor for every 15 trainees and 2 instructors for every 25 trainees is recommended.

2.1.2.3 The use of media and hands-on experiments is an important factor in determining the amount of common space required in a classroom. The most commonly used visual media are slides, chalk/marker boards, overhead projectors, computer presentations, video tape and easels. The use of projected media (slides, overheads, TV, etc.) has considerable impact on room size and should be taken into consideration when assigning classrooms.

2.1.2.4 In planning for space requirements for the training of AIS/MAP personnel, training managers must take into consideration the trainee workstations, area required for hands-on training, faculty workstations and storage area.

2.1.2.5 Trainee workstation space includes the trainee's work surface, any additional equipment (terminal, audio/visual, etc.), a chair, and the space for chair push-back and manoeuvrability. The concept of workstation space is important when sizing rooms for classes containing different numbers of trainees. The total area allowed in a classroom for each trainee varies with the size of the class. An adequate work surface within the work space is very important. The large amount of reference material used in the training of AIS/MAP Officers requires considerably larger work surfaces than would be provided by the attached writing surface of an auditorium chair.

2.1.2.6 Computers can also be considered as useful training aids for AIS/MAP Officers. Used as instructional media, computers usually take the form of desktop micro-computers with keyboard and monitor. They can communicate verbal and graphic information and can accept verbal as well as manual or tactile responses. Computers may be used for drills, computer-managed instruction, testing and simulations. For detailed information about the use of computers as a training tool, training managers are advised to refer to the ICAO TRAINAIR document — *Computer Application in Training*.

2.1.3 The learning environment

2.1.3.1 The key to a good learning environment is the elimination of discomforts and other undesirable characteristics. Ten primary factors have been identified:

— the climate must be comfortable;

— distracting sound must be kept to a minimum;

— work areas must be aesthetically pleasing;

— workstations must be comfortable;

— work space must be adequate;

— work area must be reasonably clean;

— training equipment must be adequate;

— visual media must be visible;

— lighting must be of adequate level for training; and

— audio media must be clear and easy to listen to.

2.1.3.2 If any of these factors are unsatisfactory, the result can be distraction from the task at hand, and fatigue can result from the effort required of the trainee to adapt to a poor environment. One of the most widely recognized factors listed is that of the comfort of workstations which includes the comfort of the chair.

2.2 PERFORMANCE EVALUATION (TESTS)

2.2.1 Performance evaluation (tests) is an integral part of the training process. Tests should always be prepared with the sole purpose of measuring whether or not the trainee has achieved the training objective. Trainees must always be informed on how they are going to be evaluated, so they can orientate their efforts. The information must include the conditions that will exist during the test, the performance that is expected from the trainees, the standards of accomplishment that have to be met and the consequences of an inadequate performance. It is recommended that errors on knowledge exams and skill tests be reviewed with trainees to reflect corrections to achieve 100 per cent. Trainees must be informed of the result of their evaluation and instructors must offer correction of improper responses.

2.2.2 Time and resource constraints may limit the amount of testing that can be given to each objective. However, the criticality of the subject and the performance difficulties which can be encountered should give some indication as to when, how and what performance evaluation should be required. Generally speaking, performance measurement is undertaken to evaluate whether or not courses taught have been understood by the trainees at the desired level:

— *Skills* are best tested by performance tests (the trainee performs the task described in the objective under real or simulated conditions).

— *Knowledge* is best tested by oral or written tests.

— *Attitudes* are tested by observations of performance or by means of questionnaires.

CHAPTER 3 - PREREQUISITES/MINIMUM QUALIFICATIONS TEST FOR AIS/MAP OFFICERS

Mathematics/Physics,Geography and English

Introduction

To ensure that the student will be able to understand and apply the mathematics/physics/geography subjects encountered in AIS/MAP operations, a "threshold test" must be given to the trainee which must prove that he or she has the mathematics/physics/geography knowledge needed to complete the AIS/MAP officer's training. In addition, trainees must demonstrate a level of proficiency in common English language.

3.1 Mathematics

Conditions: Provided with a scientific non-programmable calculator, (which includes trigonometric functions).

Performance: The trainee will be able to perform arithmetic computations and basic algebraic and trigonometric computations.

Standard of accomplishment:
The trainee must be 100% accurate in all computations.

Required knowledge, skill and attitude

Arithmetic (DoE: 3)

- Arithmetical terms and signs, addition, subtraction, multiplication and division
- Ordinary and decimal fractions
- Factors and multiples
- Ratio
- Proportions
-Averages
- Percentages

Algebra (DoE: 3)

- Evaluating simple algebraic expressions
  addition
  subtraction
  multiplication
  use of brackets

Trigonometry (DoE: 3)

- The sine and cosine formula
- The area of a triangle in relation to the sine and cosine formula

- Length of an arc and area of a sector of a circle
- The concept and application of the radian
- Trigonometrical ratios of angles of any magnitude

3.2 Physics

Conditions: Provided with a scientific calculator.

Performance: The trainee must be able to perform the relevant computations.

Standard of accomplishment:
Must be 100% accurate in the computations.

Required knowledge, skill and attitude

Motion (DoE: 3)

- Vectors
- Triangle of forces
- Parallelogram of forces
- Velocity and acceleration
- Relative (motion) velocity
- Bearings
- Notable scientific theorems on static, dynamics

Temperature (DoE: 3)

- Definition
- Thermometers
- Temperature scales
    - Celsius (centigrade)
    - Fahrenheit
- Conversion from one scale to the other

Pressure (DoE: 3)

- Definition
- Barometers
- Pressure units
    - Pascal
    - millimetres
    - inches

3.3 Geography

Introduction

To be able to study the principles of air navigation, a thorough knowledge of some of the basics of geography is essential.

Objectives

Conditions: Provided with a map of the world with parallels and meridians spaced at 5° intervals and a description illustrated on a map of the major transport routes.

Performance: To explain the solar system and features of the earth, determine latitude and longitude of geographical features, identify major transport routes and explain the importance of geography and major transport routes to aircraft operations.

Standard of accomplishment:
The trainee must be able to explain and illustrate the solar system and features of the earth, determine latitude and longitude of prominent geographical features on the world map to an accuracy of 1°, identify and explain the major transport routes and explain their importance to aviation.

Required knowledge, skill and attitude

The earth and time (DoE: 3)

- Size and shape of the earth, axis and poles
- Earth's rotation and revolution
- Latitude, longitude, equator, parallels of latitude, prime meridian and meridians
- Geographical position and distances
- North, cardinal points, direction in angular degrees with reference to North
- Time:
  - i) Solar day
  - ii) Year
  - iii) The 24 hour clock
  - iv) Time zones

Topography and major transport routes DoE: 2)

- The Continents
- The major, oceans and seas
- The major transport routes

Note.- In case no candidates are available with the necessary pre-requisite knowledge of mathematics, physics and geography, instruction of these subjects should be made part of the AIS/MAP officer's training programme.

3.4 English[2]

Conditions: *Written test*
Provided with English text dealing with concrete aviation related subjects.

[2]Does not apply to trainees when the training is provided in English.

Oral test
In the test room, trainees will have a face to face common English language conversation with two skilled examiners if possible.

Performance: *Written test*.
Trainees will be able to write a text in English on a concrete subject and to read and understand aviation related English text, such as an article in an aviation magazine.
Oral test.
Trainees will demonstrate oral English language proficiency according to the Attachment - *ICAO Language Proficiency Rating Scale*, Level 3 (Pre-operational) of ICAO Annex 1 - *Personnel Licensing*.

Standard of accomplishment:
Written test.
Comprehension of written text should be accurate on common concrete and work related topics.
Oral test.
Trainees must meet the evaluation requirements according to the holistic descriptors and rating scale for Level 3 (Pre-operational) as described in the Attachment - *ICAO Language Proficiency Rating Scale of* ICAO Annex1 - *Personnel Licensing*.

CHAPTER 4. PHASE I -COMMON CORE KNOWLEDGE

A - AVIATION SPECIFIC KNOWLEDGE REQUIREMENTS

CIVIL AIR LAW, RULES AND REGULATIONS

Introduction

A number of Conventions, Regulations, Legislation, Orders, Agreements, etc. have been promulgated among and within States since the first flight by a heavier-than-air machine to ensure that flights are operated in a safe and orderly manner. Achievement of safety and regularity in the operation of aircraft requires that all States accept and implement a common standard of aircraft operation with regard to training, licensing, certification, etc., for international aircraft operations. The standardization of operational practices for international services is of fundamental importance to prevent costly errors which may be caused by misunderstanding or inexperience. Although this manual and other ICAO manuals address international aircraft operations, the need for standardization is equally applicable to any aircraft operation.

International standards, national regulations and air laws are promulgated to ensure safety, regularity and efficiency of international aircraft operation. The International Civil Aviation Organization (ICAO), pursuant to the provisions of Article 37 of the Convention on International Civil Aviation, develops and adopts Standards and Recommended Practices (Annexes to the Convention) as the minimum requirement for aircraft operation. National regulations are developed on the basis of those Standards and Recommended Practices with some variations to suit the specific requirements of individual States. States may enact legislation that may differ from that enacted in other States. However, international aircraft operations share many regulations, laws and statutes. The syllabus contained in this chapter gives a general view on air law as adopted by ICAO and practised in international aircraft operations.

Training objectives

Conditions: Provided with a broad outline of the Convention on International Civil Aviation, a brief history of the International Civil Aviation Organization (ICAO), its functions, ICAO documents and publications, national air law and other regulatory requirements and documents of importance to international civil aviation.

Performance: The trainee will be able to explain the role of ICAO and national aviation regulatory bodies, identify the applicable documents and regulations to aircraft operation, identify the ICAO documents and publications, and apply those regulations which fall under the duties and responsibilities of the AIS/MAP Officer.

Standard of accomplishment:
To explain correctly the organization and role of ICAO and national aviation regulatory bodies, specify the regulations relevant to aircraft operations, identify all ICAO documents and publications, determine and apply all the publications and provisions which fall under the responsibilities of the AIS/MAP Officer.

Required knowledge, skill and attitude

The International Civil Aviation Organization (ICAO), Rules, Regulations and Documentation

The Convention on International Civil Aviation (DoE: 1)

The Convention on International Civil Aviation

- a brief history of the Convention on International Civil Aviation held at Chicago in 1944 and commonly referred to as "The Chicago Convention" or "The Convention"
- Contracting States
- principal considerations:
  - sovereignty of States over their airspace
  - rights of flight over territory of Contracting States
  - measures to facilitate international air navigation
  - international Standards and Recommended Practices
  - establishment of an authority to administer and regulate civil aviation activities
  - importance of ICAO for the safety of air navigation

Sovereignty of airspace

- State sovereignty over the airspace above its territories
- legal problems related to a State's airspace not resolved by the Convention:
  - height airspace extends to
  - distance beyond the State land mass
- sovereignty over international airspace (such as high seas)

Rights of (commercial) flight over the territories of Contracting States

- conditions for overflying a Contracting State's airspace without special permission or agreement for aircraft not engaged in scheduled service, not carrying any payload (passengers, cargo, mail, etc):
  - provisions of the Convention
  - rights to make stops for non-traffic purposes
  - possibilities for the privilege of taking on payload
  - aircraft excluded (State aircraft such as military aircraft)
- agreements and special permissions required by aircraft engaged in scheduled services:
  - the freedoms of the air
  - the Two Freedoms Agreement (common)
  - the Five Freedoms Agreement (rare)
  - bilateral and multilateral treaties (most common)
- privileges granted by the Two Freedoms Agreement:
  - overfly without landing
  - land for non-traffic purposes
- privileges granted by the Five Freedoms Agreement:
  - overfly without landing
  - land for non-traffic purposes
  - offload payload from the State of aircraft registry
  - take on payload destined for the State of aircraft registry
  - take on payload destined for other States that have accepted the Five Freedoms Agreement

The International Civil Aviation Organization (ICAO) (DoE: 1)

The International Civil Aviation Organization

- brief history of the organization and its functions:
  - terms of reference and objectives
  - organizational structure
  - the process of making international standards
  - end-product of its activities

ICAO documents and publications related to AIS/MAP activities

- the ICAO Annexes to the Convention on International Civil Aviation:
  - brief outline of the purpose and content of each Annex with special emphasis on provisions directly related to AIS/MAP Officer's duties and responsibilities (the instructor is expected to link these provisions to the issues identified in the previous lesson). Outline the value of the Standards and Recommended Practises (SARPS) and the Notification of Differences.
  - practical application of the provisions of the Annexes to AIS/MAP Officer's duties and responsibilities with emphasis on:
    - Annex 4 - *Aeronautical Charts:*
    - Annex 15 - *Aeronautical Information Services:*
    - Annex 10 - *Aeronautical Telecommunications*, Volume II - *Communication Procedures:*
    - Annex 11 - *Air Traffic Services:* and
    - Annex 14 - *Aerodromes*, Volumes I and II.

- publications related to the Procedures for Air Navigation Services (PANS) and technical publications related to AIS/MAP Officer's duties and responsibilities:
  - brief outline of information on PANS, with emphasis on the PANS ABC (Doc 8400) and technical publications to further assist the AIS/MAP Officer to recognize:
    - the scope of his responsibility
    - location of useful reference material
    - abbreviations and terms used in aircraft operation
  - brief outline of the Regional Supplementary Procedures (SUPPS)
  - Air Navigation Plans:
    - examine in particular the Air Navigation Plans most relevant to the area in which the trainee's organization operates:
      - for general familiarization and on-the-job reference
      - to outline problems of implementation and maintenance of facilities
      - for use of plan data for planning and current operations.

  - Manuals (other than the *Aeronautical Chart Manual* (Doc 8697-AN/889) and the *Aeronautical Information Services Manual* (Doc 8126-AN872), as they will be considered in detail under Aeronautical Information Services (AIS) and Aeronautical Charts (MAP)
  - Circulars
  - Designators and Indicators
    - *Location Indicators* (Doc 7910)

— *Designators for Aircraft Operating Agencies Aeronautical Authorities and Services* (Doc 8585)
— *Aircraft Type Designators* (Doc 8643)

— Facility and Service Documents
— *Manual of Airport and Air Navigation Facility Tariffs* (Doc 7100-AT/707)
— *Aeronautical Chart Catalogue* (Doc 7101-MAP/565)
— *Aeronautical Information Services Provided by States* (Doc 7383-AIS/503)

Note.— A list of ICAO documents and publications which contain material relevant to the duties of AIS personnel, is shown in the "Appendix — References" to this Manual.

National Air Law (DoE: 3)

- examine the national organization of aviation and its administration, including:
  - designated authorities concerned with facilitating national and international air navigation
  - methods by which legislation is implemented and notified
- examine the national air law, air orders and regulations
  - entry, transit and departure of aircraft;

Note.- Reference should be made to the content of Part GEN 1 of the national AIP.

International agreements/conventions ratified by the State (DoE: 2)

- examine the relevant agreements and conventions

Flight documents to be carried on aircraft (DoE: 1)

- *Provide a general description of the following documents.*

The Flight manual
The aircraft Minimum Equipment List (MEL)
The Operations Manual
Aircraft documentation

Aviation Terminology, Flight Operation and Aircraft Systems

Introduction

The AIS/MAP Officer's training should, in addition to those subjects which directly concern his responsibilities, include knowledge of other aspects of aviation, including flight operations. This will provide the trainees with a more complete comprehension of their working environment.

Under this subject, AIS/MAP Officers are expected to learn commonly used aviation terminologies and be able to apply them in the appropriate context as required. They will also be introduced to the theory and physiology of flight which should enable them to acquire knowledge of the principles of flight.

Knowledge gained by AIS/MAP Officers in these subjects constitutes an important part of understanding operation of aircraft. It will achieve a more comprehensive operational understanding, and a general awareness of the needs for aeronautical information by air crew members, thus contributing to improving the over-all safety of air navigation. Nevertheless, it must be realized that the knowledge imparted in most of the items presented is basic and not meant to produce experts on the subjects. However, their value as an introduction to the aircraft operation environment and their capacity to promote better understanding with flight crew members and other personnel in the aviation environment cannot be overstated.

Training objectives

Conditions:	Given pertinent information on aviation terminology, operation of aircraft and aircraft components. Using realistic models, photographs or drawings of aircraft, and a tour of an actual aircraft to describe and show the aircraft systems.
Performance:	The trainee will be able to define aviation terminology, identify terms common to aircraft operation, the physiology of flight and the major aircraft systems.
Standard of accomplishment:	To define aviation terminology, identify terms common to aircraft operation, identify the major aircraft components and explain the theory of flight.

Required knowledge, skill and attitude

Note.-- An indication of the recommended degree of expertise (DoE) for the various subjects is given in parenthesis.

Aviation terminology and terms common to aircraft operation (DoE: 2)

Goal: *To define aviation terminologies and identify terms common to aircraft operation, applying them in the appropriate context.*

- identify terminologies common to operation of aircraft and apply them in the appropriate context;
- importance to flight safety of using correct terminologies;
- measurement units used in aircraft operation;
- the correct application of the phonetic alphabet in aviation-related communication; examples of misunderstandings that may arise from improper use and their effect on flight safety (use factual accident/incident examples, if available).

Theory of flight and flight operations (DoE: 1)

Note.— Please note that some of the subjects discussed here may, because of their importance to AIS/MAP personnel, be covered in more detail in other parts of this chapter, as applicable.

Goal: *To enable the trainee to understand and to identify the theory of flight, identify and describe the basic components of an aircraft, their use and operation, and the effect of those components on flight conditions. Basic components must be correctly associated with use and operation.*

· theory of flight

· identification of the main components of an aircraft and their basic function both on the ground and in flight; flight deck equipment including weather radar, cockpit voice recorder; basic flight instruments: airspeed indicator, altimeter, magnetic compass, etc.;

· hazards associated with volcanic ash/dust, ice formation on wings and control surfaces, the recognition and reporting of such phenomena;

· flight control surfaces and flight controls and their function; the four forces (thrust, lift, drag and gravity) acting on an aircraft; the three axes (yaw, pitch and role) and the movement around each axis;

· recognition of aircraft critical surfaces and hazards to flight associated with the contamination of those surfaces; awareness of conditions most likely to produce surface contamination;

· the timely communication, to the flight crew, of observed or reported deficiencies in the safe operation of the aircraft.

Aircraft (including helicopter) systems (DoE: 1)

Goal: *To identify the main aircraft propulsion and functional systems.*

· types of aircraft propulsion systems:
  — propeller-driven aircraft
  — jet-propelled aircraft
· propeller-driven aircraft:
  — type of engine used (turboprop, piston)
  — basic principles of operation
· jet-propelled aircraft:
  — pure jet engine
  — fan jet or bypass engine
  — basic principles of operation
· operational differences between jet, turboprop and piston engine aircraft:
  — due to different means of propulsion
  — due to significant differences in performance

• Air-conditioning and pressurization systems

- Automatic flight control systems
- Electrical power
- Flight controls
- Fuel system
- Hydraulic power
- Ice and rain protection
- Landing gear
- On board navigation and communication systems

Note.— Navigation and communication systems, facilities and procedures are covered in more detail in other parts of this chapter.

Classroom exercise:

- *identify basic components of an aircraft; and*
- *description and purpose of main aircraft systems*

NAVIGATION

Introduction

Air navigation, the science of locating the position and plotting the course of aircraft, governs the act of directing the aircraft to fly from place to place, in the most efficient and safe manner and within a given time. Knowledge of air navigation is essential for AIS/MAP personnel.

Air navigation courses are taught to acquire knowledge of the basic navigation principles and practices required for flight planning, plotting positions and measuring distances accurately on charts. Trainees will also be provided with a general outline of the systems, equipment and procedures used by flight crew from take-off to landing.

For the trainees to properly follow the course and fully participate in class exercises, it is recommended that, in addition to standard equipment such as pencils and erasers, they be provided with scientific calculators. It is also understood that the air navigation course has been preceded by a pre-requisite test or a refresher course on basic trigonometry, and the use of scientific calculators, as required. Actual examples of the different projections of charts for all regions (equatorial, mid-latitude and polar) should be used for trainee classroom practice including measuring distances, measuring great circle and rhumb-line tracks and plotting on charts

Courses in air navigation comprise several subjects, each of which may, when delivered separately, require a specific training objective indicating training conditions, performance, and standard of accomplishment. However, as most of the training objectives specify similar conditions (such as the

provision of appropriate and pertinent documentation and training material), an intermediate objective rather than a training objective is given at the beginning of each subject.

Training objectives

Conditions: Provided with appropriate and pertinent training materials, references, documentation, charts including realistic representation of the earth, and instruments (such as airspeed indicators and altimeters or aircraft instrument simulator computer programmes or aircraft instrument electronic systems simulator computer programmes), as required,

Performance: The trainee will be able to apply acquired knowledge and skills in the topic objectives of each subject and to demonstrate an ability to perform the required action identified by the subject in the most efficient and effective manner.

Standard of accomplishment:
Concepts (position, distance, time, etc.), properties such as those of the different navigation charts, ICAO Standards and Recommended Practices (SARPS) relating to air navigation, the provision of charts, etc., as defined in the training subjects must be explained, and the ability to convert, measure, and determine time, distance, headings, altitude, airspeed, etc., as is required by the specific subjects must be demonstrated with 100% accuracy using charts, calculator or computers, as appropriate.

Required knowledge, skill and attitude

Position and distance (DoE: 3)

Goal: *To describe the form of the earth and identify units used in navigation for determining bearings, position and distance and perform calculations as necessary, to an accuracy of 100%..*

Frame of reference for position

- form of the earth
- great circles
- small circles
- earth axis and geographic poles
- equator
- parallels
- latitude
- meridians and anti-meridians
- convergency of meridians
- prime meridian
- longitude
- general principles of WGS-84
- position on the earth's surface

Measurement of distance and direction

- nautical mile

- great circle tracks and distances
- general methods of determining distance:
  - distance tables
  - measurement on chart or globe
  - navigation computers
  - conversion: nautical mile (NM) — statute mile — kilometre (KM)

- practice in calculating distances between places

- general methods of determining directions

True and magnetic directions (DoE: 3)

Goal: *To identify and explain the difference between true, magnetic and compass directions and describe how they are measured.*

Definition
- angle in horizontal plane measured clockwise through 360 degrees relative to:
  - true north
  - magnetic north
  - compass north

True direction
- measured relative to meridian on charts and globes
- direct measurement difficulties in flight unless special equipment, such as inertial navigation system (INS), inertial reference system (IRS) or global navigation satellite system (GNSS), is available on board the aircraft
- changes in true direction of a great circle track due to meridian convergency
- difficulty in determining direction in the vicinity of geographic poles due to limitations on the use of a magnetic compass

Rhumb-line
- definition — mid-latitude sailing
- appearance on a globe

Terrestrial magnetism and direction
- method of measurement by magnet influenced only by the earth's magnetism relative to local direction of magnetic north
- location and movement of magnetic poles
- variation and isogonal
- conversion of magnetic direction to true direction and vice versa
- required change in magnetic direction to follow a:
  - great circle
  - rhumb-line
- limitations on the use of magnetic direction in the vicinity of magnetic poles
- compasses

Time/UTC (DoE: 3)

Goal: *To determine the need for an accurate time standard and convert local time to co-ordinated universal time (UTC) to a 100% accuracy.*

Change in time zones around the earth
- need for time zone
- normal extent of time zone
- local variations in time zones
- seasonal variations in daylight saving time
- international date-line

Co-ordinated universal time and dates
- need for universal time standard for aviation
- conversion of standard time and date into UTC
- practical examples and practice

Need for accurate time
- aircraft separation standards

Time signals
- availability
- signal format (date/time group)

Classroom exercise: *Calculations of distances and directions on the globe.*

Gyroscopes (DoE: 1)

Goal: *To describe the principles and some applications of gyroscopes.*

The simple gyroscope
- description
- properties

Directional gyro
- description
- need for initial alignment with true or magnetic north

Applications of gyroscopes:
- INS;
- IRS

Chart projections (DoE: 2)

Introduction

Goal: *To identify desirable chart properties and describe the general methods used to project a round earth on flat paper.*

***Note**.- Details of aeronautical charts are given in Chapter 5, under "Aeronautical Charts".*

The reduced earth
- typical representation of the earth
- scale
- desirable properties
- undesirable navigational properties

Charts
- definition
- problems associated with and the impossibility of correctly representing a sphere on a plane surface
- desired properties for navigation
- the construction of charts to the scale required for a wide range of practical applications
- representation of the earth's features

Chart projections
- definition
- chart development on a plane surface
- chart development on a cylinder surface - Mercator projection
- chart development on a cone surface - Lambert conformal projection

Charts used by a typical aircraft operator (DoE: 1)

Source of charts
- government agency/Aeronautical Information Service
- air pilot publications
- private agencies
- airline groups
- individual airlines

Goal: *To identify specific charts used by operators of aircraft.*

Note.- Details of aeronautical Charts are provided in ICAO Annex 4 -Aeronautical Charts. Chapter 5, under 5.10.

Charts normally used for planning flights
- route charts
- radio navigation charts
- small-scale plotting charts

Charts normally used in typical flight sequence
- aerodrome/heliport charts
- (terminal) area charts
- standard departure chart-instrument (SID)

- En-route Charts (radio navigation charts)
- small-scale plotting charts
- (terminal) area charts for standard instrument arrivals
- standard arrival chart-instrument (STAR)
- instrument approach charts

Note.— The above assumes a normal IFR intercontinental jet flight with a self-contained navigation system such as INS, IRS or GNSS.

Classroom exercise: *The trainees must be provided with the opportunity to examine the complete ramp-to-ramp sequence of charts normally used by a major international operator. In addition to consolidating trainees' knowledge of the various charts required, this exercise should be used to outline the various phases of flight.*

Measurement of aircraft speed (DoE: 1)

Goal: *To identify different methods of measurement of aircraft speed.*

Definitions of

- true airspeed (TAS)
- indicated airspeed (IAS)
- ground speed
- Mach number
- Speed indicators

Track and ground speed (DoE: 1)

Goal: *To identify components of track and ground speed and explain the method of measuring track and ground speed and the method used to follow tracks in flight.*

Track, ground speed and drift

- velocity of the aircraft relative to the air defined by heading and airspeed
- velocity of the air relative to the ground defined by wind speed and direction
- velocity of the aircraft relative to the ground is the sum of the above velocities
- definition of drift

Outline of methods used in flight to measure track and ground speed

- from inertial navigation system (INS) / inertial reference system (IRS):
- from Doppler navigation system:
- from area navigation systems:
- from drift meters:
- from tracking by ground radar
- from fixes determined by the flight crew

Altimetry and altimeters (DoE: 1)

Goal: *To identify aircraft altimeter systems and their uses.*

Altimetry
- height
- altitude (transition altitude)
- elevation
- flight level (transition level, transition layer)

Separation standards
- Vertical separation
  - FL allocation
  - semi circular rules
  - RVSM
- Horizontal separation
  - time and distance
  - Mach number

The absolute altimeter (radio altimeter)
- principles
- provision of true height above surface directly beneath the aircraft
- use and limitations for general application

The pressure altimeter
- principles
- construction
- scales and sub-scales
- calibration
- errors

Altimeter settings
- sub-scale set to standard pressure — altimeter reads pressure altitude
- sub-scale set to current airport QNH — altimeter reads correct airport elevation above mean sea level for that airport
- sub-scale set to current airport QFE — altimeter reads zero for that airport

Altimeter settings for a low-altitude flight
- QNH set for departure airport
- QNH reset for locations en route
- QNH set for arrival airport

Altitude setting for a high-altitude flight
- QNH set for departure airport
- altitudes used during climb until transition altitude reached
- transition altitude

· standard altimeter setting made at transition altitude
- flight levels used in conjunction with standard

altimeter setting until transition level reached on descent
· local QNH and altitudes used below transition level

Precautions taken for terrain clearance
· restrictions on use of lowest flight level with standard pressure
· restrictions on use of lowest flight plan altitude with standard pressure

Point of no return (PNR) (DoE: 1)

Goal: *To identify the significance of the point of no return (PNR) in aircraft navigation .*

Definition and type of PNR
· returning to airport of departure
· proceeding to alternate airport
· all power plants operating
· power plants failure

Critical point (equal time point) (DoE: 1)

Goal: *To identify the significance of the critical point or equal time point in aircraft navigation.*

Definition and type of critical point (CP)
· returning to airport of departure or proceeding to planned destination
· proceeding to alternate airport
· all engines operating
· engine failure

General determination of aircraft position (DoE: 2)

Goal: *To identify the methods used by flight crew to determine aircraft position.*

Inertial navigation system
· description

Inertial reference system
· description

Global navigation satellite system (GNSS)
· description

Visual navigation system
· description

General position-fixing methods

- depend on intersection of lines of position
- position circles obtained by various means
- hyperbolic lines of position from:
  - Loran A or C navigation systems [ONLY IF STILL IN USE]
- great circle bearings
- bearings measured relative to aircraft heading
- fixes which may be obtained by:
  - direct readout of latitude and longitude from area navigation systems
  - plotting simultaneous range and bearing from single site
  - plotting lines of position from multiple origins
  - making allowances for aircraft movement between time of position lines
  - analysing intersection of multiple position lines to estimate position

Classroom exercise:

- *Simple exercise of plotting an aircraft position; and*
- *apply rules concerning FL and altitudes*

Aircraft mass (weight), balance control and performance (Overview) (DoE 1)

Note.— It should be noted that the term "weight" is used in place of "mass" in some States. Mass as used in this manual is interchangeable with "weight" and the abbreviation "W" for weight is also used to indicate mass in several places.

Aircraft mass and performance

Introduction

Today, aviation technology has evolved to such an extent that aircraft manufacturers can and do design and produce aircraft whose performance is designed to match the requirements of the market. Aircraft performance has, through the years, been refined to such a degree that it has literally become the nucleus for the growth of the air transportation industry. When the performance of aircraft is improved or when aircraft are designed to perform so that they satisfy a given market, the running cost is decreased and that translates into lower fares, creating the possibility of carrying more passengers. Of course, modern commercial aircraft operation demands that a high level of performance be achieved without prejudicing the high safety standards.

The commercial value of improved aircraft performance mainly depends on the efficiency with which the aircraft is operated. The wide range of fleet available to the operator may lead to the misuse or mismatch of equipment to the operation.

In this part, the trainee will be provided with an overview of the effect/influence of mass on aircraft performance by outlining some of the factors to be considered, covering:

- Basic principles of flight safety

- Basic mass and speed limitations

Balance control and performance

Introduction

Mass and balance control affects aircraft handling and safety as well as optimization of payload and economy of fuel. An overloaded aircraft is extremely dangerous, and many accidents and incidents have been attributed to overloading. A badly loaded aircraft, though perhaps not actually overloaded, can be equally dangerous and can adversely affect aircraft handling and safety. Accidents have been caused by unclear loading instructions and careless loading.

An aircraft with its centre of gravity (CG) located outside aircraft limits will be difficult, if not impossible, to control. Centre of gravity location can be changed dramatically by movement of an insufficiently secured load. Incorrect fuel management can also adversely affect the CG. An understanding of the effects of fuel mismanagement is necessary to underline the importance of correct use of fuel index sheets and fuel graphs when completing load-sheets/trim-sheets. The aircraft load must be planned and completed in such a manner as to ensure that the CG stays within aircraft limits at all stages of flight, that all zone and compartment limits are respected and that none of the structural aircraft mass are exceeded at any time, i.e. maximum zero-fuel mass, maximum ramp mass or taxi mass, maximum take-off mass (either structural or conditionally restricted) or maximum landing mass.

Mass and balance and load planning are not just about the correct load distribution of mass in order to achieve the optimum CG location. Structural limits such as floor strengths, as well as zone load and compartment load maxima, must also be considered. Secure tie-down must be ensured. Some compartments are better equipped than others with tie-down equipment, and loads must be planned accordingly. Dimensional statistics of cargo pieces must be compared to compartment door (the door through which the load has to enter the aircraft) limits during load planning. Compatibility of substances with dangerous goods must also be considered. There are obvious examples of this such as not positioning live animals near food, sensitive films near radioactive material, or videotape near magnetic material. There are many other less obvious examples of incompatibility. Potential damage to or interference with aircraft equipment by substances or materials must be considered; for example, magnetic material may interfere with aircraft compasses if loaded in the wrong area or if its strength exceeds limits. Radioactive material must be correctly located and must not exceed limits either by actual amounts or accumulative effects. Incorrectly handled or loaded, it can constitute a hazard to passengers, crew and ground personnel. Load planning must also consider loading and unloading sequences. An aircraft with en-route stops must be loaded to minimize unloading and reloading at the intermediate stops. It should not be necessary to completely unload and then reload an aircraft at an intermediate airport in order to access air freight or baggage destined for that airport.

Also in this part, the trainee will be provided with an overview of the effect/influence of mass distribution on aircraft performance by outlining some of the factors to be considered, covering:

- aircraft balance and stability; and
- mass and balance control

Classroom exercise: *Basic calculus on operating mass (weight).*

Air Traffic Management (ATM) and Search and Rescue

Introduction

Note.— Air traffic management (ATM) and air traffic service (ATS), as used in this chapter, are interchangeable.

Air traffic management is provided by States to ensure a safe, orderly and expeditious flow of air traffic. In addition, it also has several less known objectives such as fuel conservation, noise abatement, minimum environmental disturbance, cost effectiveness, impartiality towards all users within the rules and regulations.

Air traffic management is a major element in the operation of aircraft. The AIS/MAP Officer must gain knowledge of what it is and how it operates. This chapter is designed to provide the trainees with a thorough knowledge of the organization and operation of air traffic management, the rules of the air, search and rescue services and the relevant facilities and services required for the safe and efficient operation of aircraft.

To satisfactorily achieve the objective of the training course, it is recommended that a visit to well-equipped air traffic management units, including Aerodrome Control (TWR) and the Area Control Centre (ACC), be undertaken in order to allow trainees to observe the provision of the services in real time. Such a visit can be undertaken at the end of the training programme or during the period the specific items are being discussed. An intermediate objective is given at the beginning of each subject.

Training objectives

Conditions: Provided with pertinent information and reference material on air traffic management, including the rules of the air and search and rescue services with a series of visits to different types of air traffic services centres.

Performance: The trainee will be able to identify the different types of air traffic management services provided including its organization, main functions and responsibilities.

Standard of accomplishment:
To identify the organization, facilities and services of air traffic management, including search and rescue, and specify the rules of the air.

Required knowledge, skill and attitude

Air Traffic Services (DoE: 2)

Goal: *To identify air traffic management services.*

Note. - The specifications in ICAO Annex 11 - Air Traffic Services *should be considered in conjunction with the related provisions in ICAO Doc. 4444 -* Procedures for Air Navigation Services, Air Traffic Management *(PANS ATM).*

- Definitions
- General

  — Establishment of authority
  — Objectives of the air traffic services
  — Division of air traffic services
  — Determination of the need for air traffic services
  — Designation of the portions of the airspace and controlled aerodromes where air traffic services will be provided
  — Classification of airspaces (see also Appendix 4 of Annex 11)
  — Required navigation performance (RNP) for en-route operations
  — Establishment and designation of the units providing air traffic services
  — Specifications of flight information regions, control areas and control zones
  — Identification of air traffic services units and airspaces
  — Establishment and identification of ATS routes (see also Appendix 1, Appendix 2, Attachment A and Attachment B of Annex 11)
  — Establishment of change-over points
  — Establishment and identification of significant points (see also Appendix 2 of Annex 11)
  — Establishment and identification of standard routes for taxiing aircraft
  — Co-ordination between the operator and air traffic services
  — Co-ordination between military authorities and air traffic services
  — Co-ordination of activities potentially hazardous to civil aircraft
  — Aeronautical data
  — Co-ordination between meteorological and air traffic services authorities
  — Co-ordination of aeronautical information services and air traffic services authorities
  — Minimum flight altitudes
  — Service to aircraft in the event of an emergency
  — In-flight contingencies
  — Time in air traffic services
  — Establishment of requirements for carriage and operation of pressure-altitude reporting transponders
- Air traffic control service
  — Application
  — Provision of air traffic control service
  — Operation of air traffic control service
  — Separation minima
  — Responsibility for control
  — Transfer of responsibility for control
  — Air traffic control clearances
  — Control of persons and vehicles at aerodromes
  — Provision of radar
  — Use of service movement radar (SMR)
- Flight information service
  — Application

- Scope of flight information service
- Operational flight information service broadcasts (see also Attachment C of Annex 11)

· Alerting service
  - Application
  - Notification of rescue co-ordination centres
  - Use of communication facilities
  - Plotting aircraft in a state of emergency
  - Information to the operator
  - Information to aircraft operating in the vicinity of an aircraft in a state of emergency

· Air traffic services requirements for communications
  - Aeronautical mobile service (air-ground communications)
  - Aeronautical fixed service (ground-ground communications)
  - Service movement control service
  - Aeronautical radio navigation service

· Air traffic services requirements for information
  - Meteorological information
  - Aeronautical information including:
    - Information on aerodrome conditions and the operational status of associated facilities
    - Information on the operational status of navigation aids
    - Information on unmanned free balloons
    - Information concerning volcanic activity
    - Information concerning radioactive materials and toxic chemical "clouds"

· Aeronautical data quality requirements (Appendix 5 of Annex 11)

Rules of the air (DoE: 2)

Goal: *To identify and specify the Rules of the Air.*

Note. -- The specifications in ICAO Annex 2 - Rules of the Air *should be considered in conjunction with the related provisions in ICAO Doc. 4444* - Procedures for Air Navigation Services - Air Traffic Management *(PANS-ATM)*

· Definitions

· Applicability of the rules of the air
  - Territorial application of the rules of the air
  - Compliance with the rules of the air
  - Responsibility for compliance with the rules of the air
  - Authority of pilot-in-command of an aircraft
  - Problematic use of psychoactive substances

· General rules
  - Protection of persons and property
  - Avoidance of collisions
  - Flight plans
  - Signals
  - Time
  - Air traffic control service
  - Unlawful interference

— Interception
— VMC visibility and distance from cloud minima

· Visual flight rules
· Instrument Flight Rules
  — Rules applicable to all IFR flights
  — Rules applicable to IFR flights within controlled airspace

Search and Rescue (ICAO Annex 12) (DoE: 2)

Goal: *To identify the organization, facilities and procedures of Search and Rescue services.*

Note..--The specifications in ICAO Annex 12 - Search and Rescue should be considered. Reference to Doc 9731 - International Aeronautical and Maritime Rescue (IAMSAR) Manual may be made.

· establishment and provision of search and rescue services
· establishment of search and rescue regions
· establishment and designation of search and rescue services units
· communication for search and rescue services units
· cooperation between States and other services
· preparatory measures
· operating procedures

ICAO CNS/ATM Systems (DoE: 2)
(Overview)

By the end of the 1980s, ICAO as well as the entire aviation community had recognized the fundamental limitations of the existing air traffic system and the fact that the situation was going to get progressively worse. The characteristics and the capabilities of the present-day systems and of their implementation in various parts of the world revealed the following shortcomings in the present communications, navigation and surveillance (CNS) systems:

a) the propagation limitations of current line-of-sight systems and/or accuracy and reliability limitations imposed by the variability of propagation characteristics of other systems;

b) the difficulty in large parts of the world, for a variety of reasons, in implementing present CNS systems and operating them in a consistent manner; and

c) the limitations of voice communications and the lack of digital air-ground data interchange systems to support modern automated systems in the air and on the ground.

Although the effects of these limitations are not the same for every part of the world, it is evident that one or more of these factors inhibit the further development of air navigation almost everywhere. It was obvious that new CNS systems which would permit the proper development of an improved air traffic control system should be developed.

At the end of 1983, the ICAO Council established the Future Air Navigation Systems (FANS) Committee to study, identify and assess new concepts and new technology in the field of air navigation, including

satellite technology, and to make recommendations thereon for the development of air navigation on a global basis.

The FANS Committee completed its task and presented its findings and recommendations to ICAO's Tenth Air Navigation Conference, held in Montreal from 5 to 20 September 1991. It concluded that the exploitation of satellite technology appeared to be the only viable solution to overcome the shortcomings of the existing CNS systems and also fulfil the global needs and requirements of the foreseeable future. The committee developed an over-all long-term projection for the co-ordinated evolutionary development of air navigation for international civil aviation over a period of the order of 25 years, in which, complementary to certain terrestrial systems, satellite-based CNS systems will be the key to world-wide improvements.

The main features of the global concept of the new CNS/ATM systems are:

Communications

· In the future, aeronautical mobile communication will make extensive use of digital modulation techniques to permit high-efficiency information flow, optimum use of automation both in the aircraft and on the ground, and economical frequency spectrum utilization. Except for high-density areas within coverage of terrestrial-based communications systems, aeronautical mobile communications services (data and voice) will use satellite relay, operating in the frequency bands allocated to the aeronautical mobile satellite service (AMSS). Terrestrial-based air-ground communication will continue to serve in terminal areas and in other high-density airspace.

· VHF will remain in use for voice and certain data communication in many continental and terminal areas. However, steps should be taken to preclude future saturation.

· The SSR Mode S will provide an air-ground data link which will be used for ATS purposes in high-density airspace. Inter operability with other data links will be facilitated through the application of the open systems interconnection (OSI) model.

· The aeronautical telecommunication network (ATN) concept, through the use of an agreed communication protocol structure, will evolve into the interchange of digital data packets between end-users of dissimilar air-ground and ground-ground communication sub-networks.

- CIDIN, AMHS
- CPDLC

Navigation

· Area navigation (RNAV) capability will be progressively introduced in compliance with the required navigation performance criteria. Studying the modern developments in aircraft navigation systems, the committee identified that the method most commonly used at present, i.e. requiring mandatory carriage of certain equipment, constrained the optimum application of modern airborne equipment. Now that new navigation aids (notably satellites) are available, it will be possible for aircraft operators to select, from among competing systems, the one that is most adaptable to their needs. To enable that flexibility and to support the development of more flexible route systems and RNAV environment, the concept of required navigation performance (RNP) has been developed. This concept is very similar, in principle, to the minimum navigation performance specification (MNPS) concept now in use in North Atlantic and northern Canadian airspace. Both concepts enable a required navigational performance to be achieved by a variety of

navigation equipment; however, as distinct from MNPS, RNP is primarily intended for application in airspace where adequate surveillance is available to air traffic control (ATC).

· Global navigation satellite systems (GNSS) will provide world-wide coverage and will be used for aircraft navigation and for non-precision (currently) and precision (near future) type approaches. Systems providing independent navigation, where the user performs on-board position determination from information received from broadcast transmissions by a number of satellites, will potentially provide highly reliable and accurate and high-integrity global coverage and could meet the navigation system requirements for sole means of navigation for civil aviation.

· The present radio navigation systems serving en-route navigation and non-precision approaches will be able to meet the RNP conditions and coexist with satellite navigation systems. However, it is foreseen that satellite systems will eventually become the primary means of radio navigation. The timing of withdrawal of the present terrestrial systems will depend on many factors, among which the implementation and quality of the new systems will be prominent.

Surveillance

· Secondary surveillance radar (SSR) will remain in wide use in many parts of the world. By enhancing SSR with Mode S, the selective address and data link capabilities will further enhance the beneficial role of SSR for surveillance purposes.

· Automatic dependent surveillance (ADS) will be used mainly in non-radar coverage areas. ADS is a function in which aircraft automatically transmit, via a data link, data derived from on-board navigation systems. As a minimum, the data include aircraft identification and three-dimensional position. Additional data may be provided as appropriate. The introduction of air-ground data links, together with sufficiently accurate and reliable aircraft navigation systems, presents the opportunity to provide surveillance services in areas which lack such services in the present infrastructure, in particular oceanic areas and other areas where the current systems prove difficult, uneconomical or even impossible to implement. In addition to areas which are at present devoid of traffic position information other than the pilot-provided position reports, ADS will find beneficial application in other areas, including high-density areas, where it may serve as an adjunct to or backup for secondary surveillance radar and thereby reduce the need for primary radar.

Air traffic management (ATM)

· The term air traffic management (ATM) is used to describe the airspace and traffic management activities carried out in a co-operative manner by the aeronautical authorities concerned with planning and organizing the effective use of the airspace and air traffic flows within their area of responsibility. ATM consists of a ground part and an air part, where both parts are integrated through well defined procedures and interfaces. The ground part of ATM comprises air traffic services (ATS), air traffic flow management (ATFM) and airspace management (ASM). The general objectives of ATM are to enable aircraft operators to meet their planned times of departure and arrival and adhere to their preferred flight profiles with minimum constraints and without compromising the agreed level of safety. The goals of the ATM system are to maintain or increase the existing level of safety, to accommodate different types of equipped aircraft, to increase system capacity and to minimize delays through the realization of an efficient use of the airspace.

The ICAO CNS/ATM Systems concept is widely seen as advantageous because it permits the enhancement of safety. Improved reliability of the aeronautical mobile satellite communications system, for example, will mean more complete and less interrupted ATS communications in some parts of the world. In addition, ADS and data communications systems facilitate improved conflict detection and resolution and assist the controller by providing advice on conflict resolution. More rapid and detailed information on weather warnings such as storm alerts will also contribute to the safety and effectiveness of flight operations. Further, the concept introduces air traffic management improvements which will permit more flexible and efficient use of airspace. A global introduction of the ICAO CNS/ATM Systems can, within a short period, achieve a system which is capable of balancing the advantages of both strategical planning and short-term tactical control, thereby enhancing flight safety and efficient airspace utilization world-wide.

Note.- Reference to Doc.9750 - Global Air Navigation Plan for CNS/ATM Systems may be made.

Classroom exercise: • *Identify the different organizations, facilities and services of ATM and SAR***.**

Aerodromes and Heliports

Introduction

This Chapter is designed to provide the trainees with a knowledge of the organization, layout and operation of aerodromes and heliports and the facilities and services required for the safe and efficient operation of aircraft. Trainees will be familiarized with the physical characteristics of aerodromes/heliports and their facilities. The trainees should also have a sound knowledge of the aerodrome/heliport visual aids for air navigation. Visits to the main facilities and services at the major aerodrome should be made

Training objectives

Conditions: Provided with pertinent information and reference material on aerodrome and heliport facilities and services..

Performance: The trainee will be able to identify the various physical characteristics, facilities and services at aerodromes and heliports.

Standard of accomplishment:
The trainee must be able to unmistakably identify the relevant aerodrome and heliport physical characteristics, facilities, services and procedures.

Required knowledge, skill and attitude

Aerodrome facilities and services (DoE: 3)

Goal: *To identify aerodrome features, facilities and services of significance.*

Note.- Reference is made to ICAO Annex 14 - Aerodromes *volume 1, Appendices and Attachments.*

General

- definitions
- aerodrome reference codes
- aerodrome location indicators (refer also to IATA location identifiers)

Aerodrome layout
Definitions:
- movement area
- manoeuvring area
- aprons

Aerodrome authority/administration
- aerodrome operators

Aerodrome data
- aerodrome reference points
- aerodrome and runway elevations
- aerodrome reference temperature
- aerodrome dimensions and related information
- pre-flight altimeter check location
- pre-flight VOR and INS check location *(when available)*
- declared distances
- condition of the movements area and related facilities
- disabled aircraft removal
- rescue and fire fighting
- visual approach slope indicator systems
- coordination between aeronautical information services and aerodrome authorities

Aerodrome physical characteristics
- runways
- runway shoulders
- runway strips
- runway end safety areas
- runway turn pads
- displaced thresholds
- clearways
- stopways
- radio altimeter operating area
- taxiways
- taxiway shoulders
- taxiway strips
- holding bays, runway-holding positions, intermediate holding positions and road-holding positions
- aprons
- isolated aircraft parking position
- strength of pavements (ACN-PCN method of reporting pavement strength)
- de/anti-icing facilities

Obstacle restriction and removal

- obstacle limitation surfaces
- obstacle limitation requirements
- objects outside the obstacle limitation surfaces
- other objects

Measuring and expressing runway friction

- variation in braking action on wet, snowy or icy runways
- measurement of runway friction
- expression of estimated braking action
- variations in measurements and their effects on different aircraft

Aerodrome visual aids for navigation (Annex 14, Vol 1, 5.1, 5.2, 5.3, 5.4, and 5.5)

- indicators and signalling devices
- markings
- lights
- signs
- markers

Visual aids for denoting obstacles

- objects to be marked and/or lighted
- marking of objects
- lighting of objects

Visual aids for denoting restricted use areas

- closed runways and taxiways or parts thereof
- non-load-bearing surfaces
- pre-threshold area
- unserviceable areas

Equipment and installations

- secondary power supply
- electrical systems
- monitoring
- fencing
- security lighting
- airport design
- siting and construction of equipment and installations on operational areas
- aerodrome vehicle operations
- surface movement guidance and control systems

Emergency and other services

- aerodrome emergency planning
- rescue and fire fighting
- disabled aircraft removal
- maintenance
- bird hazard reduction

- apron management service
- ground servicing of aircraft

Classroom exercise:

- *extraction of airport data of significance from publications published by:*
  - *the State Aeronautical Information Publication (AIP)*
  - *aerodrome charts published by private agencies*

Heliport facilities and services (DoE: 2)

Goal: *To identify heliport features, facilities and services of significance.*

Note.- Reference is made to ICAO Annex 14 - Aerodromes*, Volume 2 -* Heliports *and its Appendix 1.*

General

- definitions
- heliport location indicators

Heliport authority/administration

- heliport operators
- heliport certification

Heliport data

- aeronautical data
- heliport reference point
- heliport elevation
- heliport reference temperature
- heliport dimensions and related information
- declared distances
- coordination between aeronautical information services and aerodrome authorities

Heliport physical characteristics

- surface-level heliports
  - final approach and take-off areas
  - helicopter clearways
  - touchdown and lift-off areas
  - safety areas
  - helicopter ground taxiways
  - air taxiways
  - air transit route
  - aprons
  - location of final approach and take-off area in relation to a runway or taxiway

- elevated heliports
  - final approach and take-off area and touch down and lift-off area
  - safety area

· helidecks
  — final approach and take-off area and touchdown and lift-off area
· shipboard heliports
  — final approach and take-off area and touchdown and lift-off area

Obstacle restriction and removal
· obstacle limitation surfaces and sectors
· obstacle limitation requirements

Visual aids
· indicators
· markings an markers
· lights

Heliport services
· rescue and fire fighting

Aeronautical data quality requirements

Classroom exercise:
- *identify AD and HEL characteristics, facilities and services; and*
- *apply rules on obstacle identification and removal*

Aeronautical Communication and Navigation Facilities, Services and Procedures

Introduction

To understand the Aeronautical Communication Services and the Navigation Services and Procedures and be able to use aeronautical fixed services, are essential for the AIS/MAP Officer to effectively perform his duties.

Training objectives

Conditions: Provided with relevant information on aeronautical communication and navigation facilities, services and procedures and an environment where the use of the aeronautical fixed service, real or simulated, and terminology including the phonetic alphabet can be practised under supervision,

Performance: The trainee will be able to communicate clearly and concisely using data transmission and be able to specify the aeronautical navigation facilities, services and procedures.

Standard of accomplishment:
Trainee will specify the rules, regulations and procedures, show his ability to use the aeronautical fixed service for exchange of aeronautical information/data and identify the aeronautical communication and navigation facilities services and procedures.

Required knowledge, skill and attitude

Aeronautical Communication Facilities and Services

International aeronautical telecommunication service (DoE: 3)

- aeronautical fixed service
- aeronautical mobile service
- aeronautical radio navigation service
- aeronautical broadcasting service

Aeronautical Fixed Service (AFS) (DoE: 3)

Goal: *To define and use the aeronautical fixed telecommunication network (AFTN).*

- definition of aeronautical fixed service (AFS)
- responsibility for providing services
- purpose of the aeronautical fixed telecommunication network (AFTN)
- AFTN facilities
- access to AFTN
- AFS messages
- ATS Direct Speech circuits
- message format
- Meteorological operational channels and communication networks
- Aeronautical Fixed Telecommunication Network (AFTN)
  - -- composition of messages
  - -- addressing of messages
  - -- categories of messages
  - -- responsibility for determining acceptability
  - -- order of priority
  - -- routing

- national practical fixed networks:
  - — AFTN
  - -- Internet use

- other communication networks (e.g. SITA) (DoE 1)

Classroom exercise:

- exchange of messages emphasizing:
  - — need for preparation before transmission
  - — clarity and brevity
  - — use of correct call signs
  - — correct message format

Aeronautical mobile service (DoE: 1)

Goal: *To explain the various communications services.*

- communications services
- types of messages

Radio frequency bands and wavelengths
- description (HF, VHF, UHF, FM, AM, SSB, DSB)
- band frequencies utilization
- international Morse code (in written form only)
- use of the Morse code in air-ground aids identification

Mobile services
- phonetic alphabet
- standard words
- call signs
- abbreviations
- communications
- priorities:
  - distress
  - urgency
  - traffic

Aeronautical (Radio) Navigation Facilities, Services and Procedures

Introduction to (radio) navigation (DoE: 1)

Goal: *To identify the principles and properties of radio transmission .*

Transmission of signals

Ground-based direction-finding stations and radar (DoE: 1)

Goal: *To identify those ground stations which are used to directly determine aircraft position or bearing.*

HF direction finding stations
- information provided
- location and availability of services
- range
- accuracy
- uses: NDB

VHF and UHF direction-finding stations and distance measuring equipment
- information provided — great circle bearings
- location and availability of services
- range
- accuracy

- uses: VOR/DME

Primary ground radar
- information provided — great circle bearings
- location and availability of services
- range
- accuracy
- uses: en route, military

Secondary surveillance radar (SSR)
- general principles
- advantages over primary radar
- location and availability of services
- transponder codes
- accuracy
- uses: en-route, terminal and AD radars

Automatic dependent system (ADS)
- general principles
- range
- accuracy
- uses: oceanic- and isolated areas

VOR/DME-type navigation (DoE: 2)

Goal: *To identify the use of those radio navigation systems which provide flight crews with direct indications of range and bearing.*

Principles of VHF omnidirectional radio range (VOR)
- status of VOR
- range and accuracy
- airborne VOR equipment

Principles of aircraft distance measuring equipment (DME)
- status of DME
- range and accuracy
- aircraft DME
- frequency selection paired with VOR

VORTAC
- radial from VOR
- DME range from collocated TACAN

Instrument landing system (ILS) (DoE: 2)

Goal: *To identify the components and principles of operation of the radio navigation system widely used for instrument approach and landing.*

Ground equipment
- description

Localizer
- description

Glide path
- description

ILS categories
- category I
- category II
- categories IIIa and IIIb

Aircraft equipment (DoE 1)
- localizer receiver
- glide path receiver — frequency paired to localizer
- marker receiver
- cross-pointer indications
- coupling to autopilot

Navigation procedures (DoE: 2)

Goal: *To identify the radio navigation and instrument flight procedures utilized in flight.*

Standard instrument departures (SIDs)
- purpose
- effect on flight operations
- establishment and designation
- facilities and procedures used to follow SIDs
- transition to airway routes

Airway and air route navigation
- use of facilities
- radials flown with reference to horizontal situation indicator (HSI) or radio magnetic indicator (RMI)
- principle of ADF tracking using RMI
- use of INS when cleared on airway

Direct and area navigation (RNAV) system routes
- definition of "direct" and "RNAV" routes
- use of INS, GNSS, and area navigation systems

Holding
- ATC reasons for holding instructions

- minimum fuel consumption considerations
- holding patterns
- expected approach time
- descending while holding
- transition to approach control

Transition to terminal area
- standard instrument arrivals (STARs)
- transition to approach control

The instrument approach
- transition to approach facility
- outbound track
- procedure turn
- final track
- descent and landing

The ILS approach
- transition to ILS localizer
- glide path interception
- altitude over markers
- radar monitoring
- pressure and radio altimeters for minimum altitudes and decision height
- transition from instrument indications to visual cues for flare and landing
- manually flown approach
- automatic approach
- automatic landing using automatic approach and auto flare

The non-precision approach

- commonly used facilities
- tracking procedures
- descent procedures
- final descent based on calculated rate and time to minimum altitude
  - ILS localizer without glide slope
  - ILS localizer back course
  - VOR approach
  - NDB approach

Ground-controlled approach
- VHF direction finder
- airport surveillance radar
- precision approach radar

Radio navigation service
- standard navigation aids
- operational objectives:

— CAT I
— CAT II
— CAT III
— ILS
— Ground controlled approach (GCA)
— VOR/DME
— NDB, D/F

Automated aeronautical service

· telecommunications service
· VOLMET
· VHF/HF
· ATIS

Classroom exercise: *Identify the different radio navigation services and procedures utilized during flight*

Aeronautical Meteorology

Introduction

While all transport is subject to weather conditions which can vary from benign to vicious, it can be argued that aviation is the most sensitive to weather conditions. Moreover, an international or small local airport can be equally affected by weather conditions. Even relatively low-speed cross-winds combined with wet runway conditions can effectively close an airport, and conditions of poor visibility can cause major disruptions to aviation schedules. Meteorological conditions may also compromise safety, efficiency and regularity of flight operations en-route.

It is useful, that the AIS/MAP Officers have sufficient skill and knowledge to be able to identify meteorological information, reports, forecasts and warnings correctly.

In order to ensure that the trainee fully understands the role that the local meteorological office and aeronautical meteorological station play in the preparation, coding and dissemination of weather data, it is recommended that the trainee be taken on a guided tour of the nearest meteorological office and/or aeronautical meteorological station, where questions and discussion should be encouraged. It should be emphasized to the trainees that the maintenance of good co-ordination between the designated meteorological office and respective aeronautical information service/pre-flight briefing unit and ATS units at the airport has a positive impact on the quality of the work of the units and the provision of pre-flight information to flight operations personnel, including flight crews.

The following syllabus outlines the minimum knowledge and skill that is necessary for the AIS/MAP Officers. While it may be necessary for authorities to enhance some part(s) of the outlined syllabus, it must not be at the expense of other parts.

Training objectives

Conditions: Provided with relevant examples of actual aeronautical meteorological reports and forecasts, and copies of the appropriate charts and publications currently in use and relevant to flight operations.

Performance: To identify meteorological services to aviation, identify aeronautical meteorological reports, forecasts, and warnings.

Standard of accomplishment:

Identify:

a) meteorological observations as well as their dissemination;

b) meteorological forecasts as well as their dissemination, and

c) weather conditions

—at aerodromes and vicinity

—in relevant flight information regions (FIRs) and control areas.

Required knowledge, skill and attitude

Note.-- An indication of the recommended degree of expertise (DoE) for the various subjects is given in parenthesis.

Atmospheric temperature and humidity (DoE: 1)

Goal: *To identify the temperature and humidity at the surface of the earth.*

Temperature at the earth's surface

- definition
- standard method of measurement
- diurnal variation

Humidity at the earth's surface

- absolute
- relative
- dew point

Effect of temperature and humidity on aircraft operation

Atmospheric pressure (DoE: 1)

Goal: *To identify horizontal variations in atmospheric pressure and how pressure distributions are shown on meteorological charts. To indicate the units of measurement for atmospheric pressure and related conversions.*

Definition and measurement

- definition of pressure
- measurement of pressure
- units of measurement
- conversions

Pressure at sea level

- common reference
- surface synoptic chart
- lines of equal pressure (isobars)

Variation of pressure with height

- reduction of pressure to aerodrome and mean sea level
- altimetry:
  - pressure altitude, density altitude
  - height, altitude, flight level
  - QNH and QFE altimeter setting

Constant pressure charts

- common constant pressure levels and their standard altitudes
- lines of equal height (contours or isohypses)

Effect of pressure altitude on take-off performance

Wind (DoE: 1)

Goal: *To identify the definitions related to wind. To indicate the units of measurement for wind and related conversions. To identify the effects of friction.*

Definitions and measurement of wind

- definitions:
  - wind
  - wind direction (magnetic and true)
  - wind speed
  - wind shear
  - --- units of measurement
  - --- conversions

--- methods of measuring wind velocity
— vertical motion in the atmosphere

Effects of surface friction

- gusts:
  - winds reported averaged over 2 or 10 minutes
- squalls
- diurnal variations in wind
- topographical effects

Effect of surface wind on take-off and landing

- selection of runway
  — crosswind, tailwind limits

Jet streams (DoE): 1)

Goal: *To identify jet streams*

Jet streams

- jet streams:
  — definition
  — cause
  — major areas and orientation
  — maximum wind speeds
  — cross-section of a typical jet stream
  — low-level jet streams and associated wind shear
  - impact on flights

Turbulence (DoE: 1)

Goal: *To identify the various types of atmospheric turbulence and its effect on aircraft operations. To identify mountain waves and their effect on aircraft operations.*

Types of atmospheric turbulence

ICAO criteria for reporting turbulence :

— nil
— light
— moderate
— severe

Impact of turbulence on flight operations

Mountain waves

- ICAO criteria for reporting mountain waves:
  - moderate
  - severe
- impact on flight operations

Classification of clouds and precipitation (DoE: 1)

Goal: *To identify types of clouds and precipitation.*

Classification of clouds

- low clouds (Stratus, Stratocumulus)
- medium-level clouds (Altostratus, Nimbostratus, Altocumulus)
- high-level clouds (Cirrus, Cirrostratus, Cirrocumulus)
- convective clouds (Cumulus, Cumulonimbus)

Various types of precipitation

- drizzle (including freezing drizzle)
- rain (including freezing rain)
- snow (including blowing snow)
- snow grains
- ice pellets
- ice crystals
- hail
- small hail and snow pellets

Intensity of precipitation (for aeronautical purposes):

- light
- moderate
- heavy

Effect on aerodrome operations

- height of cloud base part of aerodrome operating minima
- effect of precipitation on runway surface:
  - liquid, freezing precipitation, snow (including slush)
  - icing
- information on the state of runway surface
  - SNOWTAM (role and dissemination)
  - runway state group (in METARs/SPECIs)

Thunderstorms (DoE: 1)

Goal: *To identify types of thunderstorms and associated phenomena such as wind shear, and their effect on surface weather and flight conditions.*

Types

- air mass thunderstorms
- severe thunderstorms:
  - gust front and microburst
  - super-cell storm
  - squall line

Funnel cloud (tornado or waterspout)

Surface weather associated with thunderstorms

- gusty, turbulent winds:
  - wind shifts
- wind shear (including gust fronts and dry and wet microbursts)
- heavy precipitation (rain and/or hail)
- changes in temperature and pressure
- lightning

Effects on aircraft operations

- aircraft operations in thunderstorms:
  - often impossible to get above or around the storm due to its great extent
  - severe turbulence (also above the storm)
  - severe icing
- aircraft take-off and landing affected by:
  - gusty, turbulent winds
  - wind shear (including gust fronts and microbursts)
  - reduced visibility due to heavy precipitation or hail
- effects of lightning on:
  - airframe
  - compass and radio communications

Detection

- use of radar systems:
  - airborne weather radar
  - ground-based radar
  - Doppler radar to detect wind shear
- use of satellite imagery
- use of lightning detection systems

Classroom exercise:

- inspection of examples of satellite images with cumulonimbus clouds and thunderstorms

Aircraft icing (DoE: 1)

Goal: *To identify the problems associated with aircraft icing, and the operation of various icing protection systems.*

Occurrence

- in clouds
- in freezing precipitation
- in temperatures above 0°C:
  - cold-soak effect

Icing intensity

- ICAO criteria for reporting icing:
  - light
  - moderate
  - severe

Operational problems associated with icing

- reduced aerodynamic, propeller and engine efficiency:
  - loss of aircraft performance
- impaired controllability due to contaminated aerofoil and asymmetric deposition of ice
- impaired cockpit vision
- air data instrument error
- loss of performance due to increased mass
- damage to airframe and engines
- strategies to minimize the effect of icing on flight operations

Visibility and runway visual range (RVR) (DoE: 1)

Goal: *To define visibility and runway visual range and to identify the processes and conditions that result in significant visibility reduction.*

Types of visibility used in aviation

- visibility:
  - definition
  - minimum and prevailing visibility:
  - observation
  - reporting
- runway visual range (RVR):
  - definition
  - use

— assessment
- units, conversions
— reporting

· slant visual range (SVR)
· vertical visibility

Meteorological components of aerodrome operating minima

· visibility, RVR
· height of cloud base, vertical visibility

Causes of reduced visibility

· fog and mist
· haze
· smoke
· sand and dust (widespread)
· volcanic ash
· precipitation

Volcanic ash (DoE: 1)

Goal: *To identify the problems caused by volcanic ash, to identify the ICAO International airways volcano watch, warnings for volcanic ash and observations and reports on volcanic activity.*

Volcanic ash and flight operations

· impact on flight operations (requirement for avoidance to be emphasized):
  - engines
  - airframe
  - instruments, radio communications
  - en-route
  - at aerodromes
· detection
· reporting of volcanic ash

ICAO international airways volcano watch (IAVW)

- observation component
- NOTAM, ASHTAM
- volcanic ash advisory centres (VAACs):
  - forecasting movement of volcanic ash clouds
- volcanic ash advisories issued
- SIGMET information for volcanic ash clouds

Aeronautical meteorological observations (DoE:1)

Goal: *To identify aeronautical meteorological observations*

Requirements for aviation

- routine and special observations

Elements of observations at aerodromes

- wind direction
- wind speed
- visibility
- RVR
- present weather
- cloud
- air temperature
- dew-point temperature
- pressure
- supplementary information

Automated weather observing system (AWOS)

- current limitations and related issues

Ground-based radar observations

- interpretation of radar observations

Sources of meteorological information (DoE: 1)

Goal: *To identify the sources of meteorological information for pre-flight planning. The trainee should be able to outline the methods used for the provision of meteorological information to aircraft in flight.*

Sources of meteorological information for pre-flight planning

- local meteorological office
- automated systems
  - established by the meteorological authority
  - accessible through dedicated or public communications and information systems
- AIS/MET pre-flight planning packages
- published by the meteorological authority, included in AIP

Adequate notification required from pilots and operators to meteorological offices

- scheduled and non-scheduled flights

Sources of meteorological information in-flight

- ATS units concerned
- VOLMET, ATIS
- non-routine requests to be addressed to ATS units concerned

Classroom exercise:

- *familiarization with the services available in the State concerned*

Meteorological service for international air navigation (DoE: 1)

Goal: *To identify the organization of aeronautical meteorological services established for the provision of meteorological service for international air navigation.*

Role of international organizations

- role of the World Meteorological Organization (WMO):
  - international Standards (Technical Regulations) related to basic meteorological data:
    - observations
    - telecommunications
    - data processing
- role of ICAO:
  - international Standards and Recommended Practices related to aeronautical meteorology
  - main components
    - world area forecast system (WAFS)
    - international airways volcano watch (IAVW)
    - tropical cyclone warning system
    - meteorological offices
    - meteorological watch offices (MWOs)
    - aeronautical meteorological stations

World area forecast system (WAFS)

- centralization of en-route forecasting at two world area forecast centres (WAFCs) in the final phase of the system:
  — WAFC London
  — WAFC Washington
- role of WAFCs
- products and data issued
- means of communication used
- institutional issues:
  - authorized access

International airways volcano watch (IAVW) and tropical cyclone warning system

- centralization of services concerning volcanic ash and tropical cyclones:
  - 9 volcanic ash advisory centres (VAACs) of IAVW
  - 6 tropical cyclone advisory centres (TCACs)
- role of VAACs and TCACs
- advisory information issued

Organization of aeronautical meteorological services within States

- role of the meteorological authority
- (aerodrome) meteorological office:
  - role
  - products and services provided
    - aerodrome, take-off and landing forecasts (TAF, trend forecasts)
    - aerodrome warnings and wind shear warnings
    - reliance on WAFS for en-route information for flight planning and flight documentation
    - issuance of en-route forecasts for low-level flights
    - briefing and consultation
    - display of meteorological information
- meteorological watch office :
  - role (in particular, in relation to FIRs)
  - products and services provided
    - maintain watch over en-route weather
    - SIGMET (and AIRMET) information for the en-route phase
- aeronautical meteorological station:
  - role
  - products issued
    - routine and special reports (METAR, MET REPORT, SPECI, SPECIAL)
- responsibilities assigned to States:

  - provide in accordance with ICAO requirements meteorological service in the State concerned
  - designate the meteorological authority
  - reference to aeronautical publications, identifying relevant chapters:
    - ICAO Annex 3 — *Meteorological Service for International Air Nvigation*[3]
    - ICAO *Manual of Aeronautical Meteorological Practice* (Doc 8896)
    - ICAO Air Navigation Plans (ANPs/FASID) (Part VI — Meteorology)
    - States' Aeronautical Information Publications (AIPs)

Exchange of meteorological information

- detailed exchange requirements included in the ICAO air navigation plans :
  - role of MET tables
- satellite broadcasts
  - satellite distribution system for information relating to air navigation (SADIS)
  - international satellite communications system (ISCS)

[3] Identical to the WMO Technical Regulations (C.3.1)

- AFTN:
  - Meteorological Operational Telecommunications Network Europe (MOTNE)
  - AFI MET bulletin exchange (AMBEX) scheme
  - regional OPMET bulletin exchange (ROBEX) scheme
- WMO global telecommunication system (GTS)

Aeronautical meteorological reports (DoE: 1)

Goal: *To identify aeronautical meteorological reports*

Types of reports

- routine report (MET REPORT, METAR)
- special and selected special report (SPECIAL, SPECI)

Routine report

- reporting times:
  - reasons for greater frequency than for synoptic observations
- issued in two forms:
  - coded (METAR code) — disseminated beyond the aerodrome
  - abbreviated plain language (MET REPORT) — disseminated locally at the aerodrome
- METAR code:
  - format
  - abbreviations and terminology
  - use of CAVOK
  - may be supplemented by trend forecast
- may be supplemented by runway state groups (EUR and NAT Regions)
- MET REPORT
  - format
  - abbreviations and terminology
  - differences between METAR and MET REPORT

Special report

- criteria
- issued in two forms:
  - coded (SPECI code) – disseminated beyond the aerodrome
  - abbreviated plain language (SPECIAL)— disseminated locally at the aerodrome
  - SPECI code
    - format similar to METAR
  - SPECIAL
    - format similar to MET REPORT

Use of reports in air traffic services

- automatic terminal information service (in ATIS broadcasts and D-ATIS)
- meteorological information for aircraft in flight (in VOLMET broadcasts and D-VOLMET)

Classroom exercise: *To identify the contents of aeronautical meteorological reports.*

Prognostic charts (DoE: 1)

Goal: *To identify aeronautical prognostic charts.*

Aeronautical prognostic charts

- prepared and issued as part of the world area forecast system (WAFS) by:
  — WAFC London
  — WAFC Washington

- upper wind and upper-air temperature charts
- significant weather (SIGWX) charts
  — depiction of SIGWX phenomena
- for flights below FL 100 — charts prepared locally by meteorological office

WAFS grid point forecasts in digital form

- contain upper wind and upper-air temperature forecasts in the GRIB code
- provided by WAFC London and Washington for:
  - computer flight planning
  - issuance of upper wind and upper-air temperature charts at meteorological offices

Classroom exercise:

- *look at examples of aeronautical prognostic charts*

Aeronautical forecasts and warnings (DoE: 1)

Goal: *To identify aeronautical weather forecasts and warnings.*

Take-off forecasts

- required to plan maximum permissible take-off mass
- parameters included
- formats established by local arrangement
- required to ensure compliance with operating minima

En-route forecasts for pre-flight planning

- required for flight planning at least two hours before ETD
- basic requirements:
  - upper winds and upper-air temperatures
  - significant en-route weather
  - valid for time and route of flight
- methods of meeting the requirements:
  - fixed time WAFS prognostic charts
- upper wind and upper-air temperature charts:
  - WAFS grid point forecasts in digital format (GRIB code)
- SIGWX charts
- SIGMET information
  - in particular those related to tropical cyclones and volcanic ash
- GAMET forecasts for low-level flights

Forecasts for landing at destination/alternate

- trend-type landing forecast:
  - METAR or SPECI + a two-hour trend forecast
  - change indicators in the trend forecast
- aerodrome forecast:
  - TAF code format

Warnings

- SIGMET/AIRMET information:
  - en route
  - criteria for issuance
  - role of SIGMET information related to tropical cyclones and volcanic ash
  - format
- aerodrome warnings:
  - terminal area
  - content
- wind shear warnings:
  - terminal area
  - format
- wake turbulence

Classroom exercise:

- *to examine charts and forecasts used for flight planning and included in flight documentation, aerodrome and trend-type landing forecasts and aerodrome and wind shear warnings*

Aircraft observations and reports (AIREPs) (DoE: 1)

Goal: *To identify purpose of air-reporting and the requirement for air-reporting.*

Purpose of aircraft observations and reports

- identifying conditions affecting the safety and efficiency of flight operations

Types of aircraft observations and reports (AIREPs)

- routine AIREPs
- special AIREPs
- other non-routine aircraft observations and reports

Modes of aircraft observations and reports

- automatic by data link
- manual by voice communications

Routine AIREP

- routine AIREP by data link:
  - preferred mode
  - elements
    - wind direction and speed
    - temperature
    - turbulence (if available)
    - humidity (if available)
  - frequency of reporting
    - 15 minutes en-route
    - 30 seconds in the climb-out phase for first 10 minutes of flights
  - data link systems used
    - automated dependent surveillance (ADS) report with meteorological information data block
    - controller pilot data link communications (CPDLC) application "position report"
  - dissemination
    - to WAFC London, Washington
    - fully automated
- routine AIREP by voice communications:
  - where air-ground data link is not available
  - elements observed by pilots
    - temperature
    - wind direction and speed
    - turbulence
    - aircraft icing
    - humidity (if available)
      - detailed instructions on reporting in Appendix 1 to the PANS-RAC (Doc 4444)
    - reporting at designated ATS/MET reporting points
    - dissemination
      – to the associated MWO

Special AIREP

- observations made at all flight phases
- reported by voice communications or semi-automatically through suitable data link applications
- criteria for reporting identical to criteria for SIGMET information
- dissemination
    - to the associated MWO

Other non-routine aircraft observations and reports

- pilot reports meteorological conditions affecting the safety and efficiency of flights which are not subject to special AIREPs

Classroom exercise:

- *to be shown examples of routine AIREPs and the current list of ATS/MET reporting points in the area of responsibility.*

Meteorological information for air traffic services units and
search and rescue services centres (DoE: 1)

Goal: *To identify meteorological information to be supplied to ATS units and search and rescue centres and to analyse some aspects of the ATS/AIS/MET co-ordination.*

Requirements

- relating to:
    - aerodrome control towers (TWR)
    - approach control office (APP)
    - flight information centre (FIC) or area control centre (ACC)
    - rescue co-ordination centres
- format of information
- use of communications:
    - minimum requirements for direct speech communications
    - minimum requirements for printed communications

Designated meteorological offices to ATS units

- role and functions

Displays of meteorological instruments at ATS units

- requirements for TWR
- use of AWOS displays at TWR, APP

Observing and reporting of meteorological information by ATS units

- *ad hoc* visual meteorological observations by ATS personnel
    — to be transmitted to meteorological stations or offices

ATS/AIS/MET co-ordination

- letter of Agreement
  - between the ATS/AIS and MET authorities
  - detailed local agreements

Role of the ATS authority in establishing certain criteria for meteorological information

- called for in Annexes 3, 11 and the PANS-RAC (Doc 4444)
- applicable to:
  - criteria for special observations at aerodromes
  - requirement for routine observations at aerodromes
  - displays of meteorological instruments at TWR
  - ATS/MET reporting points, etc.

Facilitation

Introduction

The Standards and Recommended Practices on Facilitation are the result of Article 37 of the Convention on International Civil Aviation, which provides, *inter alia*, that the "International Civil Aviation Organization shall adopt and amend from time to time, as may be necessary, international standards and recommended practices and procedures dealing with .....*customs and immigration procedures*..... and such other matters concerned with the safety, regularity and efficiency of air navigation as may from time to time appear appropriate". Article 22 to the Convention expresses the obligation accepted by each Contracting State "to adopt all practicable measures, through the issuance of special regulations or otherwise, to facilitate and expedite navigation by aircraft between the territories of Contracting States, and to prevent unnecessary delays to aircraft, crews, passengers and cargo, especially in the administration of the laws relating to immigration, quarantine, customs and clearance"

Training objectives

Conditions: Provided with a broad outline of the regulatory requirements of importance to international civil aviation and outlining significant regulatory documents that are used by AIS personnel.

Performance: The trainee will be able to identify the role of international and national aviation regulatory bodies, identify the importance of applicable regulations dealing with immigration, quarantine, customs, clearance and such other matters concerned with safety, regularity and efficiency of air navigation.

Standard of accomplishment:
To identify and explain the regulations, legislation, provisions and practical applications.

Required knowledge, skill and attitude

Designated authorities and requirements for international flights (DoE: 1)

Designated authorities
(National rules and regulations)

- Civil aviation
- Meteorology
- Customs
- Immigration
- Health
- En-route and aerodrome/heliport charges
- Agricultural quarantine
- Aircraft accident investigation

Requirements for international flights
Note.- Reference is made to ICAO Annex 9 - Facilitation *including Appendices and Attachment*

- Definitions
- Entry and departure of aircraft
- Entry and departure of persons and their baggage
- Entry and departure of cargo and other articles
- Traffic passing through the territory of a Contracting State
- International airports – facilities and services for traffic
- Landing elsewhere than at international airports
- Other facilitation provisions

The Safe Transport of Dangerous Goods by Air

Introduction

Air freight is classified as dangerous goods if it is listed in ICAO Doc 9284 — *The Technical Instructions for the Safe Transport of Dangerous Goods by Air.* This does not mean that this document is all embracing and that a dangerous substance, if not listed there, can be loaded on an aircraft. The Technical Instructions provide detailed instructions which must be followed. Other obviously dangerous materials must be referred to the appropriate company and State authorities for instructions regarding packing, labelling and loading. Remember, new materials (some of which are dangerous) are constantly emerging onto the market and some items of dangerous goods are completely forbidden for transport by air.

ICAO Annex 18 — *The Safe Transport of Dangerous Goods by Air,* adopted by the ICAO Council in 1981, contains the Standards and Recommended Practices governing the transport of dangerous goods by air; the detailed provisions are contained in the Technical Instructions. This document is binding on all States and has been recognized as the primary authority on dangerous goods. IATA also publishes Dangerous Goods Regulations which are also used by operators and shippers. However, it should be remembered that the IATA manual is based on the requirements of ICAO Annex 18 and ICAO Doc 9284, and that it is the latter which contains the legally binding provisions for the transport of dangerous goods by air.

Training objectives

Conditions: The trainees will be provided with an overview of the content of the current issue of the ICAO Technical Instructions. and ICAO Annex 18 - *The Safe Transport of Dangerous Goods by Air*.

Performance: The trainee should provide a general impression of the regulations concerning the transportation of dangerous goods by air.

Standard of accomplishment:

To identify in general the content of the ICAO technical instructions and Annex 18 - *The safe transport of dangerous goods by air*.

Required knowledge, skill and attitude

Dangerous goods, emergency and abnormal situations (DoE: 1)

Goal: *To recognize/find the requirements for transport by air and stowage of dangerous goods as defined by ICAO and as listed in Annex 18 and the associated ICAO Technical Instructions.*

Limitations on aircraft

- OK for both passenger and cargo aircraft
- OK for cargo aircraft only
- forbidden substances
- definitions, units of measurement and conversion factors

Classification of dangerous goods

- shipper's responsibilities
- operator's responsibilities
- use of documentation

Source documents and some of the provisions (DoE: 1)

Goal: *To identify the official documents that specify whether commodities are acceptable or not for transportation by air and look up / search for some of the provisions.*

Official documents

- ICAO Annex 18 - *The safe transport of dangerous goods by air* and the associated Technical Instructions in ICAO Doc 9284 - *Technical Instructions for the safe transport of Dangerous goods by Air* are the sole authentic legal source material for the transport of dangerous goods by air. Doc 9284 is published every two years.

- ICAO Doc 9481, *Emergency Response Guidance for Aircraft Incidents involving Dangerous Goods*, is published every two years.

Limitations of dangerous goods on aircraft

- OK for both passenger and cargo aircraft
- OK for cargo aircraft only
- forbidden substances
- risk categories
- definitions, units of measurement and conversion factors

Classification of dangerous goods

- Class 1
  - Explosives
- Class 2
  - Gases
- Class 3
  - Flammable liquids
- Class 4
  - Flammable solids
  - Substances liable to spontaneously combust
  - Substances which, in contact with water, emit flammable gases
- Class 5
  - Oxidizing substances
  - Organic peroxides
- Class 6
  - Toxic substances
  - Infectious substances
- Class 7
  - Radioactive material
- Class 8
  - Corrosives
- Class 9
  - Miscellaneous dangerous goods

Classroom exercise: *Identification of the procedures as published in the AIP and other related documents concerning the transport of dangerous goods by air.*

Security (Emergencies and Abnormal Situations)

(Provision of an overview of security definitions and some measures)

Introduction

Aviation security has been one of the major concerns of the air transport industry. The AIS/MAP Officer should be aware of the provisions dealing with safeguarding civil aviation operations against unlawful interference and of the measures taken in connection with the national civil aviation security programme established by the State. Threats both to aircraft operation as well as to personnel on the ground and in the air must be dealt with seriously.

Note.— Security training may vary from State to State in the type, endurance and content of training. However, any security training programme should include the following as the bare minimum and as the basis for a complete programme which would include local requirements as specified by airport and national authorities and aircraft operators.

Training objectives

Conditions: The trainee must be provided with copies of documents, airport directives and ICAO Annexes relevant to security. He must also be made familiar with local and national security systems and structures of authority.

Performance: The trainee will be able to identify a security problem and will know who to contact and where to get information and instructions without delay.

Standard of accomplishment:

The trainee is expected to be familiar with local and national security procedures so that he will react in an efficient and logical manner to situations involving security matters.

Required knowledge, skill and attitude

Goal: *To identify emergency and security policy and a selection of procedures as laid down and practised by State authorities, airport authorities and aircraft operators.*

Familiarity with security provisions (DoE: 1)

- security measures taken by governments, airport authorities, etc.
- airport directives
- requirements of ICAO Annex 17 - *Security*
- explosive detection devices at access points to buildings, etc.
- check-in procedures
- questions asked to passengers
- hand baggage X-ray
- control of the amount of hand baggage
- normal baggage reconciliation procedures
- baggage reconciliation procedures for “missing” passengers

- control of duty-free items
- air-side/land-side boundary, closed circuit television (CCTV), police patrols, etc.
- controls for the handling of baggage, cargo, mail etc.
- security of flight catering supplies and deliveries

Local procedures for handling threats, bomb scares, etc. (DoE: 1)

Hijacking (DoE: 1)

- crew procedures, transponder code, etc.
- international convention regarding power of aircraft commander including power of delivery into custody:
  - Tokyo Convention on offences and certain other acts committed on board aircraft
  - The Hague Convention for the suppression of unlawful seizure of aircraft
  - Montreal Convention for the suppression of unlawful acts against the safety of civil aviation

Emergency procedures (DoE: 2)

- emergency co-ordination centre
- what to do when dealing with an emergency
- emergency procedures manual
- procedures for contacting and dealing with relevant emergency authorities and services

Personal security for AIS/MAP personnel (DoE: 2)

- threats to personnel
- pressure on personnel through threats to family

CHAPTER 5. PHASE I - COMMON CORE KNOWLEDGE

B - AIS/MAP SPECIFIC KNOWLEDGE REQUIREMENTS

Aeronautical Information Services

Introduction

Annex 15 to the Convention on Civil Aviation specifies that each contracting State must provide an "aeronautical information service". By definition an aeronautical information service (AIS) is "a service established within the defined area of coverage responsible for the provision of aeronautical information/data necessary for the safety, regularity and efficiency of air navigation".
Aeronautical information is defined as "information resulting from the assembly, analysis and formatting of aeronautical data", and "aeronautical data" is "a representation of aeronautical facts, concepts or instructions in a formalized manner suitable for communication, interpretation or processing".

Annex 15 also specifies that each contracting State must take all necessary measures to ensure that aeronautical information/data it provides relating to its own territory, as well as areas in which the State is responsible for air traffic services outside its territory, is adequate, of required quality and timely. To ensure the required quality, the State must take all necessary measures to introduce a properly organized quality system containing procedures, processes and resources necessary to implement quality management at each function stage.

Annex 4 -Aeronautical Charts provides aeronautical information in chart form, supplementing aeronautical information provided by the Aeronautical Information Services. The Aeronautical Chart Manual (Doc 8697) provides guidance to States in implementing the Standards and Recommended Practices (SARPS) of Annex 4.

With the introduction of airborne computer-based navigation systems, the implementation of area navigation (RNAV) and required navigation performance (RNP), corrupt or erroneous aeronautical information/data can potentially affect the safety of air navigation. This puts a high level of responsibility on the shoulders of AIS/MAP personnel to provide accurate aeronautical information/data.

It should be emphasized that Annex 15 specifies that "the State concerned shall remain responsible for the information published".

Training objectives

Conditions: Provided with appropriate and pertinent training materials, copies of ICAO documents, including Annex 15 *Aeronautical Information Services*, Doc. 8126 *Aeronautical Information Services Manual*, examples of the Integrated Aeronautical Information

Package (AIP plus Amendments and Supplements, AIC, NOTAM, PIB, checklists and summaries), Annex 4 -Aeronautical Charts and Doc 8697 - Aeronautical Chart Manual, published by the national AIS and selected foreign AIS, reference documents including Air Navigation Plan publications, Doc 7383 *Aeronautical Information Services Provided by States,* Doc. 8400 PANS ICAO *Abbreviations and Codes,* Doc. 7910 *Location Indicators* and other documents and examples of how some information is provided by other technical services within the national administration and other agencies, aeronautical charts which are incorporated in the AIP.

Performance: The trainee will be able to interpret, explain and apply acquired knowledge, skill and attitude and demonstrate the ability to perform the required action in the most efficient and effective manner.

Standard of accomplishment:

Concepts, properties and specifications in Annex 15 *Aeronautical Information Services*, as amplified by DOC 8126 *Aeronautical Information Services (AIS) Manual* must be interpreted and applied , and the trainee must demonstrate the ability to perform the tasks and duties required of the AIS/MAP Officer.

Required knowledge, skill and attitude

Goal: *To interpret and apply all aspects of aeronautical information services*

Note.- An indication of the recommended degree of expertise (DoE) is given in parenthesis.

Aeronautical information services - Requirements

Note.- Reference is made to ICAO Annex 15 - Aeronautical Information Services.

- The object of the aeronautical information service (DoE: 2)
- Definitions (DoE; 2)
- General (DoE: 3)
  - — Responsibilities and functions
  - — Quality system
  - --- Exchange of aeronautical information/data
  - — Copyright
  - — Cost recovery
  - — General specifications
  - — Common reference systems for air navigation
- Aeronautical Information Publication (AIP) (DoE: 3)
  - — Contents

- General specifications
- Specifications for AIP Amendments
- Specifications for AIP Supplements
- Distribution

· NOTAM (DoE: 3)
  - Origination
  - General specifications
  - Distribution

· Aeronautical Information Regulation and Control (AIRAC) (DoE: 3)
  - General specifications
  - Provision of information in paper copy form
  - Provision of information in electronic form

· Aeronautical Information Circulars (AIC) (DoE: 3)
  - Origination
  - General specifications
  - Distribution

· Pre-flight and Post-flight Information/Data (DoE: 3)
  - Pre-flight information
  - Automated aeronautical information systems
  - Post-flight information

· Telecommunication requirements (DoE: 2)

· Electronic Terrain and Obstacle Data (DoE: 2)
  - Function
  - Coverage and terrain and obstacle data numerical requirements
  - Terrain database – content and structure
  - Obstacle database – content and structure
  - Terrain and obstacle data product specifications
  - Availability

In conjunction with the preceding, the following detailed specifications in the Appendices must be dealt with:

· Content of the Aeronautical Information Publication (AIP)
  - Part 1 - General (GEN)
  - Part 2 - En-route (ENR)
  - Part 3 - Aerodromes (AD)

· SNOWTAM Format

· ASHTAM Format

· Information to be notified by AIRAC

· Predetermined Distribution System for NOTAM

· NOTAM Format

- Aeronautical Data Quality Requirements
- Terrain and Obstacle data requirements

Aeronautical Information Services - Application

Goal: *To explain and apply all aspects of the aeronautical information services required*

Note.- Reference is made to ICAO Doc 8126 - Aeronautical Information Services Manual.

- Introduction (DoE: 3)
  - — Purpose of an Aeronautical Information Service (AIS)
  - — Information handled by an AIS
  - — Quality System
  - — World Geodetic System - 1984 (WGS-84)
  - — Human factors considerations
  - — Use of automation
  - — Copyright and cost recovery

- Provision of raw data (DoE: 3)
  - — Assignment of responsibility for origination of raw data
  - — Basic information
  - — Information of a temporary nature and of short duration
  - — Working arrangements
  - — Modes of communication
  - — Aeronautical information, regulation and control (AIRAC)

- Organization of an aeronautical information service (AIS) (DoE: 2)
  - — Status of an AIS within the aviation administration
  - — Organization
  - --- Resources
  - --- Arrangements for exchange of aeronautical information with other States (DoE: 3)
  - --- Recording, filing and distribution of information
  - --- Basic reference material (Publications of ICAO and other international organizations)

- Integrated Aeronautical Information Package (DoE: 3)
  - — General
  - — Elements of the Integrated Aeronautical Information Package

- Aeronautical Information Publications (AIP) (DoE: 3)

- NOTAM (DoE: 3)

— NOTAM, SNOWTAM and ASHTAM
— NOTAM Selection Criteria
— Guidance on the use of AFS

- Aeronautical Information Circulars (AIC) (DoE: 3)
  — Contents
  — Annual review and checklist
  — Distribution

· Pre-flight and Post-flight Information (DoE: 3)
  — Provision of pre-flight information service
  — Location of an AIS Unit
  — Layout of an AIS Unit
  — Coverage zone
  — Detailed information to be held for each coverage zone
  — Verbal briefing
  — Self-briefing
  — Post-flight information

· Organization of an Automated Aeronautical Information Services System (DoE: 3)
  — General
  — Basic principles
  — User's operational requirements in an automated AIS system
  — Type of information to be provided
  — Database content
  — Harmonization of AIS an MET information
  — Concept for an integrated automated AIS system
  — Planning and implementation of an integrated automated AIS system
  — AFS addressing
  — Use of automation in the compilation, processing and distribution of NOTAM
  — Common AIS query procedures for self-briefing by end-users
  — Common query messages for interrogation of other AIS databases

· Preparation of original copy, reproduction and distribution (DoE: 3)
  — Reproduction processes
  — Preparation of copy
  — Selection of method
  — Paper
  — Equipment
  — Maintenance of distribution list
  — Sale of AIS documentation

— Mailing
— Automation

- **Specimen AIP (DoE: 3)**

Classroom exercise:

- *interpret and explain NOTAM, AIP, AIC, AIRAC, etc.;*
- *identify all parts and content of the AIP; and*
- *identify AIS services, their purpose and functions.*

Aeronautical Charts

Introduction

For the safe performance of air operations it is essential that a current, comprehensive and authoritative source of navigation data be available at all times. Aeronautical charts is one medium for supplying that information supplementing the aeronautical information provided by the Aeronautical Information Services. Aeronautical charts are used by all segments of aviation for planning and navigation purposes including pilots, airline operations personnel, air traffic control, etc. and it has become essential that critical, current and accurate charts are made available to the users as and when needed.

Standards and Recommended Practices (SARPS) for Aeronautical Charts were first adopted by the Council of ICAO on 16 April 1948, pursuant to the provisions of Article 37 of the Convention on International Civil Aviation (Chicago, 1944) and were designated as Annex 4 to the Convention. They became applicable on March 1949. Subsequently amendments/additions to the SARPS were made on the basis of developing operational requirements for charts, the functions to be satisfied, including the specifications for general application, the specifications for individual types of charts with due regard to their interrelationship, introduction of new charts for use in the cockpit and the obligations of States to produce aeronautical charts.

Knowledge of the use, preparation/production and making available of Aeronautical Charts is essential for the AIS/MAP Officer.

Training objectives

Conditions: Provided with appropriate and pertinent training materials, including Annex 4 *Aeronautical Charts,* DOC 8697 *Aeronautical Charts Manual,* examples of aeronautical charts published by the national administration and charts produced by selected foreign administrations, drafting tools/equipment, as required.

Performance: The trainee will be able to identify, explain and apply the knowledge, skill and attitude requirements and demonstrate the knowledge of construction, contents, production, editing, amending and distribution of aeronautical charts as required in the most efficient and effective manner.

Standard of accomplishment:

Concepts, properties and specifications for charts in Annex 4 - *Aeronautical Charts*, as amplified by ICAO Doc. 8697 *Aeronautical Charts Manual*, must be interpreted and applied and the knowledge of construction, contents, production, editing, amending and distribution of aeronautical charts must be demonstrated.

Required knowledge, skill and attitude

Goal: *To interpret and apply -the specifications/requirements for Aeronautical Charts.*

Note.- An indication of the recommended degree of expertise (DoE) is given in parenthesis.

Aeronautical Charts - Requirements

Note.- Reference is made to ICAO Annex 4 - Aeronautical charts

- Definitions, applicability and availability (DoE: 2)
- General specifications (DoE: 3)
  - Operational requirements for charts
  - Titles
  - Miscellaneous information
  - Symbols
  - Units of measurement
  - Scale and projection
  - Date and validity of aeronautical information
  - Spelling of geographical names
  - Abbreviations
  - Political boundaries
  - Colours
  - Relief
  - Prohibited, restricted and danger areas
  - Air traffic services airspaces
  - Magnetic variation
  - Typography
  - Aeronautical data

— Common reference system

· Specifications for aeronautical charts (DoE: 3)

Goal: *To provide the trainee with detailed knowledge of the purpose and content of the charts used for air navigation.*

Note.- The following charts should be considered simultaneously with Chapter 7-Preparation of Specific Charts and the Specimen Charts in the Aeronautical Charts Manual (ICAO Doc 8697)

· Aerodrome Obstacle Chart - ICAO Type A (Operating Limitations) - *(Mandatory chart)*
  — Function
  — Availability
  — Format
  — Identification
· Aerodrome Obstacle Chart - ICAO Type B - *(Non-mandatory chart)*
  — Function
  — Availability
  — Format
  — Identification
· Aerodrome Obstacle Chart - ICAO Type C - *(Conditionally required chart)*
  — Function
  — Availability
  — Format
  — Identification
· Precision Approach Terrain Chart - ICAO - *(Mandatory chart)*
  — Function
  — Availability
  — Identification
· Enroute Chart - ICAO - *(Mandatory chart)*
  — Function
  — Availability
  — Identification
  — Culture and topography
· Area Chart - ICAO - *(Conditionally required chart)*
  — Function
  — Availability
  — Identification
  — Culture and topography
· Standard Departure Chart -Instrument (SID) - ICAO - *(Conditionally required chart)*
  — Function

- Availability
- Identification

- Standard Arrival Chart - Instrument (STAR) - ICAO - *(Conditionally required chart)*
  - Function
  - Availability
  - Identification
- Instrument Approach Chart - ICAO - *(Mandatory chart)*
  - Function
  - Availability
  - Format
  - Identification
- Visual Approach Chart - ICAO - *(Conditionally required chart)*
  - Function
  - Availability
  - Format
  - Identification
- Aerodrome/Heliport Chart - ICAO - *(Mandatory chart)*
  - Function
  - Availability
  - Identification
- Aerodrome Ground Movement Chart - ICAO - *(Non mandatory chart)*
  - Function
  - Availability
  - Identification
- Aircraft Parking/Docking Chart - ICAO - *(Non mandatory chart)*
  - Function
  - Availability
  - Identification
- World Aeronautical Chart - ICAO - 1 : 1 000 000 - *(Mandatory chart)*
  - Function
  - Availability
  - Format
  - Identification
- Aeronautical Chart - ICAO 1 : 500 000 - *(Non mandatory chart)*
  - Function
  - Availability
  - Format
  - Identification
- Aeronautical Navigation Chart - ICAO Small Scale - *(Non mandatory chart)*
  - Function
  - Availability

— Format

· Plotting Chart - ICAO
  — Function
  — Availability
  — Format

· Electronic Aeronautical Chart Display - ICAO
  — Function
  — Information available for display
  — Display requirements

· Radar Minimum Altitude Chart
  — Function
  — Availability
  — Projection
  — Identification

· — Marginal note layout
· — ICAO chart symbols
· — Colour guide
· — Hypsometric tint guide
· — Sheet layout index for the WAC - ICAO 1: 1000 000
· — Aeronautical data quality requirements

Aeronautical Charts - Production

Goal: *To provide the trainee with an introduction to the purpose and general content of the Aeronautical Chart manual.*

Note.- An indication of the recommended degree of expertise (DoE) is given in parenthesis.

Aeronautical charts production (DoE 2)

Note.- Reference is made to ICAO Doc 8697 - Aeronautical Chart Manual.

· General (DoE 2)
  --- Evolution of Annex 4
  — Functional relationship of aeronautical charts
  — Obligation of States to provide charts
  — National cartographic services
  — Relations with other States
  — Relations with other International Organizations

· Requirements for aeronautical charts (DoE 2)

— Establishing the need for aeronautical charts
— Mandatory charts
— Non-mandatory charts
— Conditionally required charts
— Chart groups
— Joint civil/military charts
— Priorities
— Relations with chart users

· Maintenance of charts (DoE 2)
— Nature of the problem
— Preventive measures
— Methods
— Frequency of revisions
— Issue of "advance" information

· Cartographic techniques (DoE 2)
— Draughting media
— Draughting (Monocolour or polychrome charts)
— Transfer process screens and symbols
— Lettering
— Mechanical aids
— Automation

· Reproduction (DoE 2)
— Estimating demand
— Estimating production runs
— Reproduction
— Colours and Multicolour printing
— Scale of Hypsometric and Bathymetric Tints (World Aeronautical Chart - ICAO 1 : 1 000 000
— Scale of Hypsometric and Bathymetric Tints (International Map of the World 1 : 1 000 000)

· Chart distribution (DoE 2)
— Introduction
— Distribution with Aeronautical Information Publication (AIP)
— Distribution by subscription
— Distribution agencies
— Availability of foreign charts
— Out-of-date charts

WORLD GEODETIC SYSTEM - 1984 (WGS-84)

Introduction

ICAO Annex 15 specifies that published geographical coordinates indicating latitude and longitude must be expressed in terms of the World Geodetic System – 1984 (WGS-84) geodetic reference system. Furthermore, for those positions specified in Appendix 1 to Annex 15, the geoid undulation referenced to the WGS-84 ellipsoid must be published for the specific surveyed ground positions, in addition to the elevation of those positions.

To provide guidance on the provision of geographic coordinates and vertical component values, referenced to the WGS-84 datum , ICAO Doc 9674 - WGS-84 Manual has been developed, to assist States in the uniform implementation of the Standards and Recommended Practices on WGS-84 contained in ICAO Annex 4, Annex 11, Annex 14 and Annex15.

Training objectives

Conditions: Provided with the basic knowledge contained in Doc 9674 - WGS - 84 Manual.

Performance: The trainee will be able to identify the principles of the provision of geographic coordinates and vertical component values referenced to the WGS-84 datum.

Standard of accomplishment:

The principles concerned regarding the provision of geographic coordinates and vertical component values referenced to the WGS-84 datum must be identified and explained and the trainee should be able to apply that knowledge as necessary.

Required knowledge, skill and attitude

Goal: *To identify the different specifications of WGS-84 related to reference systems and chart projections.*

Note. - An indication of the recommended degree of expertise (DoE) for the various subjects is given in parenthesis.

World Geodetic System - 1984 (WGS-84) - Implementation

Reference is made to Doc 9674 - World Geodetic System - 1984 (WGS-84) Manual .

- Introduction (DoE: 1)
- Accuracy resolution and integrity of aeronautical data (DoE: 2)
- The global WGS-84 Coordinate system (DoE: 2)
- A guide to obtain WGS-84 coordinates (DoE: 1)
- Surveying guidance (DoE: 1)
- Quality assurance (DoE: 2)
- Deliverables (DoE: 1)

- The Global Positioning System (GPS) (DoE: 1)
- Principles of Geodesy (DoE: 1)
- The international terrestrial reference system (ITRS) (DoE: 1)
- Datum transformation formulae (Doe: 1)
- Surveying and photogrammetric methods (DoE: 1)
- Map projections (DoE: 1)

ICAO ABBREVIATIONS AND CODES

Introduction

ICAO Doc 8400 - *ICAO Abbreviations and Codes* contains abbreviations and codes approved by the Council of ICAO for world-wide use in the international aeronautical telecommunication service and in aeronautical information documents, as appropriate and uniform abbreviated phraseology for use in pre-flight information bulletin, with the status of Procedures for Air Navigation Services (PANS).

Training objectives

Conditions: Provided with appropriate and pertinent training materials, copy of Doc 8400 - PANS ABC, examples of the Integrated Aeronautical Information Package, including NOTAM and pre-flight information bulletins (PIB), published by the national AIS and selected foreign AIS, showing the use of abbreviations

Performance: The trainee will be able to interpret, explain and apply skill and attitude requirements and demonstrate the ability to perform the required action when necessary.

Standard of accomplishment:
Concepts, in the PANS ABC should be interpreted and applied as necessary.

Required knowledge, skill and attitude

Goal: *To apply and use the abbreviations in the aeronautical information service and aeronautical charts, to apply and use the NOTAM Code in the preparation of NOTAM and apply and use the uniform abbreviated phraseology in NOTAM and pre-flight information bulletins (PIB).*

Note.- An indication of the recommended degree of expertise (DoE) for the various subjects is given in parenthesis.

ICAO Abbreviations and Codes - Application

Note.- Reference is made to ICAO Doc 8400 - PANS ABC

- Principles for the formulation of abbreviations (see Foreword) (DoE: 2)
- Abbreviations - Decode/Encode (DoE: 3)
- Abbreviations for identifying Aeronautical Fixed Service (AFS) Messages (selection) (DoE: 2)
- Abbreviations and Terms to be transmitted as spoken words when used in Radiotelephony (DoE: 2)
- Abbreviations and Terms to be transmitted using the individual letters in non-phonetic form when used in Radiotelephony (DoE: 2)
- Designation of typical Radiocommunication Emissions (DoE: 2)
- The NOTAM Code (DoE: 4)

LOCATION INDICATORS

Introduction

ICAO Doc 7910 - *Location Indicators* contains a list of four letter location indicators for geographical locations throughout the world, and a list of addresses of centres in charge of flight information regions (FIR) and/or upper flight information regions (UIR).

Location Indicators are assigned by States to identify those geographical locations at which a station forming part of the Aeronautical Fixed Service (AFS) is situated. The assignment of location indicators is supervised by ICAO, by checking for conformity with the "Formulation of assignment of location indicators".

Training objectives

Conditions: Provided with ICAO Doc 7910 - *Location Indicators* and examples of the Integrated Aeronautical Information Package showing the use of Location indicators.

Performance: The trainee will be able to identify the principles of assignment and use of location indicators.

Standard of accomplishment:

The principles concerned regarding assignment and use of location indicators must be identified and explained and the trainee should be able to apply that knowledge as necessary.

Required knowledge, skill and attitude

Goal: *To familiarize trainees with the application and use of location indicators.*

Note. - An indication of the recommended degree of expertise (DoE) for the various subjects is given in parenthesis.

Location Indicators - Application

Reference is made to ICAO Doc 7910 - Location Indicators

- Definitions (DoE: 3)
- Formulation and assignment of location indicators (DoE: 3)
  - Establishment of Aeronautical Fixed Service (AFS) Routing Areas
  - Assignment of location indicators
  - Changes in the assignment of location indicators
  - Use of location indicators (DoE: 2) (4 for Phase II)
- Addresses of centres in charge of FIR/UIR (including part 5) (DoE: 3)
- Location Indicators – Encode/Decode (DoE: 3)

REGIONAL SUPPLEMENTARY PROCEDURES

Introduction

Procedures for world-wide applicability can be found in Annexes to the Convention on International Civil Aviation or in Procedures for Air Navigation Services (PANS).

The *ICAO Regional Supplementary Procedures (SUPPS)* in ICAO Doc 7030 on the other hand, have been developed to meet the needs of specific areas which are not covered in the world-wide provisions.

The SUPPS form the procedural part of the Air Navigation Plan. They complement the statement of requirements for facilities and services contained in the Air Navigation Plan publications

Training Objectives

Conditions: Provided with an introduction to the general content of ICAO Doc 7030 - *Regional Supplementary Procedures*, and examples of SUPPS contained in AIPs,.

Performance: The trainee will be able to identify the principles of SUPPS,.

Standard of accomplishment:

The principles concerned, regarding development and applicability of the SUPPS, must be identified

Required knowledge, skill and attitude

Goal: *To familiarize trainees with the content of regional supplementary procedures (SUPPS)*

Note. - An indication of the recommended degree of expertise (DoE) for the various subjects is given in parenthesis.

Doc. 7030 - Regional Supplementary Procedures

- Criteria to be satisfied in the development of SUPPS (DoE 1)
- Status of SUPPS (DoE 1)
- Application of SUPPS (DoE 1)

Aeronautical Information Publication (AIP)

- SUPPS published in National AIP (DoE 2)
- SUPPS published in AIPs of neighbouring States (DoE 1)

QUALITY SYSTEM

Introduction

ICAO Annex 15, 3.2.1 specifies:

"Each contracting State shall take all necessary measures to introduce a properly organized quality system containing procedures, processes and resources necessary to implement quality management at each function stage in 3.1.7[4] above. The execution of such quality management shall be demonstrable for each function stage, when required."

Annex 15 continues, to recommend:

"3.2.2 **Recommendation.-** *The quality system established in accordance with 3.2.1 should be in conformity with the International Organization for Standardization (ISO) 9000 series of quality assurance standards, and certified by an approved organization"*.

[4] "3.1.7 An aeronautical information service shall receive and/or originate, collate or assemble, edit, format, publish/store and distribute aeronautical information/data concerning the entire territory of the State as well as areas in which the State is responsible for air traffic services outside its territory. Aeronautical information shall be published as an Integrated Aeronautical Information Package".

"Note.- International Organization for Standardization (ISO) 9000 series of quality assurance standards provide a basic framework for the development of a quality assurance programme. The details of a successful programme are to be formulated by each State and in most cases are unique to the State organization."

The quality system will provide quality and timely aeronautical information/data to the aviation community which is essential, for the Communications, Navigation and Surveillance/Air Traffic Management (CNS/ATM) Systems.

The implementation of area navigation (RNAV), required navigation performance (RNP) and airborne computer based navigation systems need exacting requirements for the quality (accuracy, resolution and integrity) of aeronautical information/data.

Annex 15, 3.2 *Quality System*, contains Standards and Recommendations for the establishment of a Quality System by States.

Guidance material for the implementation of the Quality System for Aeronautical Information Services by States will be made available and should be included in the syllabus when available.

Training objectives

Conditions: Provided with pertinent information in Annex 15 and Annex 4 and reference material in Annexes 11 and 14 on the Quality System

Performance: The trainee will be able to identify the principles applied in determining the establishment of a Quality System and Quality Management for Aeronautical Information Services and Aeronautical Charts.

Standard of accomplishment:
To identify and apply the principles concerned as required.

Required knowledge, skill and attitude

Goal: *To enable trainees to identify the characteristics, use and application of the quality management system procedures in AIS/MAP.*

Quality system requirements for AIS/MAP

Note.- Reference is made to ICAO Annex 15, Annex 4, Annex 11 and Annex 14. Guidance material on the Quality Management System for Aeronautical Information Services should be considered.

Annex 15 (DoE: 3)

Definitions

- Aeronautical data
- Assemble
- Cyclic redundancy check
- Data quality
- Integrity (aeronautical data)
- Precision
- Quality
- Quality assurance
- Quality control
- Quality system
- Requirements for quality
- Resolution
- Traceability
- Validation
- Verification

Chapter 3, paragraph 3.2 Quality System and Appendix 7 - Aeronautical data quality requirements

Annex 4 - Aeronautical Charts (DoE: 3)

- Appendix 6 - Aeronautical Data Quality Requirements

Annex 11 - Air Traffic Services (DoE: 3)

- Appendix 5 - Aeronautical Data Quality Requirements

Annex 14 - Aerodromes (DoE: 3)

Volume 1:Aerodrome design and operations

- Appendix 5 - Aeronautical Data Quality Requirements

Volume 2: Heliports

- Appendix 1 - Aeronautical Data Quality Requirements

Quality Management System for AIS/MAP Services - Implementation

Note.- Reference is made to ICAO Doc. 9839 - AN/455 - Quality Management System Manual for AIS/MAP Services *(DoE: 3)*

AERONAUTICAL INFORMATION SERVICES PROVIDED BY STATES

Introduction

ICAO Doc 7383 - *Aeronautical Information Services provided by States* contains in Part 1 data concerning the type of information available from States and how they can be obtained and Part 2 shows the exchange of NOTAM between international NOTAM Offices. It also includes ICAO's requirements for aeronautical information published by States.
In addition, a listing of international airports, including those designated under Article 10 of the Convention on International Civil Aviation is provided in Part 3 of this document.

Training objectives

Conditions: Provided with Doc 7383 - *Aeronautical Information Services Provided by States* and examples of the publications produced by some of the States.

Performance: The trainee will be able to identify the information provided by the document.

Standard of accomplishment:
The trainee must be able to identify and explain the information contained in Doc 8585 and use the information when required.

Required knowledge, skill and attitude

Goal: *To familiarize trainees with aeronautical information services provided by States.*

Note. - An indication of the recommended degree of expertise (DoE) is given in parenthesis.

Aeronautical Information Services provided by States

Note.- Reference is made to Doc 7383 - Aeronautical information services provided by States

- ICAO requirements for aeronautical information (DoE 2)
- AIS areas of responsibility (DoE 2)

- Aeronautical information services available from States (DoE 2)
- Current international exchange of NOTAM (DoE 1)
- International Airports (DoE 2)

AERONAUTICAL CHART CATALOGUE

Introduction

ICAO Doc 7101 - *Aeronautical Chart Catalogue* contains mainly information about aeronautical charts and aeronautical chart series produced by States and known to be available to users involved in international civil aviation. It includes also information on aeronautical charts produced by State recognized agencies and how they can be obtained.

Training objectives

Conditions: Provided with Doc 7101 - *Aeronautical Chart Catalogue* and examples of the aeronautical Charts produced by some of the States or State recognized agencies..

Performance: The trainee will be able to identify the information provided by the document.

Standard of accomplishment:
The trainee must be able to identify and explain the information contained in ICAO Doc 7101 and use the information when required.

Required knowledge, skill and attitude

Goal: *To enable trainees to identify the content of and to use the Aeronautical chart catalogue.*

Note. - An indication of the recommended degree of expertise (DoE) is given in parenthesis.

Aeronautical chart catalogue - Content

Note.- Reference is made to ICAO Doc 7101 - Aeronautical Chart Catalogue.

- List of aeronautical charts (DoE 1)
- Indices to aeronautical chart series (DoE 1)
- Aeronautical charts published by State recognized agencies (DoE 1)

Flight Plans

Introduction

To provide the trainee with an introduction the preparation of a flight and how to file a flight plan.

Training objectives

Conditions: Trainees must be provided with an introduction for planning a flight and preparation of a flight plan.

Performance: The trainee will be able to identify flight preparation and completion of an ICAO flight plan.

Standard of accomplishment:
To identify the requirements for flight planning and how a flight plan is filed..

Required knowledge, skill and attitude

Introduction to flight planning (DoE: 1)

Goal: *To identify flight planning procedures and the need for flight plans.*

The flight planning objectives for the aircraft operator

The value of the flight plan to air traffic services

Role of the airline's flight operations personnel in the flight planning process

ICAO flight plan form

The final phases (DoE 1)

The flight crew briefing

- flight crew briefing includes:
  - meteorological information
  - status of airports, navigation aids and communications facilities (collected from AIS - NOTAM)

HUMAN FACTORS (DOE 1)

(Overview)

Note.— For more detailed information on the importance of Human Factors in civil aviation operations, instructors and trainees can refer to ICAO Doc. 9683 - Human Factors Training Manual, which is essential reading for those who would like to acquire an understanding of aviation Human Factors.

Introduction

Lapses in human performance are cited as causal factors in the majority of accidents. If the accident rate is to be decreased, Human Factors must be better understood and Human Factors knowledge more broadly applied. Increasing awareness of the importance of aviation Human Factors presents the international aviation community with a significant opportunity to make aviation both safer and more efficient. The purpose of this chapter is to introduce the AIS/MAP Officer to fundamental Human Factors concepts in aviation and to provide guidelines for introducing Resource Management for Aeronautical Information Services and Aeronautical Charts (ARM).

The meaning of Human Factors

Human Factors as a term has to be clearly defined because these words, when used in the vernacular, are often applied to any factor related to humans. The human element is the most flexible, adaptable and valuable part of the aviation system, but it is also the most vulnerable to influences that can adversely affect its performance. Throughout the years, some three out of four accidents in aviation have resulted from less than optimum human performance.

Human Factors is a technology that deals with people: it is about people in their working and living environments, and it is about their relationship with machines, equipment and procedures. Just as important, it is about their relationship with each other as individuals and in groups. It involves the overall performance of human beings within the aviation system. Human Factors seeks to optimize the performance of people by the systematic application of the human sciences, often integrated within the framework of system engineering. Its twin objectives can be seen as safety and efficiency.

Human Factors has come to be concerned with diverse elements in the aviation system. These include human behaviour; decision making and other cognitive processes; the design of controls and displays; flight deck and cabin layouts; air traffic control display systems; communication and software aspects of computers; aeronautical information services, aeronautical charts and documentation, as well as training.

Cultural differences have been recognized as issues of concern to Human Factors. The subject has been studied by many Human Factors specialists, and as is the case with many Human Factors issues, the jury is

still out and universal definition and explanation have yet to be determined. In the context of the training of AIS/MAP Officers, cultural differences should be addressed in the light of the misunderstanding that may be created between AIS/MAP personnel, Flight operations personnel, crew members and ATS personnel of differing cultural backgrounds and the resulting possible break in communication and co-ordination. When addressing this issue, instructors must exercise caution as discussion on cultural differences is subject to misunderstanding and can result in unnecessary friction. During this phase of the training, emphasis should be placed on the development of an organizational culture that encourages a team work approach to the responsibilities of all personnel involved.

In spite of the reliance on the academic sources of information, aviation Human Factors is primarily oriented toward solving practical problems in the real world. There are a growing number of integrated Human Factors techniques or methods; these varied and developing techniques can be applied to problems as diverse as accident investigation and the optimization of personnel training.

It is most important that everyone concerned with the operation and administration of the aviation system recognize the inevitability of human error. No person, whether designer, engineer, manager, controller, AIS/MAP Officer, flight dispatcher or crew member, can perform perfectly all the time. Also, what could be considered perfect performance in one set of circumstances might well be unacceptable in another. Thus, people need to be seen as they really are; to wish that they be intrinsically "better" or "different" is futile, unless such a wish is backed by a recommendation for remedial action. Such a recommendation can be further supplemented by provision of the means to achieve better design, training, education, experience, motivation, etc., with the objective of positively influencing relevant aspects of human performance.

An understanding of the predictable human capabilities and limitations and the applications of this understanding are the primary concerns of Human Factors. Human Factors has been progressively developed, refined and institutionalized since throughout the last century and is now backed by a vast store of knowledge which can be used by those involved in enhancing the safety of today's complex civil air transport system.

Resource management (RM) for AIS/MAP - Aeronautical Information Services and Aeronautical Charts (ARM)

Resource management (RM) training is but one practical application of Human Factors. Although RM can be approached in many different ways, there are some essential features. Training should focus on the functioning of the AIS/MAP Officers as part of a larger team which may include flight crew members, and not simply as a collection of technically competent individuals, and should provide opportunities for AIS/MAP Officers to practise their skills in the roles they normally perform. The programme should teach the AIS/MAP Officer how to use their personal and leadership styles in ways that foster flight safety. The programme should also teach that personal behaviour during normal, routine circumstances can have a powerful impact on how well the duties are performed.

Research studies from the behavioural sciences strongly suggest that behaviour change in any environment cannot be accomplished in a short period of time, even if the training is very well designed. Trainees need time, awareness, practice and feedback, and continual reinforcement to learn lessons that will long endure. ARM addresses the challenge of optimizing the person/machine interface and related interpersonal issues. These issues include effective team building and maintenance of teams, information transfer, problem solving, decision making, maintaining situational awareness and dealing with automated systems. Thus, to be effective, ARM training must be accomplished in several phases and over several years.

Accordingly, ARM training should include at least three distinct phases:

a) an awareness phase where ARM issues are defined and discussed;

b) a practice and feedback phase where trainees gain experience with ARM techniques; and

c) a continual reinforcement phase where ARM principles are addressed on a long-term basis.

Awareness

Awareness is the essential first phase and usually comprises instructional presentations focussing on the roles of interpersonal and group factors in the maintenance of co-ordination between the AIS/MAP Officer and personnel of departments and agencies providing AIS with "raw" information and the end users of the aeronautical information. It is important because it provides a common terminology and a conceptual frame-work for AIS/MAP Officers and flight operations personnel including flight crew members. A useful way of beginning the awareness phase might be to introduce ARM skills as they pertain to communication, situation awareness, problem solving, etc. Actual situations in which communication between AIS/MAP personnel and flight operations personnel could have a direct negative impact on the safety of air navigation should be examined and the positive and negative interactions reviewed.

It is important to recognize that awareness is only a first step; classroom instruction alone will probably not significantly alter the AIS/MAP Officer's attitudes and behaviour in the long term.

Practice and feedback

The second phase of ARM training is practice and feedback. Some programmes use role-playing techniques to provide group skills practice, as well as attitude-measuring questionnaires, as a means of providing feedback to individuals on their own interpersonal styles, some aspects of which they probably have not previously evaluated. Attitude insights allow individuals to recognize some of their strengths and weaknesses. Alone, however, they may not provide guidance on how those attitudes will positively or negatively affect each situation. Role-playing or group exercises can provide useful practice in areas of

decision making and other skills discussed in the awareness phase of the ARM curriculum. They can also demonstrate the critical responsibility of AIS/MAP Officers and the effect of stress on their ability to perform their tasks under actual emergency situations. The interrelationship between the actions of the AIS/MAP Officer and the user of the aeronautical information must be examined.

Videotape feedback is particularly effective because the third-person perspective creates a level of awareness not possible with other techniques. This perspective provides insight and provokes "self-critique" which appears to be a strong stimulus for attitude and behaviour change. It is easy to identify less-than-optimum managerial or interpersonal styles if one sees it for oneself. Moreover, these video feedback exercises will provide opportunities for peer critiques. There is ample evidence of the effectiveness of the video feedback technique, which should be used whenever possible. If video feedback is not possible, each exercise must be followed by a carefully guided debriefing session. Participants should be able to identify the objectives of each exercise and be encouraged to provide constructive feedback on performance ("peer review" should be highly encouraged), identify areas of concern, propose alternatives and relate all exercises to practical experience.

Reinforcement

The third phase is reinforcement. No matter how effective the ARM classroom curriculum, interpersonal drills and feedback techniques are, a single exposure will be insufficient. Undesirable attitudes and norms which contribute to ineffective AIS/MAP Officer's performance are often encountered and may have developed over a lifetime. It is unrealistic to expect a short training programme to counteract a lifetime of development. For maximum effect, ARM must be embedded in the total training programme, be continually reinforced, and become an inseparable part of the organization's culture. This last factor is often overlooked; it is clear, however, that effective ARM training requires the support of the highest levels of management.

Training objectives

Conditions: Using guidance already developed for flight crew members and other groups in respect to AIS/MAP training in resource management and role-playing simulating conditions that require the application of ARM concepts,

Performance: The trainee will be able to apply concepts learned in ARM training in the performance of their duties and responsibilities. They will be able to develop awareness of "good'' versus "poor" performance, to accept the need for supportive and co-operative inter-relationships between AIS/MAP Officers and end users of the aeronautical information service they provide.

Standard of accomplishment:

During training, the recorded performance of the trainee can be compared with models provided as references.

Required knowledge, skill and attitude

Goal: *To enable trainees to develop awareness of good and poor performance in the inter-relationship between AIS/MAP and its customers (users of the services provided by AIS/MAP).*

Basic concepts of ARM

Operating environment

- pilots
- flight operations personnel
- air traffic controllers
- authorities/services providing AIS with information on air navigation facilities, services and procedures
- meteorological information
- communications/navigation systems
- aerodrome/airport management
- automated systems

Situational awareness

- The ability to absorb information in a dynamic environment, to evaluate and refine the information, to anticipate contingencies and to initiate appropriate action as necessary.

Communications

- The AIS/MAP Officer's chief function is as a centre of aeronautical information. He continually receives and disseminates information, and interfaces with flight operations personnel including flight crew and many others in the operational environment. Communication skills are at the heart of this work. Communication must be easily understood by individuals in the different departments. Joint training and communications between departments should be encouraged. Emphasis must be given to:
  - inquiry/advocacy/assertion;
  - expressing/writing/composition
  - conflict resolution; and
  - radiocommunication (phraseology and technique).

Handling information

- One of the AIS/MAP Officer's main responsibilities is to keep the aeronautical information, which is essential for the safety of air navigation up to date and provide it in a suitable form to the end user, which includes flight operations personnel including air crew. The AIS/MAP Officer is required to review large quantities of real-time information and to decide what information is pertinent to be published/distributed.

Interpersonal skills

- ARM concentrates on the AIS/MAP Officer's attitudes and behaviour and the effects of same on others.

Workload management

- ARM will have a powerful influence on how the AIS/MAP Officer will function during high workload and stressful situations. Prioritizing tasks is one key element in consistent, effective operational control.

Effective decision making

- Through inquiry, advocacy and assertion, the AIS/MAP Officer assumes an important role within the operational environment. This role in workload management and situational awareness supports the effective functioning of the Aeronautical Information Service. It requires the AIS/MAP Officer to apply problem solving skills including the following:
  - weighing up competing needs;
  - awareness of resources available to various parties involved in the decision making;
  - applying effective problem-solving strategy to help in decision making; and
  - avoiding error-producing situations and behaviour.

Fundamentals of ARM training implementation

- Assess the status of the organization before implementation.
- Get commitment from all managers.
- Customize training to reflect the needs of the organization.
- Define the scope of the programme.
- Communicate the nature and scope of the programme before startup.

Components of ARM training

- Training consists of classroom presentations that focus on the interpersonal relations and co-ordination involved in the decision-making process.
- Indoctrination/awareness training modules for experienced AIS/MAP Officers are not the only way that this ARM training component may be provided. ARM concepts should be addressed in the AIS/MAP Officer initial qualification training.
- Curriculum development should address those ARM skills which are known to influence AIS/MAP Officer performance.

Recurrent training and feedback

- ARM training should be included as a regular part of required recurrent training. Recurrent ARM training should include refresher practice and feedback exercises.
- Recurrent training allows participants to practice newly improved skills in communication and interpersonal relationships and to receive feedback on their effectiveness.

- Effective feedback refers to the co-ordination concepts identified in indoctrination/awareness training and relates to specific behaviours. Practice and feedback are best accomplished through the use of some form of simulation and audio or videotape.

Continuing reinforcement

- Technical training (e.g. initial and recurrent training).
- Interdepartmental training.
- Effective resource management skills are not acquired by passively listening in a classroom but by active participation and practice.

Assessment in ARM training programmes

Self

- One of the best learning opportunities occurs when AIS/MAP Officers examine, with the assistance of a trained facilitator, their own behaviour and performance.
- Each organization should design a systematic assessment programme to track the effects of its training programme and to make continuous programme adjustments.

Effectiveness of the developer

The effectiveness of any training programme is directly related to the expertise of the developers and facilitators. Ideally they should be qualified AIS/MAP Officers, with the requisite qualifications, with skills and training in the following:

a) listening and communicating;

b) role-playing, simulations and group discussions; and

c) debriefing and feedback.

Evolving concepts of ARM

More and more authorities and agencies are discovering the value of ARM training. Just as the AIS/MAP Officer is a resource to the user of aeronautical information, that user can be a resource to the AIS/MAP Officer. Similarly other groups are resources to the AIS/MAP Officer and each other. Joint training of AIS/MAP Officers, Flight operations personnel, pilots, air traffic controllers and personnel responsible to provide AIS/MAP with "raw" information has been found to be valuable. The objective is to improve the effectiveness of all the groups within the operating team.

Effective ARM begins in initial training, is strengthened by recurrent practice and feedback, and is sustained by continuing reinforcement.

Classroom exercise: *Using "role play", trainees will simulate and apply the different concepts related to ARM.*

UNITS OF MEASUREMENT TO BE USED IN AIR AND GROUND OPERATIONS

Introduction

ICAO Annex 5 - *Units of measurement to be used in Air and Ground Operations* contains the dimensional units to be used in air and ground operations. It deals with the standard of application of units of measurement and termination of the use of non- SI units,

.

Training objectives

Conditions: Provided with ICAO Annex 5 - *Units of measurement to be used in air and ground operations*.

Performance: The trainee will be able to identify the information provided in ICAO Annex 5.

Standard of accomplishment:

The trainee must be able to identify and explain the information contained in Annex 5 and use the information as required.

Required knowledge, skill and attitude

Goal: *To familiarize trainees with the content of ICAO Annex 5 and refresh their knowledge of the units of measurement used in aeronautical operations.*

Note - An indication of the recommended degree of expertise (DoE) is given in parenthesis.

Annex 5 - Units of measurement to be used in air and ground operations

- Definitions (DoE: 1)
- Applicability (DoE: 1)
- Standard application of units of measurement,
  Selection of units of measurement as applicable to AIS/MAP services (DoE: 2)
- Attachments to Annex 5 (DoE 1)

AIRCRAFT TYPE DESIGNATORS

Introduction

ICAO Doc 8643 - *Aircraft Type Designators*, contains those aircraft types which are most commonly provided with air traffic services (ATS). These designators are primarily intended for use in flight plans and associated air traffic messages.

Training objectives

Conditions: Provided with Doc 8643 - *Aircraft Type Designators* and examples of flight plans and air traffic services messages containing the designators concerned.

Performance: The trainee will be able to identify the Structure of the Document, the Formulation of Aircraft Type Designators and relevant additional information.

Standard of accomplishment:
The Document Structure and the formulation of Aircraft Type Designators must be explained and the content of the Document identified

Required knowledge, skill and attitude

Goal: *To familiarize trainees with the use of ICAO aircraft type designators.*

Note. - An indication of the recommended degree of expertise (DoE) for the various subjects is given in parenthesis.

Doc 8643 - Aircraft Type Designators

- Document Structure (DoE: 1)
- Formulation of Aircraft Type Designators and Additional Information (DoE: 1)
- Action to be taken by States (DoE: 1)
- Aircraft Type Designators listed in Doc 8643 (DoE: 1)

Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services

Introduction

ICAO Doc 8585 contains designators for aircraft operating agencies and for authorities and services associated with international aviation. The designators consist of :

a) Three-letter designators intended for use on the international aeronautical communication service; and
b) Telephony designators for aircraft operating agencies and authorities and services operating aircraft, to be used as appropriate.

In addition, Doc 8585 contains postal and telegraphic addresses of government civil aviation authorities.

Training objectives

Conditions: Provided with Doc 8585 - *Designators for Aircraft Operating Agencies Aeronautical Authorities and Services*, and examples of their use in AFTN messages, flight plans and associated messages containing the designators concerned.

Performance: The trainee will be able to explain the Use of the designators, the Rules for the Registration of or Change in the designators and identify the general content of the document.

Standard of accomplishment:
The use of the designators, the Rules for the registration of or change in the designators must be explained and the content of the document identified

Required knowledge, skill and attitude

Goal: *To familiarize trainees with the use of designators for aircraft operating agencies, aeronautical authorities and services.*

Note. - An indication of the recommended degree of expertise (DoE) for the various subjects is given in parenthesis.

Doc 8585 -Designators for aircraft operating agencies and aeronautical authorities and services.

- Use of three-letter designators (DoE: 1)
- Rules for the registration of or change in designators (DoE: 1)
- Three-letter designators listed in Doc 8585 (DoE: 1)

Aeronautical English (written)

Introduction

ICAO Annex 15 - *Aeronautical Information Services* (AIS) specifies that each element of the Integrated Aeronautical Information Package[5] for international distribution must include English text for those parts expressed in plain language.

Training objectives

Conditions: Provided with parts of the documents contained in the Integrated Aeronautical Information Package (IAIP) issued by both national and foreign (other countries') AIS.

Performance: Trainees will be able to prepare samples of the IAIP documents in the English language. Also, trainees will demonstrate accurate reading comprehension when using IAIP documents in the English language.

Standard of accomplishment:
Trainees must be able to prepare accurate IAIP in English and understand the information contained in IAIP documents written in English.

Required knowledge, skill and attitude

Goal: *To familiarize trainees with the aeronautical terminology in the English language as used in the IAIP documents*.

Classroom exercise: Using actual national and foreign IAIP documents and actual "raw" aeronautical information, trainees will prepare the relevant documents in English.

OTHER ICAO DOCUMENTS RELEVANT TO AIS/MAP OFFICER'S DUTIES(DOE: 1)

There are several other ICAO Documents and Publications containing material relevant to the duties of AIS/MAP Officers

The Appendix to this Manual contains a list of ICAO documents and publications which contain material relevant to the duties of AIS/MAP personnel.

[5]The Integrated Aeronautical Information Package consists of AIP, including amendment service; Supplements to the AIP; NOTAM and PIB; AIC; and checklists and lists of valid NOTAM.

Those documents and publications which have not been taken into consideration in the preceding Chapters, should be brought to the attention of trainees and reviewed as necessary.

CHAPTER 6. PHASE II - SPECIALIZATION

KNOWLEDGE, SKILL AND PERFORMANCE REQUIREMENTS FOR AIS/MAP SPECIALIST

Introduction

Following the core training for AIS/MAP technical officers prescribed in Phase I, the trainee must undergo training for AIS/MAP specialist in at least one of the following categories:

- AIS/MAP Aerodrome Unit/ARO specialist
- AIS/MAP International NOTAM Office (NOF) specialist
- AIS/MAP Database specialist
- AIS/MAP Publications/Editing/Text producing specialist
- AIS/MAP Aeronautical Cartography specialist

The aim of Phase II is to expose the trainees to the practical situations and a working environment as realistic as possible. They will be given the opportunity to develop decision making abilities (evaluation, validation, preparation, authorization for provision of accurate and timely aeronautical information/data) by applying skills and knowledge gained in earlier and current parts of the course.

The training for AIS/MAP Specialist in Phase II takes the form of a series of (short) lectures and detailed presentations on the related topics, followed by supervised exercises on the specific tasks of each specialty.

The exercises consist of simulations which should be as closely as possible to the actual performance of the functions/tasks concerned. In the design of the practical exercises, it is recommended to use past and current records of NOTAMs (including SNOWTAM and ASHTAM), AIP, AIRAC and Regular AIP Amendments and Supplements, AIC, PIB, (national and foreign), FPL Database inputs, records and outputs, relevant national and local regulations etc..

The practical classroom exercises provided in Phase II are additional to those carried out in Phase I of the AIS/MAP training.

Trainees must be tested and evaluated by formal performance tests by a qualified examiner commissioned by the civil aviation authority

The ICAO TRAINAIR course development methodology is an effective approach to the preparation of training material for AIS/MAP specialist/rating. (See Foreword)

AIS/MAP SPECIALIZATION

AIS/MAP AERODROME UNIT/ARO SPECIALIST

The principal functions/duties to be performed by the AIS/MAP Aerodrome Unit/ARO Specialist are:

a) Liaise with other services and organizations at the aerodrome, the International NOTAM Office, AIS Headquarters to obtain and provide aeronautical information/data;
b) Compile and validate (or check and update as necessary) Pre-Flight Information Bulletins (PIB) before release to aircrew, aircraft operators and Flight Operations Officers/Flight Dispatchers;
c) Provide validated aeronautical information/data to ATC;
d) Provide detailed aeronautical briefings to personnel involved in flight operations, including flight crews;
e) Initiate NOTAM for processing by NOF of occurrences at the aerodrome concerned;
f) Clarify publications;
g) Maintain library of related aeronautical documents of own State, other Contracting States and ICAO, as necessary;
h) Maintain aeronautical information bulletin board displays;
i) Receive and process post-flight reports;
j) Support accident/incident investigations;
k) Participate in quality management processes.

The objectives and required basic knowledge and skills of this function include:

Note.- An indication of the recommended degree of expertise (DoE) is given in parenthesis.

Details concerning the aerodrome (DoE 4)

When stationed at an aerodrome, the AIS/MAP Aerodrome Unit/ARO Specialist is required to extensively know at least the following details concerning the aerodrome:

- layout and physical characteristics;
- airspace structure;
- air navigation facilities;
- rules and regulations;
- terrain, obstacles and prominent landmarks;
- emergency and contingency procedures.

ICAO Annex 15, Chapter 8, the content of Chapter 8 (DoE 4)

Pre-flight briefing

Content of pre-flight briefing	the content of pre-flight briefing (DoE 3)
	scope of available briefing material (DoE 3)
	significance of pre-flight briefing material to the user (DoE 3)
	decoding of abbreviations in pre-flight briefing material (Do 4)
	interpretation of information in pre-flight briefing material (DoE 4)
Preparation of briefing	selection of appropriate briefing material in accordance with requirements of briefing the user (DoE 4)
	verification of briefing material for completeness and validity (DoE 4)
	correction of mistakes in the briefing material (DoE 4)
Briefing	briefing the user with required information (DoE 4)

appropriate briefing techniques (DoE 4)
various briefing methods available (DoE 4)
working principles of the various briefing methods (DoE 3)
advantages and disadvantages of the various briefing methods (DoE 2)
summary of information provided (DoE 4)
clarification of information if necessary (DoE 4)
provision of additional information if requested (DoE 4)

Pre-flight information bulletin (PIB)

purpose of the PIB (DoE 2)
different types of PIB (DoE 3)
content of area-, route-, aerodrome- and administrative bulletin (DoE 3)
description of PIB format (DoE 3)
sequence of preparation of the PIB (DoE 3)
access to data for PIB production (DoE 4)
retrieval of selected data PIB production (DoE 4)
preparation and production of PIB (DoE 4)

Classroom exercise: *Prepare a PIB and using role play exercises carry out briefings.*

NOTAM

General

definition of NOTAM (DoE 2)
purpose of NOTAM (DoE 2)
NOTAM format (DoE 3)
basic rules for NOTAM creation (DoE 4)
requirements for NOTAM verification (DoE 4)

NOTAM identification

NOTAM identification (DoE 3)
(allocation of series and number)
NOTAM types *(N,R,C etc.)* (DoE 3)
application of NOTAM N, R, C etc. (DoE 3)

NOTAM qualification

purpose of NOTAM qualification (Q line) (DoE 3)
general rules for NOTAM qualification *(NSC)* (DoE 3)
NOTAM qualifiers (DoE3)
(FIR, NOTAM Code, traffic, purpose, scope, lower, upper, geographical reference)
decode/encode NOTAM qualifiers (DoE 3)

NOTAM items

purpose of NOTAM items (DoE 3)
NOTAM item content (DoE 3)
decode/encode NOTAM items (DoE 3)

NOTAM production

Reception of raw data for NOTAM

sources of raw data for NOTAM (DoE 2)
channels of communication for submission of raw data (DoE 3)
selection from raw data the information for dissemination by NOTAM [4]
need for authorization of draft NOTAM information (DoE 4)

format of draft NOTAM (DoE4)
check draft NOTAM information/data for completeness (DoE 4)

Preparation of NOTAM encode draft NOTAM information/data (DoE 4)
prepare text in item E) of draft (DoE 4)
produce NOTAM (DoE 4)
allocate NOTAM series, number and type (DoE 4)
address NOTAM (DoE4)
verify NOTAM before distribution (DoE 4)

NOTAM distribution procedures for NOTAM distribution (DoE 4)
application of NOTAM distribution (DoE 4)

Classroom exercise: *Manage and process raw data and:*

- *produce NOTAM project;*
- *prepare distribution list.*

Storage of NOTAM

Storage of NOTAM purpose of NOTAM storage *(investigation, time limit)* (DoE 3)
NOTAM storage procedures *(electronic/manual)* (DoE 3)
store NOTAM in accordance with procedures (DoE 4)

NOTAM database

Purpose of database purpose of the NOTAM database (DoE 3)
area of coverage of the NOTAM database (DoE 3)
working principles of the NOTAM database (DoE 3)
interaction of NOTAM database with other data systems (DoE 3)

Data input differentiation of types of data (DoE 4)
identification of appropriate static data (DoE 4)
input of static data (DoE 4)
selection of appropriate dynamic data for input (DoE 4)
input of dynamic data (DoE 4)

NOTAM for special purposes

Types of special purpose NOTAM list of special purpose NOTAM (DoE 2)

"Trigger" NOTAM purpose of "trigger" NOTAM (DoE 3)
rules for issuing "trigger" NOTAM (DoE 3)
"trigger" NOTAM procedures for AIRAC AIP amendment issue (DoE 3)
"trigger" NOTAM procedures for AIP supplement issue (DoE 3)
preparation and production of appropriate "trigger" NOTAM (DoE 4)

NOTAM checklist purpose of NOTAM checklist (DoE 3)
rules for production of NOTAM checklist (DoE 3)
preparation and production of a NOTAM checklist (DoE 4)
comparison of incoming NOTAM checklist with stored NOTAM (DoE 4)
procedures for correction of anomalies (DoE 4)

List of valid NOTAM

List of valid NOTAM	purpose of list of valid NOTAM (DoE 3) preparation and production of list of valid NOTAM (DoE 4) checking information in incoming list of valid NOTAM with stored NOTAM (DoE 4) procedures for correction of anomalies (DoE 4) storage of list of valid NOTAM (DoE 3)

Classroom exercise: *Update list of valid NOTAMs*

Messages in connection with NOTAM

Types of messages	types of messages referring to NOTAM (DoE 3)
Sending of messages	determination of when to send a specific message (DoE 4) prepare, produce and issue an appropriate message (DoE 4)
Receiving messages	identification of types of messages (DoE 3) preparation and issuance of appropriate response as required (DoE 4)

Fall back procedures

Fall back procedures	typical situations covered by fall back procedures (DoE 3) fall back procedures for common types of (communication) failure (DoE 3) application of appropriate fall back procedure in accordance with the type of failure (DoE 4)

Classroom exercise: *Given current NOTAMs and communications:*

- *prepare response: and*
- *apply fall back procedure.*

SNOWTAM

General	definition of SNOWTAM (DoE 3) purpose of SNOWTAM (DoE 3) content of SNOWTAM (DoE 3)
Reception of SNOWTAM	identification of originators of raw information data for SNOWTAM (DoE 3) methods of obtaining raw data for SNOWTAM (DoE 3) methods of transmitting SNOWTAM data to AIS/MAP (DoE 3) checking of SNOWTAM data for completeness (DoE 4)
SNOWTAM format	completion of SNOWTAM format including addressing (DoE 4)
SNOWTAM distribution	procedures for SNOWTAM distribution (DoE 3) application of SNOWTAM distribution procedures (DoE 4) methods of SNOWTAM storage *(manual/electronic)* (DoE 2)

ASHTAM

General	definition of ASHTAM (DoE 3)

purpose of ASHTAM (DoE 3)
content of ASHTAM (DoE 3)

Reception of ASHTAM identification of originators of raw information data for ASHTAM (DoE 3)
methods of obtaining raw data for ASHTAM (DoE 3)
methods of transmitting ASHTAM data to AIS/MAP (DoE 3)
checking of ASHTAM data for completeness (DoE 4)

ASHTAM format completion of ASHTAM format including addressing (DoE 4)

ASHTAM distribution procedures for ASHTAM distribution (DoE 3)
application of ASHTAM distribution procedures (DoE 4)
methods of ASHTAM storage *(manual/electronic)* (DoE 2)

Classroom exercise: *Given standard data:*

- *produce SNOWTAM project; and*
- *produce ASHTAM project*

Post-flight information

Post-flight information purpose of post-flight information (DoE 2)
procedures to be followed on receipt of post-flight information *(including information on the presence of birds)* (DoE 3)
application of the procedures on receipt of post-flight information (DoE 4)

Coordination

Coordination with ATS Units, Aerodrome authorities, Airlines, Customs and immigration authorities, Meteorological authorities and other authorities and agencies and services at the airport
need for coordination (DoE 2)
identification of principal authorities, services and agencies coordinating with AIS/MAP (DoE 3)
coordination procedures with ATS, and all other authorities, agencies and services at the airport (DoE 3)

Aircraft accident/incident procedures for dealing with aircraft accident/incident reports (DoE 3)
procedures to be followed in the event of an aircraft accident (DoE 3)

Classroom exercise: *Complete accident/incident report form.*

Where pre-flight and post-flight services are combined/collocated with the ATS Reporting Office (ARO). the following objectives, basic knowledge and skills are required:

ATS reporting office (ARO)
main functions of an ARO (DoE 2)
requirements for physical location of an ARO (DoE 2)
coverage zone of an ARO (DoE 3)
detailed information to be held (DoE 2)
responsibilities of operators/pilots to file a flight plan (DoE 2)

Aircraft Type Designators

Introduction

ICAO Doc 8643 - *Aircraft Type Designators*, contains those aircraft types which are most commonly provided with air traffic services (ATS). These designators are primarily intended for use in flight plans and associated air traffic messages.

Training objectives

Conditions: Provided with Doc 8643 - Aircraft Type Designators and examples of flight plans and air traffic services messages containing the designators concerned.

Performance: The trainee will be able to identify the Structure of the Document, the Formulation of Aircraft Type Designators and relevant additional information.

Standard of accomplishment:
The Document Structure and the formulation of Aircraft Type Designators must be explained and the content of the Document identified

Required knowledge, skill and attitude

Note. - An indication of the recommended degree of expertise (DoE) for the various subjects is given in parenthesis.

Doc 8643 - Aircraft Type Designators

- Document Structure (DoE: 1)
- Aircraft Type Designators listed in Doc 8643 (DoE: 2)

Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services

Introduction

ICAO Doc 8585 - *Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services* contains designators for aircraft operating agencies and for authorities and services associated with international aviation. The designators consist of :

a) Three-letter designators intended for use on the international aeronautical communication service; and
b) Telephony designators for aircraft operating agencies and authorities and services operating aircraft, to be used as appropriate.

In addition, Doc 8585 contains postal and telegraphic addresses of government civil aviation authorities.

Training objectives

Conditions: Provided with Doc 8585 - Designators for Aircraft Operating Agencies Aeronautical Authorities and Services, and examples of their use in AFTN messages, flight plans and associated messages containing the designators concerned.

Performance: The trainee will be able to explain the use of the designators and identify the general content of the document.

Standard of accomplishment:

The use of the designators must be explained and the content of the document identified

Required knowledge, skill and attitude

Note. - An indication of the recommended degree of expertise (DoE) for the various subjects is given in parenthesis.

Doc 8585 -Designators for aircraft operating agencies and aeronautical authorities and services.

- Use of three-letter designators (DoE: 3)
- Three-letter designators listed in Doc 8585 (DoE: 2)

Flight Planning

Introduction

To provide the trainee with an insight into the preparations involved in planning for a flight before the operation of an aircraft.

The AIS/MAP Specialist must know how a flight plan is prepared and filed, as the duties in the Aerodrome AIS Unit combined with the ATS Reporting Office (ARO) will include acceptance of flight plans.

Training objectives

Conditions: Trainees must be provided with appropriate information necessary for planning and preparation of a flight plan.

Performance: The trainee will be able to understand preparation, completion and interpretation of an ICAO flight plan.

Standard of accomplishment:

To identify the requirements for flight planning, explain what flight plan information is most important and how a flight plan is filed..

Required knowledge, skill and attitude

Introduction to flight planning (DoE: 2)

Goal: *To identify flight planning procedures and the need for flight plans.*

The flight planning objectives for the aircraft operator

- to co-ordinate and integrate all essential pre-flight activities
- to establish operational limitations (ETOPS, ferry flights)
- to ensure safety of flight
- to avoid forecast severe weather
- to schedule so as to avoid times of known adverse weather
- to operate economically
- to estimate:
  - fuel requirements
  - flight time
- safety is always the prime objective.

The value of the flight plan to air traffic services

- co-ordination and integration of flight plans and traffic flows by ATC
- co-ordination with other ATS units
- assistance in the prompt issue of a clearance that most closely meets the operator's request

Role of the airline's flight operations personnel in the flight planning process

ATC flight plan

- types of flights for which flight plans are required
- flight plan formats:
  - ICAO flight plan form
  - VFR
  - IFR
- filing of flight plans:
  - time before estimated time of departure
  - authority/agency
  - communication method
- repetitive flight plan:
  - purpose
  - format

— amendments prior to departure
— amendments after take-off

The final phases (DoE: 3)

The flight crew briefing

· flight crew briefing includes:
  — meteorological information
  — status of airports, navigation aids and communications facilities (collected from AIS - NOTAM and other documents related to AIS/MAP)
  — reasons for the recommended flight plan

Filing the flight plan

· normally done by flight operations personnel at a time specified by ATC
· normal format for international flights is as specified by ICAO
· exceptions include domestic flight plan formats acceptable to that State
· the importance of filing a flight plan strictly in accordance with the prescribed format should be emphasized
· repetitive flight plans

The Flight Plan

Note.- Reference is made to ICAO Annex 2-Rules of the air *and to ICAO Doc 4444*-PANS ATM *(DoE: 3)*

Annex 2 - Rules of the air - 3.3 Flight plans

· Submission of a flight plan
· Contents of a flight plan
· Completion of a flight plan
· Changes to a flight plan
· Closing a flight plan

Doc 4444 - PANS ATM - 4.4 FLIGHT PLAN and APPENDIX 2

· 4.4.1 Flight plan form
· 4.4.2 Submission of flight plan
· 4.4.3 Acceptance of flight plan
· Appendix 2 - Flight plan
  - ICAO model flight plan form
  - Instructions for completion of the flight plan form
  - Instructions for the transmission of a filed flight plan (FPL) message
  - Instructions for transmission of a supplementary flight plan (SPL) message
  - Example of a completed flight plan form

- ICAO model repetitive flight plan (RPL) listing form
- Instructions for the completion of a repetitive flight plan (RPL) listing form
- Example of a completed repetitive flight plan (RPL) listing form

Flight plan and related messages

The AIS/MAP Aerodrome Unit/ARO Specialist must know how and why a flight plan is prepared and filed.

General	different types of flight plan (DoE 2)
ICAO model flight plan form (FPL)	three parts of the FPL form (DoE 3)
	meaning of the items in the FPL (DoE 3)
	encode and decode FPLs (DoE 3)
Operating practices	requirements for submission of a flight plan (DoE 3)
	checking for the acceptance of flight plan (DoE 3)
	procedures for addressing of FPL (DoE 3)
	addressing of FPL (DoE 4)
	FPL transmission procedures (DoE 4)
	methods of FPL storage (DoE 2)
ATS messages	categories of ATS messages (DoE 3)]
	differentiation of types of ATS messages (DoE 3)
	composition of FPL associated messages (DoE4)
	addressing of FPL associated messages (DoE 4)
	application of FPL associated messages' transition procedures (DoE 4)
	composition and addressing of supplementary messages (DoE 4)
	application of supplementary message transmission procedures (DoE 4)
	methods of storage for FPL associated- and supplementary messages (DoE 3)
Repetitive flight plan (RPL)	purpose of RPL (DoE 3)
	items contained in RPL (DoE 3)
	collection, storage and processing of RPL data (DoE 3)
CFMU messages	purpose of CFMU messages (DoE 3)
	types of CFMU messages (DoE 3)
	function of operational reply messages (ORM) (DoE 2)
	types of ATFM messages (DoE 3)
	encode/decode of ATFM messages (DoE 4)
	transmission of ATFM messages (DoE 4)
Integrated Initial Flight Plan Processing System (IFPS)	organization and function of IFPS (DoE 2)
	air traffic affected by IFPS (DoE 3)
	the ADEXP format (DoE 3)
	how to react to ORM (DoE 4)
	interpretation of flight movement messages (DoE 3)

Classroom exercise: *Revision, acceptance and submission of FPL, SPL, RPL.*

Quality control

Quality control	need for quality control (3) quality control procedures (DoE 4) application of quality control (DoE 4)

Classroom exercise: *Perform quality check on:*

- *PIB;*
- *NOTAM production;*
- *local database; and*
- *FPL submission.*

Aeronautical English (oral)

Introduction

In addition to dealing with written English in the IAIP documents, the AIS/MAP Aerodrome Unit/ARO Specialist will brief flight crews and/or Flight Operations Officers/Flight dispatchers on relevant aeronautical information essential to the safety, regularity and efficiency of air navigation, and relevant to the route stages originating at the aerodrome.

Training objectives

Conditions: Provided with parts of actual Integrated Aeronautical Information Package (IAIP) documents, issued by both the national and foreign AIS, containing aeronautical information relevant to actual flight operations originating at a national aerodrome.

Performance: Using role play exercises, trainees will be able to brief flight crews for simulated flight operations originating at the national aerodrome.

Standard of accomplishment:

Trainees will demonstrate a proficiency at Operational level, i.e. Level 4 as described in ICAO Annex 1 - *Personnel Licensing*, Appendix 1 and Attachment - *ICAO Language Proficiency Rating Scale*.

Required knowledge, skill and attitude

Goal: *To familiarize trainees with the aeronautical/aviation terminology in the English language used when briefing flight crews, Flight Operations Officers/Flight Dispatchers, etc..*

Note.- The Degree of Expertise (DoE) is as contained in the descriptors listed in the above mentioned Attachment to ICAO Annex 1.

Classroom exercise: Role play exercises of briefing flight crews etc., using the relevant training material and actual IAIP documents.

INTERNATIONAL NOTAM OFFICE (NOF) SPECIALIST

The principal functions/duties to be performed by AIS/MAP NOF Specialist are:

Note.— In the following context, NOTAM includes NOTAM, SNOWTAM AND ASHTAM)

a) Liaise with other services and organizations, Aerodrome AIS Units and AIS Headquarters to obtain and provide relevant aeronautical information/ data;
b) Validate dynamic data and compile NOTAM;
c) Originate Trigger NOTAM;
d) Originate and Distribute NOTAM;
e) Review NOTAM for continued relevance;
f) Receive NOTAM from other NOTAM Offices and re-distribute, as required;
g) Maintain NOTAM register(s);
h) Maintain NOTAM database;
i) Generate NOTAM checklists;
j) Attend to operator input queues to resolve messages rejected by automated systems;
k) Perform quality and integrity checks of automated systems;
l) Oversight database, investigate errors and prepare performance and variation reports;
m) Support accident/incident investigations;
n) Participate in quality management processes.

The objectives and required basic knowledge and skills for this function include:

NOTAM

General	definition of NOTAM (DoE 1)
	purpose of NOTAM (DoE 2)
	NOTAM format (DoE 3)
	basic rules for NOTAM creation (DoE 4)
	requirements for NOTAM verification (DoE 4)
NOTAM identification	NOTAM identification (DoE 3)
	(allocation of series and number)
	NOTAM types *(N,R,C etc.)* (DoE 3)
	application of NOTAM N, R, C etc. (DoE 3)
NOTAM qualification	purpose of NOTAM qualification (Q line) (DoE 3)
	general rules for NOTAM qualification *(NSC)* (DoE 3)
	NOTAM qualifiers (DoE3)

	(FIR, NOTAM Code, traffic, purpose, scope, lower, upper, geographical reference)
	decode/encode NOTAM qualifiers (DoE 3)
NOTAM items	purpose of NOTAM items (DoE 3)
	NOTAM item content (DoE 3)
	decode/encode NOTAM items (DoE 3)

NOTAM production

Reception of raw data for NOTAM	sources of raw data for NOTAM (DoE 2)
	channels of communication for submission of raw data (DoE 3)
	selection from raw data the information for dissemination by NOTAM [4]
	need for authorization of draft NOTAM information (DoE 4)
	format of draft NOTAM (DoE4)
	check draft NOTAM information/data for completeness (DoE 4)
Preparation of NOTAM	encode draft NOTAM information/data (DoE 4)
	prepare text in item E) of draft (DoE 4)
	produce NOTAM (DoE 4)
	allocate NOTAM series, number and type (DoE 4)
	address NOTAM (DoE4)
	verify NOTAM before distribution (DoE 4)
NOTAM distribution	procedures for NOTAM distribution (DoE 4)
	application of NOTAM distribution (DoE 4)

Classroom exercise: *Process raw data and prepare NOTAM for distribution.*

Incoming NOTAM

NOTAM reception	conversion of NOTAM received into correctly formatted system NOTAM [4]
	checking of all items of incoming NOTAM (DoE 4)
	translation of item E) into English (as necessary) (DoE 4)
	clarification of erroneous or ambiguous parts of content of the NOTAM [4]
	monitoring of sequence of NOTAM (DoE 4)
	requisition of missing NOTAM (DoE 4)
Redistribution of NOTAM	requirements for distribution of NOTAM (DoE 3)
	procedures for redistribution of NOTAM (DoE 3
	addressing of NOTAM for redistribution (DoE 4)
	application of the procedures for redistribution (DoE 4)
	application of the procedure for rerouting (DoE 4)

Storage of NOTAM

Storage of NOTAM	purpose of NOTAM storage *(investigation, time limit)* (DoE 3)
	NOTAM storage procedures *(electronic/manual)* (DoE 3)
	store NOTAM in accordance with procedures (DoE 4)

NOTAM database

Purpose of database	purpose of the NOTAM database (DoE 3)
	area of coverage of the NOTAM database (DoE 3)
	working principles of the NOTAM database (DoE 3)
	interaction of NOTAM database with other data systems (DoE 3)
Data input	differentiation of types of data (DoE 4)
	identification of appropriate static data (DoE 4)
	input of static data (DoE 4)
	selection of appropriate dynamic data for input (DoE 4)
	input of dynamic data (DoE 4)

Classroom exercise: *Applied practical training on NOTAM acceptance, addition, distribution and redistribution procedures.*

NOTAM for special purposes

Types of special purpose NOTAM	list of special purpose NOTAM (DoE 2)
"Trigger" NOTAM	purpose of "trigger" NOTAM (DoE 3)
	rules for issuing "trigger" NOTAM (DoE 3)
	"trigger" NOTAM procedures for AIRAC AIP amendment issue (DoE 3)
	"trigger" NOTAM procedures for AIP supplement issue (DoE 3)
	preparation and production of appropriate "trigger" NOTAM (DoE 4)
NOTAM checklist	purpose of NOTAM checklist (DoE 3)
	rules for production of NOTAM checklist (DoE 3)
	preparation and production of a NOTAM checklist (DoE 4)
	comparison of incoming NOTAM checklist with stored NOTAM (DoE 4)
	procedures for correction of anomalies (DoE 4)

List of valid NOTAM

List of valid NOTAM	purpose of list of valid NOTAM (DoE 3)
	preparation and production of list of valid NOTAM (DoE 4)

checking information in incoming list of valid NOTAM with stored NOTAM (DoE 4)
procedures for correction of anomalies (DoE 4)
storage of list of valid NOTAM (DoE 3)

Classroom exercise: *Using current information, produce, correct and store list of valid NOTAM*

Messages in connection with NOTAM

Types of messages	types of messages referring to NOTAM (DoE 3)
Sending of messages	determination of when to send a specific message (DoE 4)
	prepare, produce and issue an appropriate message (DoE 4)
Receiving messages	identification of types of messages (DoE 3)
	preparation and issuance of appropriate response as required (DoE 4)

Fall back procedures

Fall back procedures	typical situations covered by fall back procedures (DoE 3)
	fall back procedures for common types of (communication) failure (DoE 3)
	application of appropriate fall back procedure in accordance with the type of failure (DoE 4)

Classroom exercise: *Using current records and lists, carry out fall back procedures.*

Quality control

Quality control	need for quality control (DoE 3)
	quality control procedures (DoE 4)
	application of quality control (DoE 4)

Classroom exercise: *Perform quality check on:*

- *NOTAM encode/decode;*
- *NOTAM production: and*
- *NOTAM associated messages and fall back procedures.*

AIS/MAP DATA BASE SPECIALIST

The principal functions/duties to be performed by AIS/MAP data base specialist are:

a) Liaise with other services and organizations to obtain and provide relevant aeronautical data;

receive, collate, assemble, edit, format and validate static aeronautical data;

b) Prepare static data for database entry;

c) Prepare dynamic data for data entry;

d) Oversight data entry;

e) Ensure data integrity through CRC processes;

f) Perform data quality and integrity checks;

g) Oversight database, investigate errors and prepare performance and variation reports;

h) Maintain bilateral agreements with data custodians and data users for completeness, accuracy, integrity, suitability, availability and release of data;

i) Authorize data for release;

j) Attend to reject queues to resolve messages that do not conform to the requirements of automated systems;

k) Support accident/incident investigations;

l) Participate in quality management processes.

Automated AIS/MAP system

Note.- Reference is made to ICAO Doc 8126 - Aeronautical Information Services Manual *(DoE 3)*

- Chapter 9 Organization of an automated aeronautical information services system;
-- Appendix A, Use of automation in the compilation, processing and distribution of NOTAM;
-- Appendix B, Common AIS query procedures for self briefing for end-users;
-- Appendix C, Common query messages for the interrogation of other AIS data bases.

AIS/MAP database

Purpose of database — purpose of the AIS/MAP database (DoE 3)
area of coverage of the AIS/MAP database (DoE 2)
working principles of the AIS/MAP database (DoE 3)
interaction of AIS/MAP database with other data systems (DoE 3)

Reception of raw data for AIS/MAP data base — sources of raw data for AIS/MAP data base (DoE 2)
channels of communication for submission of raw data (DoE 3)
selection from raw data the information for dissemination by AIS/MAP (DoE 4)
need for authorization of AIS/MAP information/data (DoE 4)
check information/data for completeness (DoE 4)
requisition of missing information/data (DoE 4)

Data input differentiation of types of data (DoE 4)
identification of appropriate static data (DoE 4)
input of static data (DoE 4)
selection of appropriate dynamic data for input (DoE 4)
input of dynamic data (DoE 4)

Storage of AIS/MAP information/data

Storage purpose of AIS/MAP information/data storage *(investigation, time limit)* (DoE 3)
AIS/MAP information/data storage procedures *(electronic/manual)* (DoE 3)
storage of AIS/MAP information/data in accordance with procedures (DoE 4)

Distribution

Information/data distribution requirements for distribution of AIS/MAP information/data (DoE 3)
procedures for AIS/MAP information/data distribution (DoE 4)
addressing of AIS/MAP information/data for distribution (DoE 4)
application of AIS/MAP information/data distribution (DoE 4)

Fall back procedures

Fall back procedures typical situations covered by fall back procedures (DoE 3)
fall back procedures for common types of *(communication/electronic)* failure (DoE 3)
application of appropriate fall back procedure in accordance with the type of failure (DoE 4)

Classroom exercise: *Using current data and simulated scenario, process several different data packs.*

Electronic terrain and obstacle data

Database for electronic terrain and obstacle data
Coverage, content, structure and product specifications of terrain data base, obstacle database and aerodrome mapping database. (DoE: 4)

Quality control

Quality control need for data quality control (DoE 3)

quality control procedures (DoE 4)
application of quality control check (DoE 4)

Classroom exercise: *Perform quality check on:*

- *data/information; and*
- *data integrity.*

AIS/MAP DOCUMENTATION/EDITING/TEXT PRODUCING SPECIALIST

The principal functions/duties to be performed by AIS/MAP documentation/editing/text producing specialist/rating are:

a) Liaise with other national and international Services and Organizations to obtain, maintain and provide aeronautical information;
b) Collate and verify aeronautical information;
c) Oversight the input of information into desk-top publishing systems;
d) Verify textual information (print copy) and authorize publication;
e) Prepare and publish the Aeronautical Information Publication (AIP);
f) Prepare and publish AIP Amendments;
g) Prepare and publish AIP Supplements;
h) Prepare and publish Aeronautical Information Circulars (AIC);
i) Prepare and publish monthly plain language summaries;
j) Prepare and publish other domestic aeronautical documents, as required by the State;
k) Clarify publications;
l) Support accident/incident investigations;
m) Participate in quality management processes.

The objectives and required knowledge and skills for this function include:

Aeronautical Information Services

Note.- For specifications, reference is made to ICAO Annex 15 - Aeronautical Information Services

- Introduction;
- Aeronautical Information Publications (AIP) (DoE 4);
- NOTAM (DoE 3);
- Aeronautical information regulation and control (AIRAC) (DoE 4);
- Aeronautical information circulars (AIC) - (DoE 4);
-Contents of aeronautical information publication (AIP) (DoE 4);

- Information to be notified by AIRAC (DoE 4).
- Terrain and obstacle data requirements (DoE 4)

Provision of aeronautical information services

Note.- For guidance on the provision of aeronautical information services, reference is made to ICAO Doc 8126 - Aeronautical Information Services manual

- Provision of raw data (DoE 4);
- Chapter 4 - Integrated Aeronautical Information Package (DoE 4);
- Chapter 5 - Aeronautical Information Publication (AIP) (DoE 4);
– Appendix - Explanatory notes on the Specimen AIP (DoE 4);
- Specimen AIP (DoE 4).

Basic steps for publication

"to collect and prepare aeronautical information for publication in the appropriate format"

Collection of information	authorised sources of "raw" data (DoE 3)
	channels of communication for submission/receipt of "raw" data (DoE 3)
	area of responsibility for publication (DoE 4)
	need for recording and filing of "raw" data (DoE 3)
	filing of "raw" data (DoE 4)
Preparation of information	determination of category of information (DoE 4)
	selection of means of publication (DoE 4)
	verification of "raw" data (DoE 4)
Preparation for publication	process for reproduction of publications (DoE 3)
	preparation of original copy (DoE 4)
	verification of original copy for printing (DoE 4)
Dissemination of publications	means by which AIS/MAP publications are disseminated (DoE 3)
	need for maintaining distribution lists (DoE 3)
	maintaining of distribution lists (DoE 3)
	means by which AIS/MAP publications can be obtained (DoE 3)

Classroom exercise: *Using current data, sample, collect, prepare and format information for publication.*

Aeronautical Information Publication (AIP)

AIP	structure of the AIP (DoE 3)
	detailed information contained in each section of Part 1-General (GEN) (DoE 3)

	detailed information contained in each section of Part 2-En-route (ENR (DoE 3)
	detailed information contained in each section of Part 3-Aerodromes (AD) (DoE 3)
	part(s) or section(s) of the AIP to which "raw" data applies (DoE 4)
	amendment of parts or sections of the AIP (DoE 3)
Update of an AIP	how an AIP is updated (DoE 3)
	differentiation between AIP amendment and AIP supplement (DoE 3)
	information to be contained in an AIP amendment (DoE 3)
	format of an AIP amendment (DoE 3)
	information to be contained in an AIP supplement (DoE 3)
	format of an AIP supplement (DoE 3)
	purpose of a checklist of an AIP supplement (DoE 3)
	the AIRAC system (DoE 4)
	information to be notified by AIRAC (DoE 4)
	significant dates for AIRAC production (DoE 4)
	purpose of the "trigger" NOTAM (DoE 3)
	determination of the appropriate form for publication of the "raw" data (DoE 4)
	preparation of the publication in the appropriate format (DoE 4)

Classroom exercise:

- *Using raw data, prepare appropriate formatted documents for publication; and*
- *Update AIP, using examples of current AIP Amendments.*

Aeronautical Information Circular (AIC)

AIC	purpose of the AIC (DoE 3)
	information to be notified by AIC (DoE 4)
	format of an AIC (DoE 4)
	preparation of AICs in the appropriate format (DoE 4)
	purpose of a checklist for AIC (DoE 3)

Classroom exercise: *Prepare a few AIC in the appropriate final format.*

List of valid NOTAM

List of valid NOTAM	purpose of the list of valid NOTAM (DoE 3)
	information to be notified in the list of valid NOTAM (DoE 3)
	preparation of the list of valid NOTAM in the appropriate format (DoE 4)

Classroom exercise: *Using current information, prepare list of valid NOTAM.*

Quality control

Quality control	need for quality control (DoE 3) quality control procedures (DoE [4) application of quality control (DoE 4)

Classroom exercise: *Perform quality check on national aeronautical information/documents ready for publication.*

Regional Supplementary Procedures (SUPPS)

Note.- Reference is made to ICAO Doc 7030 - Regional Supplementary Procedures

- Introduction
- Criteria to be satisfied in the development of SUPPS (DoE: 2)
- Status of SUPPS (DoE: 2)
- Application of SUPPS (DoE: 2)
- Procedures contained in Doc 7030 (DoE: 1)

SUPPS in the Aeronautical Information Publication (AIP)

- SUPPS published in National AIP (DoE: 2)
- SUPPS published in AIPs of neighbouring States (DoE: 1)

AERONAUTICAL CARTOGRAPHY SPECIALIST

The principal functions/duties to be performed by AIS/MAP aeronautical cartography specialist are:

a) Liaise with other Services and Organizations to obtain, maintain and provide aeronautical cartographical information/data;
b) Collate and verify aeronautical cartographical information;
c) Maintain aeronautical cartographical database;
d) Preparation of all aeronautical charts as required for AIS/MAP purposes;
e) As required by the State, prepare aeronautical charts to support other Technical services within the Civil Aviation Authority such as Air Traffic Management Units;
f) Verify information contained on charts (print copy) and authorize publication;
g) Oversight of the preparation of aeronautical charts.

h) Support accident/incident investigations;
i) Participate in quality management processes.

The objectives and required basic knowledge and skills for this function include:

Chart projections

Relationship between great circle lines and fixes

Aeronautical charts

General need for aeronautical charts (DoE 3)
types of aeronautical charts (DoE 2)
format and layout of aeronautical charts (DoE 3)
information contained in aeronautical charts (DoE 3)
interpretation of data depicted on aeronautical charts (DoE 3)
operational function of aeronautical charts (DoE 3)
selection of charts to be produced for the AIP and in what part/section of the AIP (DoE 3)

Preparation and production of aeronautical charts
application of appropriate format for each of the required charts (DoE 4)
determination of the area to be covered by each of the charts (DoE 4)
incorporation of existing data, corrections and new data (DoE 4)
adaptation of the layout of each chart (DoE 4)
verification of completeness, accuracy and presentation of charts (DoE 4)

Classroom exercise: *Update data in each of the required charts and verify completeness, accuracy and presentation of charts.*

Preparation of Aeronautical Charts

Note.- Reference is made to ICAO Doc. 8697 - Aeronautical Chart Manual

Goal: *To provide the trainee with detailed knowledge of the purpose, construction and content of the Charts used for air navigation.*

Note.- An indication of the recommended degree of expertise (DoE) is given in parenthesis.

Aeronautical chart manual

- General (DoE: 2)
  - --- Evolution of Annex 4
  - — Functional relationship of aeronautical charts
  - — Obligation of States to provide charts
  - — National cartographic services
  - — Relations with other States
  - — Relations with other International Organizations
- Requirements for aeronautical charts (DoE: 3)
  - — Establishing the need for aeronautical charts
  - — Mandatory charts
  - — Non-mandatory charts
  - — Conditionally required charts
  - — Chart groups
  - — Joint civil/military charts
  - — Priorities
  - — Relations with chart users
- Maintenance of charts (DoE: 2)
  - — Nature of the problem
  - — Preventive measures
  - — Methods
  - — Frequency of revisions
  - — Issue of "advance" information
- Cartographic techniques (DoE: 2)
  - — Draughting media
  - — Draughting (Monocolour or polychrome charts)
  - — Transfer process screens and symbols
  - — Lettering
  - — Mechanical aids
  - — Automation
- Reproduction (DoE: 2)
  - — Estimating demand
  - — Estimating production runs
  - — Reproduction
  - — Colours and Multicolour printing
  - — Scale of Hypsometric and Bathymetric Tints (World Aeronautical Chart - ICAO 1 : 1 000 000
  - — Scale of Hypsometric and Bathymetric Tints (International Map of the World 1 : 1 000 000)
- Chart distribution (DoE: 2)
  - — Introduction
  - — Distribution with Aeronautical Information Publication (AIP)
  - — Distribution by subscription

— Distribution agencies
— Availability of foreign charts
— Out-of-date charts

Note.- The following charts should be considered simultaneously with Chapters 3 to 19 of ICAO Annex 4 - Aeronautical Charts

Chapter 7. Preparation of specific charts *(To be considered simultaneously with the Specimen Charts)* (DoE: 3)

— Introduction
— General specifications
— Aerodrome Obstacle Chart - ICAO Type A
— Aerodrome Obstacle Chart - ICAO Type B
— Aerodrome Obstacle Chart - ICAO Type C
— Precision Approach Terrain Chart - ICAO
— En route Chart - ICAO
— Area Chart - ICAO
— Standard Departure Chart - Instrument (SID) - ICAO
— Standard Arrival Chart - Instrument (STAR) - ICAO
— Instrument Approach Chart - ICAO
— Visual Approach Chart - ICAO
— Aerodrome/Heliport Chart - ICAO
— Aerodrome Ground Movement Chart - ICAO
— Aircraft Parking/Docking Chart - ICAO
— World Aeronautical Chart - ICAO 1 : 1 000 000
— Aeronautical Chart - ICAO 1 : 500 000
— Aeronautical Navigation Chart - ICAO Small Scale
— Plotting Chart - ICAO
— Radar Minimum Altitude Chart - ICAO

· Definitions *(Additional to definitions in Annex 4)* (DoE: 2)
· ICAO Publications (DoE: 2)

Classroom exercise: *With drafting material/equipment available, produce two charts, selected from the preceding list, for instance an Instrument Approach Chart - ICAO or an Aerodrome/Heliport chart - ICAO. The purpose of the exercise is to show the trainee what is involved in the preparation and production of an aeronautical chart.*

Quality control

Quality control	need for quality control (DoE 3) quality control procedures (DoE 4)

application of quality control (DoE 4)

Classroom exercise: *Perform quality check on final cartographic products.*

ADDITIONAL SUBJECTS (DOE: 3)

In addition to providing the required training of knowledge and skills needed for the specialized functions within AIS/MAP the following subjects should be made part of the all round education/training of the AIS/MAP officer. It provides the trainee with a better understanding of the AIS/MAP work environment, and should make the transfer from the training phase to actual work in an AIS/MAP function easier.

AUTHORITIES, SERVICES AND AGENCIES WITH CLOSE COOPERATION/COORDINATION WITH AIS/MAP

Air navigation services

Air navigation services — the operation of Air Traffic Management (ATM) and other facilities and services
relationship between these facilities and services and AIS/MAP

Airlines

Airline operations — the operation of flight operations services of an airline *(flight planning dispatch, etc)*
relationship between airline flight operations services and AIS/MAP

Aerodromes

Aerodrome services — the operation of aerodrome services *(incl. security, crash & rescue, ground handling, airfield services, etc.)*
relationship between aerodrome services and AIS/MAP

AIR TRAFFIC MANAGEMENT (ATM) DEVELOPMENTS

It is important for AIS/MAP staff to be aware of ongoing developments in the ATM fields and their possible impact on AIS/MAP operations. The introduction of new technology in one service may have an impact on other related services like AIS/MAP.

ATM developments

Satellite navigation — the impact of GNSS based operations on AIS/MAP *(FUA, satelite serviceability)*

Systems for on-line provision of electronic data	need for provision of electronic data in AIS/MAP

THE WORK ENVIRONMENT

Working procedures

General	the need for working procedures *(uniformity, reduction of errors/mistakes and duplication)*
Local	local working procedures *(filing procedures, local lists, checks for completeness, additional duties during night shift, etc.)* application of procedures
Emergencies	procedures applicable in case of equipment failure *(hardware)* procedures applicable in case of loss or non-reception of data *(software)* procedures applicable in the event of reduced staffing action to be taken in case of sudden medical problem with staff member or client *(first aid, telephone numbers of doctor or hospital)* procedures applicable in case of severe threat to AIS/MAP office (e.g. fire, emergency evacuation) appropriate checklists for above emergency situations
Support for investigations	role of AIS/MAP in support of investigations procedures applicable in support of investigations application of these procedures

Operation of equipment

Equipment	equipment in use at AIS/MAP use of various items of equipment working principles of various items of equipment operation of the equipment concerned
Error indicators (computers)	error indicators available on different computer systems in use at AIS/MAP significance of the various error indicators appropriate action to be taken

Additional services

Additional services	additional services provided by AIS/MAP required by local agreements, contracts, authorities *(coordination between civil aviation and military authorities, preparation of ATIS and VOLMET for transmission, sale of aeronautical charts, etc.)*

	purpose of additional services provided by AIS/MAP
	procedures applicable for the provision of additional services
	provision of additional services

HUMAN PERFORMANCE

Social skills

Importance of social skills	the importance of social skills relative to AIS/MAP
Common courtesy	awareness of customer expectations
	use of common courtesy and good manners
	recognition of the requirement of acceptable dress-code
Conduct within the service	requirements for disciplined behaviour within the service
	rules of conduct within the service *(e.g. punctuality, reporting sick, swapping of shifts)*
	adherence to the rules of conduct within the service

Appendix — References

Convention

Doc 7300 – *Convention on International Civil Aviation*

Annexes to the Convention on International Civil Aviation

Annex 1 — *Personnel Licensing*

Annex 2 — *Rules of the Air*

Annex 3 — *Meteorological Service for International Air Navigation*

Annex 4 — *Aeronautical Charts*

Annex 5 — *Units of Measurement to be Used in Air and Ground Operations*

Annex 6 — *Operation of Aircraft*
Part I — *International Commercial Air Transport — Aeroplanes*
Part II — *International General Aviation —* Aeroplanes
Part III — *International Operations — Helicopters*

Annex 7 — *Aircraft Nationality and Registration Marks*

Annex 8 — *Airworthiness of Aircraft*

Annex 9 — *Facilitation*

Annex 10 — *Aeronautical Telecommunications*
Volume I (Radio Navigation Aids)
Volume II (Communication Procedures including those with PANS status)
Volume III (Part I-Digital Data Communication; Part II- Voice Communication Systems)
Volume IV (Surveillance Radar and Collision Avoidance Systems)
Volume V (Aeronautical Radio Frequency Spectrum Utilization)

Annex 11 — *Air Traffic Services*

Annex 12 — *Search and Rescue*

Annex 13 — *Aircraft Accident and Incident Investigation*

Annex 14 — *Aerodromes*
Volume I — Aerodrome Design and Operations
Volume II — Heliports

Annex 15 — *Aeronautical Information Services*

Annex 16 — *Environmental Protection*
Volume I — Aircraft Noise
Volume II — Aircraft Engine Emissions

Annex 17 — *Security — Safeguarding International Civil Aviation against Acts of Unlawful Interference*

Annex 18 — *The Safe Transport of Dangerous Goods by Air*

Procedures for Air Navigation Services (PANS)

Doc 8400 – *PANS ABC – ICAO Abbreviations and Codes*

Doc 4444 – *PANS ATM – Air Traffic Management*

Doc 8168 – *PANS OPS - Aircraft Operations*
Volume II – Construction of Visual and Instrument Flight Procedures

Doc 7030 – *Regional Supplementary Procedures*

Facility and Service Documents

Doc 8126 — *Aeronautical Information Services Manual*

Doc 8697 — *Aeronautical Chart Manual*

Doc 7101 — *Aeronautical Chart Catalogue*

Doc 7910 — *Location Indicators*

Doc 7383 — *Aeronautical Information Services Provided by States*

Doc 9674 — World Geodetic System — 1984 (WGS - 84) Manual

Doc 9839 — *Quality Management System (QMS) Manual for AIS/MAP Services*

Doc 8585 — *Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services*

Doc 8643 — *Aircraft Type Designators*

Doc 7333 — *Search and Rescue Manual*

Doc 8335 — *Manual of Procedures for Operations Inspection, Certification and Continued Surveillance*

Doc 9137 — *Airport Services Manual*

Doc 9156 — *Accident/Incident Reporting Manual (ADREP Manual)*

Doc 9284 — *Technical Instructions for the Safe Transport of Dangerous Goods by Air*

Doc 9284SU — *Supplement to the Technical Instructions for the Safe Transport of Dangerous Goods by Air*

Doc 9328 — *Manual of Runway Visual Range Observing and Reporting Practices*

Doc 9332 — *Manual on the ICAO Bird Strike Information System (IBIS)*

Doc 9365 — *Manual of All-Weather Operations*

Doc 9766 – *Handbook on International Airways Volcano Watch (IAVW)*

Doc 9377 — *Manual on Co-ordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services*

Doc 9422 — *Accident Prevention Manual*

Doc 9432 — *Manual of Radiotelephony*

Doc 9481 — *Emergency Response Guidance for Aircraft Incidents involving Dangerous Goods*

Doc 9554 — *Manual Concerning Safety Measures Relating to Military Activities Potentially Hazardous to Civil Aircraft Operations*

Doc 9640 — *Manual of Aircraft Ground De/Anti-icing Operations*

Doc 9654 — *Manual on Prevention of Problematic Use of Substances in the Aviation Workplace*

Doc 9683 – *Human Factors Training Manual*

Doc 9835 - *Manual on the implementation of ICAO language proficiency requirements*

Relevant Regional Air Navigation Plan(s)

Doc 7474 – *Africa-Indian Ocean Region*

Doc 9673 – *Asia and Pacific Regions*

Doc 8733 – *Caribbean and South American Regions*

Doc 7754 — *European Region*

Doc 9708 – *Middle East Region*

Doc 8755 – *North Atlantic, North American and Pacific Regions*

Doc 9634 – *North Atlantic Region*

Doc 9635 – *Facilities and Services Implementation Document (FASID) - North Atlantic Region*

Circulars

Circ 120 -- *Methodology for the Derivation of Separation Minima Applied to the Spacing between Parallel Tracks in ATS Route Structures*

Circ 185 — *Satellite-aided Search and Rescue — The COSPAS-SARSAT System*

Circ 186 — *Wind Shear*

Circ 211 — *Aerodrome Flight Information Service (AFIS)*

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