

Doc 9377
AN/915



Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services

Approved by the Secretary General
and published under his authority

Sixth Edition — 2014

International Civil Aviation Organization

<http://www.icao.int/publications>

AVA Documents
Document Sharing Hub



Doc 9377
AN/915



Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services

Approved by the Secretary General
and published under his authority

Sixth Edition — 2014

International Civil Aviation Organization

Published in separate English, French, Russian and Spanish editions by the
INTERNATIONAL CIVIL AVIATION ORGANIZATION
999 University Street, Montréal, Quebec, Canada H3C 5H7

For ordering information and for a complete listing of sales agents
and booksellers, please go to the ICAO website at www.icao.int

Fourth edition 2008
Fifth edition 2010
Sixth edition 2014

**Doc 9377, *Manual on Coordination between
Air Traffic Services, Aeronautical Information Services
and Aeronautical Meteorological Services***
Order Number: 9377
ISBN 978-92-9249-698-2

© ICAO 2014

All rights reserved. No part of this publication may be reproduced, stored in a
retrieval system or transmitted in any form or by any means, without prior
permission in writing from the International Civil Aviation Organization.



Documents
Document Sharing Hub

AMENDMENTS

Amendments are announced in the supplements to the *Publications Catalogue*; the Catalogue and its supplements are available on the ICAO website at www.icao.int. The space below is provided to keep a record of such amendments.

RECORD OF AMENDMENTS AND CORRIGENDA

[illegible][illegible]

(iii)

TABLE OF CONTENTS

	<i>Page</i>
Glossary	(vii)
Chapter 1. Introduction	1-1
Chapter 2. Air traffic and meteorological services organizations.....	2-1
2.1 Units providing air traffic and search and rescue services	2-1
2.2 Centres, offices and stations providing meteorological information to aeronautical users, including ATS units and search and rescue services centres.....	2-2
2.3 Links between ATS units, RCCs/RSCs and aerodrome meteorological offices, meteorological watch offices (MWOs) and aeronautical meteorological stations.....	2-5
Chapter 3. Meteorological information for ATS and search and rescue services units.....	3-1
3.1 Introduction	3-1
3.2 Displays/instruments in ATS units	3-1
3.3 Information for TWRs and ATS units providing approach control service.....	3-2
3.4 Information for ACCs or FICs.....	3-3
3.5 Information for ATS units providing service for low-level flights	3-6
3.6 Information for air-ground control radio stations, VOLMET broadcasts and uplink of OPMET data to aircraft in flight.....	3-8
3.7 Information for RCCs and RSCs.....	3-9
3.8 Format of information.....	3-9
3.9 Emergencies.....	3-10
3.10 Communication between ATS units and meteorological centres, offices and stations	3-10
Chapter 4. Meteorological information received by ATS units from sources other than the associated meteorological offices and stations	4-1
4.1 Observing and reporting of meteorological information by ATS units	4-1
4.2 Reports of aircraft observations received in ATS units	4-1
Chapter 5. Coordination between ATS units and meteorological offices and stations	5-1
5.1 General.....	5-1
5.2 Coordination between TWRs and APPs and their associated meteorological offices and stations	5-4
5.3 Coordination between ACCs/FICs and the associated MWOs	5-6
Chapter 6. Coordination between aeronautical information services and aeronautical meteorological services.....	6-1

	Page
Chapter 7. Meteorological support to the ATM system.....	7-1
7.1 Introduction	7-1
7.2 Overview of the MET information required under the ATM operational concept.....	7-1
7.3 Meteorological support to international air navigation in accordance with the Global Plan	7-
Appendix 1. Standard radiotelephony phraseologies to be used in VOLMET broadcasts	A1-1
Appendix 2. Sample letter of agreement between the ATS and meteorological authorities	A2-1
Appendix 3. Information on the meteorological authority and meteorological services to be included in the aeronautical information publication (AIP)	A3-1
Appendix 4. Procedures used in France to provide meteorological service to ATS units.....	A4-1
Appendix 5. Procedures used in the United States to provide meteorological service to ATS units	A5-1

GLOSSARY

A

ACARS	Aircraft communication addressing and reporting system
ACC	Area control centre <i>or</i> area control
ADS	Automatic dependent surveillance
AFTN	Aeronautical fixed telecommunication network
AIC	Aeronautical information circular
AIP	Aeronautical information publication
AIRAC	Aeronautical information regulation and control
AIREP	Air-report (<i>routine or special</i>)
AIRMET	Information concerning en-route weather phenomena which may affect the safety of low-level aircraft operations
AIS	Aeronautical information services
AMBEX*	Africa-Indian Ocean Region MET Bulletin Exchange (<i>Scheme</i>)
AMD	Amend <i>or</i> amended (<i>used to indicate amended meteorological message; message type designator</i>)
AMDAR*	Aircraft meteorological data relay (<i>system</i>) (WMO)
APP	Approach control unit
ASHTAM	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
ATFM	Air traffic flow management
ATFMC*	Air traffic flow management centre
ATIS	Automatic terminal information service
ATM	Air traffic management
ATS	Air traffic services

C

CB	Cumulonimbus
CNS	Communications, navigation and surveillance
CPDLC	Controller-pilot data link communications
CTA	Control area

D

D-ATIS	Data link automatic terminal information service
D-FIS*	Data link flight information service
D-VOLMET	Data link VOLMET

* Abbreviations not included in the *Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (PANS-ABC, Doc 8400).

E

ECMWF* European Centre for Medium Range Forecasts

F

FIC Flight information centre
 FIR Flight information region
 FIS Flight information service
 FL Flight level

G

GAMET Area forecast for low-level flights
 GRIB Processed meteorological data in the form of grid point values expressed in binary form
 GTS* Global telecommunication system (WMO)

H

HF High frequency (3 000 to 30 000 kHz)

I

IAEA* International Atomic Energy Agency
 IAIP* Integrated aeronautical information package
 IAVW* International airways volcano watch

M

MET Meteorological or meteorology
 METAR Aerodrome routine meteorological report (*in meteorological code*)
 MET REPORT Local routine meteorological report (*in abbreviated plain language*)
 MWO Meteorological watch office

N

NIL None or I have nothing to send to you
 NM Nautical miles
 NOTAM A notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations

* Abbreviations not included in the *Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (PANS-ABC, Doc 8400).

O

OPMET Operational meteorological (*information*)

P

PANS-ABC *Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (PANS-ABC, Doc 8400)

PANS-ATM *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444)

PIB Pre-flight information bulletin

Q

QFE Atmospheric pressure at aerodrome elevation (*or at runway threshold*)

QNH Altimeter sub-scale setting to obtain elevation when on the ground

R

RCC Rescue coordination centre

ROBEX Regional OPMET Bulletin Exchange (*within the Middle East, Asia and Pacific Regions*)

RODEX* Regional OPMET Data Exchange (*within EUR Region*)

RSC Rescue sub-centre

RVR Runway visual range

RSMC* Regional specialized meteorological centre (WMO)

S

SADIS Distribution system for information relating to air navigation

SARPs Standards and Recommended Practices

SIGMET Information concerning en-route weather phenomena which may affect the safety of aircraft operations

SIGWX Significant weather

SNOWTAM 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 Aerodrome special meteorological report (*in meteorological code*)

SPECIAL Local special meteorological report (*in abbreviated plain language*)

SSR Secondary surveillance radar

SUPPS Regional supplementary procedures

* Abbreviations not included in the *Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (PANS-ABC, Doc 8400).

(x)

T

TAF	Aerodrome forecast (<i>in meteorological code</i>)
TCAC	Tropical cyclone advisory centre
TCU	Towering cumulus
TDWR*	Terminal Doppler weather radar
TREND	Trend forecast
TWR	Aerodrome control tower <i>or</i> aerodrome control

U

UIR	Upper flight information region
-----	---------------------------------

V

VAAC	Volcanic ash advisory centre
VDU*	Visual display unit
VFR	Visual flight rules
VHF	Very high frequency (30 to 300 MHz)
VOLMET	Meteorological information for aircraft in flight

W

WAFC	World area forecast centre
WAFS*	World area forecast system
WIFS*	WAFS Internet File Service
WMO*	World Meteorological Organization

* Abbreviations not included in the *Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (PANS-ABC, Doc 8400).

Chapter 1

INTRODUCTION

Note.— There is a close operational affinity in many States between air traffic services (ATS) and search and rescue services. Both services are often provided by the same department responsible for civil aviation. Substantial parts of this manual are therefore applicable to the coordination between search and rescue services and meteorological services, even in cases where specific reference to search and rescue services is not made.

1.1 The objectives of ATS are to:

- a) prevent collisions between aircraft in the air or on the manoeuvring area of an aerodrome;
- b) prevent collisions between aircraft on the manoeuvring area and obstructions on that area;
- c) expedite and maintain an orderly flow of air traffic;
- d) provide advice and information useful for the safe and efficient conduct of flights; and
- e) notify appropriate organizations regarding aircraft in need of search and rescue aid and assist such organizations as required.

1.2 It is clear that in order to achieve these objectives effectively, ATS units require a great deal of meteorological information and service. This has been recognized in the specifications for the meteorological service to be provided for international air navigation, which describe how operators, flight crew members, ATS units, search and rescue services centres, airport management and others concerned with the conduct of international air navigation are to be supplied with the meteorological information necessary for the performance of their respective functions.

1.3 The meteorological information required by ATS units can be divided into two kinds:

- a) that needed to carry out air traffic control functions (e.g. surface wind data for establishing runways in use, weather radar data for guiding aircraft, and upper-air forecasts for tactical decision-making); and
- b) that needed to provide information to aircraft in flight (en route, landing or taking off).

1.4 The meteorological data required by ATS units to carry out these two functions have grown over the years in number and complexity. With the use of voice communications (HF and VHF) and the implementation of data link communications, ATS units have become an important intermediary for the transmission of meteorological data to aircraft. Even when information is broadcast to aircraft, ATS units are usually responsible for some of these broadcasts (e.g. routine broadcasts of meteorological information for aircraft in flight (VOLMET broadcasts), and automatic terminal information service (ATIS) broadcasts) and also for receiving meteorological information from aircraft through air-reports (AIREPs). The latter are very important since the occurrence of certain weather phenomena, such as turbulence, icing and low-level wind shear, can, to a large extent, only be diagnosed and confirmed in this manner.

1.5 The lowering of aerodrome operating minima and the implementation of all-weather operations have increased the need for accurate and timely information on local weather conditions at aerodromes for which modern, automated meteorological instrumentation and observation systems are used. The exclusion of weather echoes from

many ATS radar systems has made it necessary to provide information to controllers from weather radar and weather radar networks. Much of this information has been integrated with processed meteorological satellite data. In order for centralized ATS units to achieve efficient air traffic flow management (ATFM) and track selection, digital grid point upper wind and upper-air temperature forecasts from the world area forecast system (WAFS) have become necessary input for air traffic control computers.

1.6 To ensure that exchanges of meteorological information take place speedily and effectively, there is a need for efficient coordination between air traffic and meteorological services and their respective authorities. Requirements for such coordination are stated or implied in many parts of Annex 3 — *Meteorological Service for International Air Navigation*, Annex 11 — *Air Traffic Services*, Annex 12 — *Search and Rescue* and the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444).

1.7 The Ninth Air Navigation Conference (1976) considered that there was a need for a manual on modern methods for the provision of meteorological information to ATS units and the use of that information by those units. It was intended that the manual should make available to States information and guidance based on practical experience concerning ways and means of improving the coordination between ATS and meteorological offices and stations serving the same aerodrome and between area control centres/flight information centres (ACCs/FICs) and their associated meteorological watch offices (MWOs). The manual was also to contain information on relevant modern methods employed by States, particularly in respect of the provision to ATS units of weather radar data and weather information required by flights operating below flight level 100.

1.8 The primary aim of this manual is to meet the general intent of the requirements expressed by the Ninth Air Navigation Conference. It also provides information regarding the coordination between search and rescue and meteorological services.

1.9 The manual does not define in detail each function of the offices, stations, units and centres concerned since that information is already provided in Annexes 3, 11, 12 and the PANS-ATM; it only gives a general idea of those functions in order to ensure mutual understanding and the provision of the necessary information to aeronautical users.

1.10 In order to discuss the coordination between air traffic and meteorological services, it is necessary to provide adequate background information concerning:

- a) the organization of air traffic and meteorological services;
- b) the meteorological information to be provided to ATS units and search and rescue services centres by meteorological offices and stations (i.e. by aerodrome meteorological offices, MWOs and aeronautical meteorological stations); and
- c) the meteorological information obtained by ATS units from sources other than the aerodrome meteorological offices, MWOs and aeronautical meteorological stations (e.g. air-reports from various phases of flight).

This background information is given in Chapters 2 to 4. It should be noted that the words “shall” and “should” are not used in this document with the same regulatory meaning as in the Annexes to the Convention, which should be consulted for the status of the provisions concerned.

1.11 This sixth edition of the manual updates the existing chapters and appendices to reflect the relevant amendments that have been made to the ICAO Annexes and includes material important to the coordination between air traffic and meteorological services. This edition preserves the manual's compatibility with Amendment 75 to Annex 3 and includes material related to the *Global Air Traffic Management Operational Concept* (Doc 9854) and the *Global Air Navigation Plan* (Doc 9750), in response to ASIA/PAC Air Navigation Planning and Implementation Regional Group (APANPIRG) Conclusion 18/49.

1.12 All aspects of the progress that has been made in the provision of meteorological service to international air navigation and in the development of contemporary meteorological techniques and modern information and communications technologies to supply meteorological information to ATS units are duly reflected in this edition. Also, contributions from two States describing the methods, arrangements and technologies currently applied in those States to achieve coordination between ATS units and meteorological offices and stations are reproduced in Appendices 4 and 5.

1.13 A chapter concerning the coordination between aeronautical information services (AIS) units and meteorological authorities and their meteorological offices and stations has been included to reflect the increasing interaction between these parties. In this context, it may be recalled that, for example, the timely provision of information and warnings to aircraft regarding volcanic eruptions, pre-eruption volcanic activity, volcanic ash, and radioactive and hazardous chemical substances "clouds" cannot be achieved without close coordination between AIS units, meteorological offices and stations, and ATS units.

1.14 It is envisaged that the current ATS system will be fundamentally improved through extensive implementation of communications, navigation and surveillance (CNS) technologies to accommodate the expected increase in flight operations in all regions. In view of the implementation of air traffic management (ATM), the manual contains a chapter which outlines the sources of, and the plans and future requirements for, meteorological support to the ATM system.

Copyright International Civil Aviation Organization
Provided by IHS under license with ICAO
No reproduction or networking permitted without license from IHS
Full document details: ICAO 9377 2014

Chapter 2

AIR TRAFFIC AND METEOROLOGICAL SERVICES ORGANIZATIONS

2.1 UNITS PROVIDING AIR TRAFFIC AND SEARCH AND RESCUE SERVICES

The following units provide air traffic and search and rescue services:

- a) **Aerodrome control tower (TWR).** A unit established to provide air traffic control service to aerodrome traffic.

Provides aerodrome control service which includes, in particular, the control of aircraft arriving at or departing from the aerodromes concerned. In most cases TWRs provide this service to aircraft on the manoeuvring area (runways and taxiways) of the aerodrome and in the vicinity of the aerodrome (i.e. during actual take-off and landing and upon entering or leaving the traffic circuit, taking into consideration the dimensions of the circuit).

- b) **Approach control unit (APP).** A unit established to provide air traffic control service to controlled flights arriving at or departing from one or more aerodromes.

Established at certain aerodromes when it is necessary or desirable to create a separate unit, it provides approach control service to controlled aircraft approaching or departing an aerodrome under instrument flight rules.

- c) **Area control centre (ACC).** A unit established to provide air traffic control service to controlled flights in control areas under its jurisdiction.

Note.— The ATS units in a), b) and c) also provide flight information and alerting services.

- d) **Flight information centre (FIC).** A unit established to provide flight information service and alerting service.

Note 1.— As indicated by its title, the function of an FIC is to provide “information” useful for the safe and efficient conduct of flights; this is different from the function of units that carry out “control” service (e.g. ACCs), which provide a service aimed at the prevention of collisions as well as the maintenance of an orderly flow of air traffic.

Note 2.— Air traffic flow management (ATFM) is being implemented as a sub-element of the air traffic management (ATM) system (see also Chapter 7). It is a tool to support ATS in ensuring an optimum flow of air traffic in areas and at times when demand may exceed the available capacity of the air traffic control system. Specialized regional ATFM centres/units are being established to provide for relevant strategic, tactical and real-time ATFM functions. The tactical and real-time functions of the specialized ATFM centres may be supported by ATFM positions at ACCs. It is envisaged that global ATFM centres may be required in the future.

- e) **ATS reporting office.** A unit established for the purpose of receiving reports concerning ATS and flight plans submitted before departure.

Note.— An ATS reporting office may be established as a separate unit or combined with an existing unit, such as another ATS unit, or a unit of the AIS (see Chapter 6).

- f) **Air-ground control radio station.** An aeronautical telecommunication station having primary responsibility for handling communications pertaining to the operation and control of aircraft in a given area.

The station may supply to aircraft, in coordination with the ATS unit concerned, meteorological information for flight information purposes. The station may also be involved in transmitting air-reports received from aircraft to the ATS units and meteorological watch offices (MWOs) concerned.

- g) **Rescue coordination centre (RCC).** A unit responsible for promoting efficient organization of search and rescue services and for coordinating the conduct of search and rescue operations within a search and rescue region.

RCC and rescue sub-centres (RSCs) promote the efficient organization of search and rescue, prepare plans for the conduct of search and rescue operations within their search and rescue regions and, when necessary, initiate and coordinate action by search and rescue units in accordance with these plans.

2.2 CENTRES, OFFICES AND STATIONS PROVIDING METEOROLOGICAL INFORMATION TO AERONAUTICAL USERS, INCLUDING ATS UNITS AND SEARCH AND RESCUE SERVICES CENTRES

2.2.1 It may be recalled that it is the responsibility of each State to determine, in accordance with Annex 3, Chapter 2, 2.1.3, and with due regard to regional air navigation agreements, the meteorological service which would meet the needs of international air navigation in that State. Furthermore, each State should designate the meteorological authority to provide or arrange for the provision of this meteorological service to international air navigation. In discharging its responsibilities, the meteorological authority may arrange for the provision of all or certain portions of that meteorological service by other professional entities on its behalf. Information regarding the designation of the meteorological authority and details relating to the provision of meteorological service to international air navigation by the meteorological authority are required to be included in the aeronautical information publication (AIP), in compliance with Annex 15 — *Aeronautical Information Services*, Appendix 1, GEN 1.1 (Annex 3, Chapter 2, 2.1.4 refers; see also Appendix 3 to this manual).

2.2.2 Meteorological service is provided by the following centres, offices and stations:

- a) **Aerodrome meteorological office.** An office designated to provide meteorological service for aerodromes serving international air navigation. An aerodrome meteorological office may be located at an aerodrome or at another location as determined by the State concerned. An aerodrome meteorological office carries out all or some of the following functions to meet the needs of flight operations at aerodromes:

- prepare and/or obtain forecasts and other relevant information (e.g. aerodrome warnings and wind shear warnings and alerts) for flights with which it is concerned; the extent of its responsibilities to prepare forecasts are to be related to the local availability and use of en-route and aerodrome forecast material received from other offices;

- prepare and/or obtain forecasts of local meteorological conditions (e.g. aerodrome forecasts (TAF));
- maintain a continuous survey of meteorological conditions over the aerodromes for which it is designated to prepare forecasts;
- provide briefing, consultation and flight documentation to flight crew members and/or other flight operations personnel;
- supply other meteorological information to aeronautical users, including associated ATS units (usually TWRs and APPs);
- display the available meteorological information;
- exchange meteorological information with other aerodrome meteorological offices; and
- supply information received on pre-eruption volcanic activity, a volcanic eruption and volcanic ash cloud to its associated ATS unit, AIS unit and MWO as agreed between the meteorological, AIS and ATS authorities concerned.

Note.— For an aerodrome without an aerodrome meteorological office located at the aerodrome, the meteorological authority concerned designates one or more aerodrome meteorological office(s) which are to supply the required information.

b) **Meteorological watch office (MWO).** A meteorological office designated, on the basis of regional air navigation agreement, to:

- maintain continuous watch over meteorological conditions affecting flight operations within its area of responsibility (a flight information region (FIR) or a control area or combinations thereof);
- prepare SIGMET and other information related to its area of responsibility;
- supply SIGMET information and, as required, other meteorological information to associated ATS units (i.e. ACC or FIC);
- disseminate SIGMET information;
- when required by regional air navigation agreement:
 - 1) prepare AIRMET information related to its area of responsibility;
 - 2) supply AIRMET information to associated ATS units; and
 - 3) disseminate AIRMET information;
- supply information received on pre-eruption volcanic activity, a volcanic eruption and volcanic ash cloud for which a SIGMET has not already been issued, to its associated ACC/FIC, as agreed between the meteorological and ATS authorities concerned, and to its associated volcanic ash advisory centre (VAAC) as determined by regional air navigation agreement; and
- supply information received concerning the release of radioactive materials into the atmosphere, in the area for which it maintains watch or adjacent areas, to its associated ACC/FIC, as agreed

between the meteorological and ATS authorities concerned, and to AIS units, as agreed between the meteorological and appropriate civil aviation authorities concerned. The information comprises location, date and time of the release, and forecast trajectories of the radioactive materials.

Note 1.— MWOs are established by the States that accepted responsibility for providing ATS within an FIR or a control area.

Note 2.— In many cases, for efficiency, MWOs are collocated with an aerodrome meteorological office.

Note 3.— The information concerning the release of radioactive materials is provided by World Meteorological Organization (WMO) regional specialized meteorological centres (RSMCs) for the provision of dispersion model products for radiological environmental emergency response, at the request of the delegated authority of the State in which the radioactive material was released into the atmosphere, or the International Atomic Energy Agency (IAEA). This information is sent to a single contact point of the national meteorological service in each State. The contact point has the responsibility of redistributing the RSMC products within the State concerned. Furthermore, the information is provided by IAEA to the RSMC collocated with VAAC London (designated as the focal point) which in turn notifies the ACCs concerned about the release.

- c) **Aeronautical meteorological station.** A station designated to make observations and issue meteorological reports for use in international air navigation.

These observations are used in the issuance of reports which the station disseminates locally at the aerodrome and beyond the aerodrome. Aeronautical meteorological stations make routine observations at fixed intervals. At aerodromes, the routine observations are to be supplemented by special observations whenever specified changes occur in respect of surface wind, visibility, runway visual range, present weather, clouds and/or air temperature.

Note 1.— Local routine and special reports (MET REPORT and SPECIAL), disseminated locally at the aerodrome, are intended for arriving and departing aircraft. Aerodrome routine and special meteorological reports (METAR and SPECI) issued for dissemination to aerodromes beyond the aerodrome of origin are mainly intended for flight planning, D-VOLMET and VOLMET broadcasts (see 3.6), etc. Trend forecasts are often attached to both types of reports.

Note 2.— In addition, an aeronautical meteorological station issues, as necessary, volcanic activity reports on the occurrence of pre-eruption volcanic activity, volcanic eruptions and volcanic ash cloud and disseminates them to the associated ATS unit, MWO and AIS unit concerned.

Note 3.— The local aeronautical meteorological station often provides its reports direct to the TWR and/or APP, i.e. not necessarily via the aerodrome meteorological office associated with these ATS units.

- d) **World area forecast centre (WAFC).** A meteorological centre designated to prepare and issue significant weather forecasts and upper-air forecasts in digital form on a global basis direct to States by appropriate means as part of the aeronautical fixed service.
- e) **Tropical cyclone advisory centre (TCAC).** A meteorological centre designated by regional air navigation agreement to provide advisory information to MWOs, WAFCs and international operational meteorological (OPMET) data banks regarding the position, forecast direction and speed of movement, central pressure and maximum surface wind of tropical cyclones.

Note.— The advisory information is prepared a) in support of the issuance of SIGMET information for tropical cyclones by MWOs; and b) for direct use by operators and flight crew members in flight planning.

- f) **Volcanic ash advisory centre (VAAC).** A meteorological centre designated by regional air navigation agreement to provide advisory information to MWOs, ACCs, FICs, WAFCs and international OPMET data banks regarding the lateral and vertical extent and forecast movement of volcanic ash in the atmosphere following volcanic eruptions.

Note.— The advisory information is prepared in support of the issuance of SIGMET information for volcanic ash cloud by MWOs and b) for direct use by operators and flight crew members in flight planning. Each VAAC is a part of the ICAO International Airways Volcano Watch (IAVW). In the ACCs and AIS units, the advisory information is used in the issuance of NOTAM or ASHTAM concerning volcanic ash activity.

2.2.3 While the meteorological offices and stations listed in 2.2.2 a) to c) form part of the national aeronautical meteorological infrastructure, the meteorological centres listed in 2.2.2 d) to f) represent international facilities organized under the auspices of ICAO.

2.3 LINKS BETWEEN ATS UNITS, RCCs/RSCs AND AERODROME METEOROLOGICAL OFFICES, METEOROLOGICAL WATCH OFFICES (MWOs) AND AERONAUTICAL METEOROLOGICAL STATIONS

2.3.1 In order to achieve close and effective coordination between ATS units, RCCs/RSCs and aerodrome meteorological offices, MWOs and aeronautical meteorological stations, the meteorological authority in each State is required to designate aerodrome meteorological offices, MWOs and aeronautical meteorological stations to be associated with individual ATS units and RCCs/RSCs.

2.3.2 Aerodrome meteorological offices located at aerodromes are normally associated with local ATS units, i.e. TWRs and APPs. There are, however, many aerodromes where there is no aerodrome meteorological office located at the aerodrome. In such cases, the functions of the aerodrome meteorological office associated with the local ATS units at that aerodrome may be delegated to an aerodrome meteorological office located elsewhere (including at another aerodrome). These functions may be shared by two or more aerodrome meteorological offices.

2.3.3 MWOs are associated with an ACC and an FIC. The responsibilities of an MWO may be shared between two or more MWOs.

2.3.4 Aerodrome meteorological offices and MWOs are associated with RCCs/RSCs.

Note.— Information on aerodrome meteorological offices and MWOs established by States to meet the requirements of international air navigation is published in the facilities and services implementation document (FASID) of the regional air navigation plans.

2.3.5 The unavoidably close interrelationship between the local aeronautical meteorological station and the TWR and APP defines the link between the three parties. This link is often referred to as an aeronautical meteorological station being “associated” with the TWR and/or the APP.

2.3.6 The ATS units and the corresponding meteorological offices are summarized in Table 2-1.

Table 2-1. ATS units and associated meteorological offices

<i>ATS unit</i>	<i>Associated meteorological office</i>
Aerodrome control tower (TWR)	Aerodrome meteorological office
Approach control unit (APP)	Aerodrome meteorological office
Area control centre (ACC)	Meteorological watch office (MWO)
Flight information centre (FIC)	Meteorological watch office (MWO)

Chapter 3

METEOROLOGICAL INFORMATION FOR ATS AND SEARCH AND RESCUE SERVICES UNITS

3.1 INTRODUCTION

3.1.1 The meteorological information required by an ATS unit and provided by their associated aerodrome meteorological offices, MWOs and/or aeronautical meteorological stations includes nearly all types of aeronautical meteorological information. Detailed listings of this information are contained in this chapter. A summary of the types of information most frequently supplied to ATS units and to air-ground control radio stations (if established to serve associated ACCs/FICs), the meteorological offices and stations responsible for providing the information, the frequency with which it is usually provided and the communications means normally used for this purpose are given in Table 3-1.

3.1.2 In view of the importance of the meteorological information supplied to ATS units for the safety and efficiency of aviation, it is essential that the information is always kept up to date, accurate and provided in a timely manner. Of particular importance in this connection is information on significant changes in the meteorological conditions. Such changes include not only changes requiring the issuance of SPECI but may also include, as agreed, changes in wind, temperature, pressure and other elements that may require ATS units to take action (e.g. for change of the runway-in-use).

3.2 DISPLAYS/INSTRUMENTS IN ATS UNITS

3.2.1 It is essential that TWRs and APPs be equipped, as a minimum, with surface wind displays and, where such values are measured by instrumented means, runway visual range (RVR) values and displays providing current pressure data for the altimeter setting for the aerodrome, corresponding to those of the meteorological station at the local aerodrome. The displays in TWRs and APPs must provide the same information, and both must derive that information from the same sensors as the displays in the meteorological station at the aerodrome. Each display should be clearly labelled to show the location of the sensor to which it refers. This applies also to multiple anemometers used at many aerodromes. In those cases, it is usually arranged that ATS units need not be provided with local special reports (SPECIAL) indicating significant changes in elements which have displays in TWRs and APPs.

3.2.2 It is highly desirable that TWRs and APPs be equipped with remote displays providing:

- a) visibility;
- b) the height of the cloud base; and
- c) temperature and dew-point temperature.

3.2.3 It is important that the displays mentioned in 3.2.2 a) and b) be related to the same locations and fed from the same sensors as the corresponding displays in the aerodrome meteorological office and/or aeronautical meteorological station.

3.2.4 Integrated automatic systems for the acquisition, processing, dissemination and display, in real time, of the meteorological parameters affecting landing and take-off operations must be deployed at aerodromes with Category II, III A and III B instrument approach and landing operations. These systems are also desirable for Category I approach and landing operations. Information concerning meteorological elements and phenomena indicated on remote displays of such systems in ATS units should also comply with the principles given in 3.2.1 and 3.2.3.

3.3 INFORMATION FOR TWRs AND ATS UNITS PROVIDING APPROACH CONTROL SERVICE

3.3.1 The following meteorological information is required to be supplied to a TWR, or ATS unit providing approach control service, by its associated aerodrome meteorological office and aeronautical meteorological station(s):

- a) local routine and special reports (MET REPORT and SPECIAL), including trend forecasts, METAR and SPECI, TAF and amendments thereto, for the aerodrome concerned;
- b) SIGMET and AIRMET information (if appropriate), wind shear warnings and alerts, and aerodrome warnings and, in the case of an approach control unit, also appropriate special air-reports for the airspace with which it is concerned;
- c) any additional meteorological information as agreed upon locally (such as forecasts of surface wind for the determination of possible runway changes in the case of TWRs);
- d) information received on volcanic ash cloud, for which a SIGMET message has not already been issued, as agreed between the meteorological and ATS authorities concerned; and
- e) information received on pre-eruption volcanic activity and/or volcanic eruption and volcanic ash cloud as agreed between the meteorological and ATS authorities concerned.

3.3.2 If agreed between the meteorological authority and the appropriate ATS authority, local special reports in respect of surface wind and other elements are not issued and supplied to a TWR, or an APP, if the TWR, or APP, has displays for these elements corresponding to the displays in the aeronautical meteorological station concerned. Similarly, local special reports in respect of RVR are not issued and supplied to a TWR, or an APP, if the TWR, or APP, and the aeronautical meteorological station concerned are equipped with corresponding RVR displays or if changes in RVR are continuously reported to the TWR, or APP, by an observer at the aerodrome concerned. It is important that the appropriate meteorological and ATS authorities develop an agreement on all aspects of this practice for inclusion in the Letter of Agreement referred to in 5.1.3.

3.3.3 Particular emphasis should be given to the occurrence or expected occurrence of a weather deterioration as soon as this can be determined. It should be noted that certain changes in the weather are regarded as “weather deteriorations”, although they may not ordinarily be considered as such. An increase in temperature may, for example, adversely affect aircraft performance.

3.3.4 Special emphasis on the observing and reporting of significant meteorological conditions in the vicinity of the aerodrome is also required, particularly in the climb-out and approach areas. These conditions include:

- a) cumulonimbus or thunderstorms;
- b) moderate or severe turbulence;
- c) wind shear, including microbursts;

- d) hail;
- e) severe squall line;
- f) moderate or severe icing;
- g) freezing precipitation;
- h) severe mountain waves;
- i) sandstorm;
- j) duststorm;
- k) blowing snow;
- l) funnel cloud (tornado or waterspout); and
- m) volcanic ash.

Where practicable, the information should identify the location of the phenomenon. The area to be covered by these observations normally extends to approximately 16 km from the aerodrome reference point. Some of this information can best be provided by relaying to TWRs, or APPs, relevant weather radar data, data from ground-based wind shear detection and remote-sensing equipment and data from automatic meteorological observing stations deployed in the vicinity of the aerodrome. Aircraft observations made during the climb-out or approach phases of flight represent an important source of information on significant weather phenomena in the vicinity of the aerodrome. This applies, in particular, to icing, turbulence and wind shear, including microbursts.

3.3.5 A TWR, or APP, receives information from its associated aerodrome meteorological office on pre-eruption volcanic activity, volcanic eruptions and volcanic ash cloud in accordance with 3.3.1 e). This vital information should be passed on, as necessary, to aircraft likely to be affected by these events, until the corresponding SIGMET and/or NOTAM/ASHTAM are issued by the MWO and/or ACC/AIS unit concerned.

3.4 INFORMATION FOR ACCs OR FICs

3.4.1 The following meteorological information is required to be supplied to an ACC or FIC by its associated MWO:

- a) METAR and SPECI, including current pressure data, trend forecasts and TAF (and amendments thereto) covering the FIR or the control area and, if required by the FICs or ACCs, covering aerodromes in neighbouring FIRs, as determined by regional air navigation agreement;
- b) forecasts of upper winds, upper-air temperatures and significant en-route weather phenomena and amendments thereto (particularly those which are likely to render operations under visual flight rules impracticable), SIGMET and AIRMET information and appropriate special air-reports¹ covering the FIR or control area concerned and, if required, covering neighbouring FIRs/control areas;

1. Appropriate special air-reports are those which have not been incorporated in a SIGMET message.

- c) any other meteorological information required by the ACC/FIC to meet requests from aircraft in flight. If the information requested is not available in the associated MWO, another meteorological office will be requested to supply it;
- d) information received on volcanic ash cloud, for which a SIGMET message has not already been issued, as agreed between the meteorological and ATS authorities concerned;
- e) tropical cyclone advisory information issued by a TCAC for its area of responsibility;
- f) volcanic ash advisory information issued by a VAAC for its area of responsibility;
- g) information received concerning the release of radioactive materials into the atmosphere, as agreed between the meteorological and ATS authorities concerned; and
- h) information received on pre-eruption volcanic activity and/or volcanic eruption as agreed between the meteorological and ATS authorities concerned.

3.4.2 The METAR and SPECI, TAF for other aerodromes and the SIGMET and AIRMET information for other FIRs that are to be provided to the ACC/FIC are determined by regional air navigation agreement. They are normally those aerodromes and FIRs located within two hours' flying time of the border of the local FIR to which there is traffic, including overflying traffic. It should be noted, however, that in order to meet the requirements for extended range operations and flights conducted under centralized operational control, the exchange of OPMET messages determined by regional air navigation agreement may also include additional reports from aerodromes beyond the two hours' flying time. Furthermore, in view of the importance of SIGMET information concerning volcanic ash and tropical cyclones for long-haul flights, the dissemination of this information and appropriate special air-reports for volcanic ash cloud (see 4.2) should be extended beyond the two hours' flying time to cover the whole of the routes to be flown. The messages resulting from such exchanges of OPMET information should be made available to the ACCs and FICs as agreed between the meteorological and ATS authorities concerned.

3.4.3 Regional supplementary procedures governing the transmission of SIGMET to aircraft are given, for certain regions, in Doc 7030 — *Regional Supplementary Procedures*.

3.4.4 Special emphasis is required on the following significant en-route meteorological phenomena that warrant the issuance of SIGMET and AIRMET:

- a) SIGMET for flights at cruising levels (irrespective of altitude):

- thunderstorm
 - obscured, embedded, frequent or in a squall line
 - with or without heavy hail
- tropical cyclone
- severe turbulence
- severe icing
- severe icing due to freezing rain
- severe mountain wave
- heavy duststorm

- heavy sandstorm
 - volcanic ash (irrespective of altitude)
 - radioactive clouds
- b) AIRMET for flights below flight level 100 or flight level 150 in mountainous areas:
- surface wind speed
 - widespread mean wind speed above 15 m/s (30 kt)
 - surface visibility
 - widespread areas of visibility less than 5 000 m, including the weather phenomenon causing the reduction of visibility
 - isolated and occasional thunderstorms
 - with or without hail
 - mountain obscuration
 - cloud
 - widespread areas of broken or overcast cloud with height of base less than 300 m (1 000 ft) above ground level
 - isolated, occasional and frequent cumulonimbus clouds
 - isolated, occasional and frequent towering cumulus clouds
 - moderate turbulence (except for turbulence in convective clouds)
 - moderate icing (except for icing in convective clouds)
 - moderate mountain wave.

Special air-reports, and meteorological satellite and weather radar data can be used to detect many of these phenomena and will assist the MWO in the issuance of the corresponding SIGMET and AIRMET.

3.4.5 Any information concerning volcanic activity and volcanic ash in the atmosphere is very important for the safety of flights. MWOs should therefore pass on any available information regarding pre-eruption volcanic activity, volcanic eruptions and volcanic ash cloud that they receive to the associated ACCs/FICs and the AIS unit concerned so that this vital information can be passed on to aircraft likely to be affected, and a NOTAM, preferably in the ASHTAM format, can be issued. Wherever possible, the information should include date and time of message; location of volcano and name if known; concise description of event including level of intensity of volcanic activity, occurrence of an eruption and its date and time and the existence of a volcanic ash cloud in the area together with direction of ash cloud movement and height.

Note 1.— The level of intensity of volcanic activity may be indicated in plain language or in the colour code for levels of alert given in Annex 15, Appendix 3.

Note 2.— Aeronautical meteorological stations observing volcanic ash or volcanic activity issue such information as a VOLCANIC ACTIVITY REPORT (Annex 3, Chapter 4, 4.8 refers).

Note 3.— Close coordination is required between the MWO, ACC/FIC and AIS units to ensure that information on volcanic ash provided in SIGMET and ASHTAM/NOTAM is consistent. In particular, information received

from national vulcanological agencies (e.g. using the volcanic activity colour code in Annex 15, Appendix 3, 3.5) should be exchanged between the MWO, ACC/FIC and AIS units.

3.4.6 As was mentioned in 2.2.2 f), VAACs, designated within the international airways volcano watch (IAVW), issue volcanic ash advisory information regarding the lateral and vertical extent and forecast movement of volcanic ash in the atmosphere following volcanic eruptions. The advisory information provides forecast extent and movement of the volcanic ash for a period of eighteen hours. The volcanic ash advisory information issued by a VAAC is required to be supplied by the VAAC to those MWOs, ACCs, FICs and other VAACs whose area of responsibility may be affected, and to WAFCs, international OPMET data banks, international NOTAM offices, and centres designated by regional air navigation agreement for the operation of AFS satellite distribution system and Internet-based services.

3.4.7 States which deal with large amounts of traffic sometimes have found it expedient to station meteorologists in the ACC or ATFM. Apart from ensuring that the unit is supplied with all the necessary meteorological information, the duty of the meteorologist is mainly to advise controllers on meteorological conditions that could influence the progress of traffic in their areas of responsibility, such as widespread thunderstorms, changes in jetstream configuration or heavy snowfalls over large areas. This advice is of particular importance where quick decisions are needed in the face of rapid weather developments or in cases of in-flight emergencies.

3.5 INFORMATION FOR ATS UNITS PROVIDING SERVICE FOR LOW-LEVEL FLIGHTS

Meteorological information required by the ATS units for low-level flights

3.5.1 Information on en-route meteorological conditions for low-level flights, including flights under visual flight rules (VFR), should cover the layer between the ground and flight level 100 (or up to flight level 150 in mountainous areas, or higher, where necessary). Owing to the variability of meteorological conditions, which may be markedly affected by the surrounding topography, information on actual en-route weather conditions and the relevant forecasts to be supplied to ACCs/FICs and/or to respective VFR positions in the centres are usually specified for smaller topographically homogenous geographical sub-areas of the FIR/control area concerned. Such sub-areas are defined by the meteorological authority in coordination with users and the ATS authority.

3.5.2 In view of the higher sensitivity of low-level flights and, in particular, VFR operations, to some weather conditions and phenomena, the information supplied to the ATS units concerned should include detailed specifications regarding the horizontal and vertical distribution of these conditions and phenomena and their intensity. Low cloud base and visibility conditions represent limiting factors for low-level flights, particularly VFR flights. It is clear that the meteorological phenomena that may affect the safety of flight operations at cruising levels and are subject to the issuance of SIGMET information also affect the safety of low-level operations. In addition, there are other weather phenomena (such as moderate icing, moderate turbulence, isolated thunderstorms, cumulonimbus (CB) and towering cumulus (TCU) clouds, mountain obscuration, moderate mountain wave, and areas with widespread strong surface wind) that are of significance to the safety of low-level flight operations (see 3.4.4 a) and b)). Information concerning all of these phenomena should be supplied to the ATS units concerned.

3.5.3 The processed data from ground-based weather radar and meteorological satellites may complement the information on actual weather conditions obtained from meteorological stations and aircraft in flight. These data are important for the issuance of forecasts and advisories prepared to support low-level operations.

3.5.4 The meteorological information to be supplied to ACCs/FICs, as outlined in 3.4.1, constitutes the basis for the information to be supplied to the ATS units providing the service for low-level operations. Nevertheless, it is important that *all* available information on weather conditions which are likely to render low-level operations en route

impracticable, including VFR flights, is made available to the ATS units concerned. All special and non-routine aircraft observations and reports received (or obtained), together with the relevant SIGMET in force, should be closely watched and employed by personnel. The role and purpose of AIRMET information are discussed below.

3.5.5 Pressure data for altimeter settings throughout the FIR/control area concerned should be available in the ATS units concerned. The lowest QNH forecast values for the FIR/control area or their sub-areas should be made available to the ACCs/FICs (and their VFR positions) concerned.

3.5.6 Upper wind and upper-air temperature forecasts supplied to the ATS units should relate to the layer up to flight level 100, or 150 or higher in mountainous terrain, and should be presented at least for the altitudes of 600, 1 500 and 3 000 m (2 000, 5 000 and 10 000 ft) and 4 500 m (15 000 ft) in mountainous areas and for points separated by no more than 500 km (300 NM). The height indications of freezing level(s) for the layer should also be included, if applicable.

3.5.7 TAF, trend forecasts (where required), aerodrome warnings, wind shear warnings and alerts should be available in the ATS units concerned to be used in support of the approach, landing, take-off and climb-out phases of low-level flights.

Format of area forecasts for low-level flights

3.5.8 Forecasts for low-level flights are routinely issued only when the density of traffic operating below flight level 100 (or up to flight level 150 in mountainous areas, or higher, where necessary) warrants their issue and dissemination for such operations. If that is the case, the meteorological authority has to determine, in consultation with the users and the ATS authority, the following aspects of such forecasts:

- a) frequency of issue;
- b) format;
- c) fixed time or period of validity; and
- d) criteria for amendments.

3.5.9 Where warranted by the density of low-level traffic and, subject to regional air navigation agreement, AIRMET information is issued by appropriate MWOs. This information gives a concise description in abbreviated plain language concerning the occurrence and/or expected occurrence of specified en-route weather phenomena that were not forecast in the area forecast for low-level flights issued by the designated aerodrome meteorological office or MWO and provided to pilots. The criteria for the issuance of AIRMET information are given in 3.4.4 b). The format of area forecasts issued in support of the issuance of AIRMET information has to be agreed upon between the meteorological authorities concerned (i.e. the meteorological authorities which are parties to the regional air navigation agreement concerning the issuance of AIRMET information) and should be selected from the following two options:

- a) GAMET area forecasts if abbreviated plain language is used; or
- b) combination of upper wind and upper-air temperature and low-level significant weather (SIGWX) forecasts if chart form is used.

GAMET forecasts are issued in two sections with the first produced primarily to support the AIRMET information and the second to provide supplementary information required by low-level flights. Complete GAMET forecasts may be used at ATS units, together with relevant AIRMET, as complete area forecasts for low-level flights.

3.5.10 Detailed provisions concerning the content and format of area forecasts for low-level flights including the GAMET message format are given in Annex 3, Appendix 5.

3.5.11 Area forecasts for low-level flights (including GAMET area forecasts), prepared to support the issuance of AIRMET information, are issued every six hours for a period of validity of six hours.

Information to be supplied to low-level flights by the ATS units

3.5.12 It should be noted that the meteorological information dealt with in 3.5.1 to 3.5.11 is used by ATS units mostly for flight information service purposes. ATS units providing service for low-level operations must also ensure that:

- a) SIGMET messages are relayed, as appropriate, to aircraft in flight;
- b) special air-reports are relayed, as appropriate, to aircraft in flight until such time as a corresponding SIGMET is issued; and
- c) where AIRMET information is issued in accordance with regional air navigation agreement, this information is relayed, as appropriate, to aircraft in flight.

3.6 INFORMATION FOR AIR-GROUND CONTROL RADIO STATIONS, VOLMET BROADCASTS AND UPLINK OF OPMET DATA TO AIRCRAFT IN FLIGHT

3.6.1 Where necessary for flight information purposes, METAR and SPECI, and TAF can be supplied to air-ground control radio stations. A copy of such information is to be forwarded to the ACC or FIC concerned.

3.6.2 The ATS unit designated to provide VHF or HF VOLMET broadcasts, in accordance with the relevant requirement in the regional air navigation plan, will be supplied with the necessary METAR/SPECI and, if required, associated trend forecasts, SIGMET messages and TAF, from a meteorological office or a communications centre designated by the meteorological authority. Guidance on the phraseologies to be used when compiling VOLMET broadcast transmissions is given in Appendix 1.

3.6.3 In the CNS/ATM environment, many of the flight information services carried out at present using continuous broadcasts, general calls or directed transmissions from the appropriate ATS unit will be replaced by data link services. Two specific data link services have already been developed for meteorological information, which will require coordination between the ATS and meteorological authorities concerned:

- a) data link VOLMET service (D-VOLMET); and
- b) data link automatic terminal information service (D-ATIS).

The D-VOLMET and D-ATIS will replace the corresponding VOLMET and ATIS broadcasts. The D-VOLMET service will include the data link flight information service (D-FIS), including METAR/SPECI, SIGMET and TAF applications.

3.6.4 Particular attention should be drawn to the specifications for the meteorological parameters to be included in the data link services applications. In principle, they should be similar to the corresponding existing broadcasts. When arranging for the uplink of meteorological information to aircraft in flight, the ATS and meteorological authorities concerned should ensure that:

- a) in the D-VOLMET data link service (and in VOLMET broadcasts), the meteorological information included should be in accordance with the respective regional air navigation agreement and have the format and content of a meteorological report disseminated beyond the aerodrome (e.g. METAR); and

- b) in the D-ATIS data link service (as in the existing ATIS broadcast), the meteorological information included should be in accordance with the meteorological reports disseminated locally at the aerodrome (i.e. local routine and special reports).

In practice, the ATS and meteorological authorities concerned must ensure that the appropriate sensors and averaging periods are used in each data link service. For example, in the D-VOLMET, the wind information should be averaged over ten minutes and be representative of the conditions above the whole runway complex, while in the D-ATIS it should be averaged over two minutes and be representative of the conditions along the runway and at the touchdown zone.

Note.— Detailed specifications for the meteorological reports (i.e. MET REPORT and SPECIAL, and METAR and SPECI) can be found in Annex 3, Chapter 4 and Attachment D. Provisions related to VOLMET are included in Annex 3, Chapter 11, 11.5 and 11.6 and provisions concerning ATIS are included in Annex 11, Chapter 4, 4.3.4 to 4.3.9.

3.7 INFORMATION FOR RCCs AND RSCs

3.7.1 Information to be supplied on request to RCCs and RSCs should include the meteorological conditions that existed in the last known position of a missing aircraft and along the intended route of that aircraft with particular reference to:

- a) significant en-route weather phenomena;
- b) cloud amount and type (particularly cumulonimbus), and height indications of bases and tops;
- c) visibility and phenomena reducing visibility;
- d) surface wind and upper wind;
- e) state of ground, in particular, any snow cover or flooding;
- f) sea-surface temperature, state of the sea or significant wave height, ice cover if any and ocean currents, if relevant to the search area; and
- g) sea-level pressure data.

3.7.2 On request from the RCC, the designated meteorological office (usually the associated MWO) should arrange to obtain for the RCC and RSC details of the meteorological forecast given in the flight documentation supplied to the missing aircraft and any amendments subsequently issued. It should also supply to aircraft and/or ships undertaking search and rescue operations information on current and expected meteorological conditions en route to and in the search area or at the scene of the accident.

3.8 FORMAT OF INFORMATION

3.8.1 The meteorological information supplied to ATS units should be in a form, as agreed locally, enabling easy interpretation (i.e. direct reading as much as possible).

3.8.2 Existing aeronautical meteorological alphanumeric codes are generally accepted by flight crews and ATS personnel as requiring a minimum of interpretation. Local routine and special reports (MET REPORT and SPECIAL),

and SIGMET and AIRMET messages must be in accordance with the templates included in Annex 3, Appendices 3 and 6, respectively.

3.8.3 When upper wind, upper-air temperature and humidity information is supplied to ATS units in digital form for use by ATS computers and automatic information systems, the contents, format and transmission arrangements are to be as agreed between the meteorological and ATS authorities. Where the data are supplied in a code form prescribed by WMO, use is to be made of the GRIB code form which is applied to upper wind, upper-air temperature and humidity forecasts issued by WAFCs of the WAFS.

Note.— The GRIB code form is contained in WMO Publication No. 306 — Manual on Codes, Volume I.2, Part B — Binary Codes.

3.8.4 Some meteorological information, such as processed weather radar and satellite data, tropical cyclone and volcanic ash advisory information, and wind shear warnings and alerts, may be supplied to ATS units in graphical format, as agreed between the meteorological and ATS authorities concerned. Such information may be supplied for display at various ATS units as separate meteorological information or jointly with ATS information. In this regard, it should be reiterated that such meteorological information is intended to assist ATS personnel in discharging their responsibilities with minimum additional workload. For this reason, it needs to be user-friendly and easy to read and interpret.

3.9 EMERGENCIES

3.9.1 Any meteorological information requested by an ATS unit or an RCC or RSC in connection with an aircraft emergency is to be supplied as rapidly as possible. Following notification by the ATS unit in charge that an aircraft accident/incident has occurred in the vicinity of an airport, aeronautical meteorological stations should:

- a) make a special accident/incident observation, either manually or prompted through the automated observing system in use;
- b) mark the time on all instrument recordings; and
- c) ensure that all pertinent meteorological observation and forecast data are retained for at least 30 days.

3.9.2 Copies of the flight documentation that was supplied to flight crew members and which, in accordance with Annex 3, Chapter 9, 9.3.4, is to be retained or stored in computer memory for a period of at least 30 days, should be made available on request for aircraft accident/incident inquiries. The flight documentation produced by the relevant WAFC (significant weather forecasts, upper-air forecasts, etc.) and supplied to the personnel involved in the accident/incident investigation should, if necessary, be validated by the WAFC concerned.

3.10 COMMUNICATION BETWEEN ATS UNITS AND METEOROLOGICAL CENTRES, OFFICES AND STATIONS

3.10.1 Suitable telecommunications facilities should be provided to permit meteorological offices and aeronautical meteorological stations to supply the necessary meteorological information to ATS units and to respond quickly to requests for non-routine information. The telecommunications facilities should also permit the transmission of meteorological information and requests for information from ATS units to meteorological offices and stations. It is particularly important that the telecommunications facilities permit the rapid and reliable exchange of information between aerodrome meteorological offices and search and rescue services units.

3.10.2 Telecommunications facilities between aerodrome meteorological offices and/or aeronautical meteorological stations, and TWRs and/or APPs should permit communications by direct speech, the speed with which such communications can be established being approximately 15 seconds. (This requirement can be met if switchboards are used.)

3.10.3 Telecommunications facilities between aerodrome meteorological offices or MWOs and ACCs, FICs and/or RCCs/RSCs should permit contacts between the respective offices and centres to be established within approximately 15 seconds. In addition, for printed communications, when a record is required, the transit time should not exceed 5 minutes

3.10.4 The telecommunications facilities mentioned in 3.10.1 to 3.10.3 may be supplemented by other forms of communications (e.g. data, visual and audio).

3.10.5 Although computerized automated information systems, automatic meteorological observing stations, automatic data transfer using keyboard input and video display units (VDUs) are employed for transmitting information from meteorological offices and stations to ATS units, this does not remove the need for efficient speech circuits.

3.10.6 Where non-routine data (special reports, SIGMET and AIRMET information, warnings, etc.) are transmitted in addition to routine data via methods such as automated information systems, automatic meteorological observing stations, VDUs and audio communications, aural and visual arrangements are needed to draw attention to this information (e.g. by means of a cueing feature). If such messages are supplied by direct-speech communications, a confirmatory hard copy of these messages may also be required.

3.10.7 In an increasing number of cases, information is supplied to certain ATS units (particularly ACCs/FICs) by more than one meteorological office, using various sources of information and methods of communication. In such cases, an agreement should be developed between the meteorological and ATS authorities concerned regarding the supply of necessary OPMET messages to ACCs and FICs direct from international sources of OPMET information (e.g. AFS satellite broadcast and Internet-based services and ICAO regional schemes for OPMET data exchange, such as the Africa-Indian Ocean Region MET Bulletin Exchange (AMBEX), European regional OPMET data exchange (EUR RODEX) and Regional OPMET Bulletin Exchange (ROBEX)). Similarly, ACCs and FICs may be offered access to the communications systems/networks of the meteorological authority of the State concerned and to international OPMET data banks.

3.10.8 Finally, it should be noted that suitable means of communication should be agreed upon for the transmission of tropical cyclone and volcanic ash advisories from TCACs and VAACs to the ACCs and FICs concerned.

Table 3-1. Aeronautical meteorological information supplied to ATS units

<i>Information</i>	<i>Distributor</i>	<i>Destination</i>	<i>Frequency</i>	<i>Communications means</i>
METAR and local routine reports with trend forecast*, as required	Aeronautical MET station [trend forecast prepared by aerodrome MET office]	TWR APP ACC FIC COM station	Hourly**	See Note 1 See Note 1 See Note 1 See Note 1 See Note 2
SPECI and local special reports with trend forecast*, as required	Aeronautical MET station [trend forecast prepared by aerodrome MET office]	TWR APP ACC FIC COM station	When warranted	See Note 1 See Note 1 See Note 2 See Note 2 See Note 2
TAF	Aerodrome MET office	TWR APP ACC FIC COM station	Every 3 or 6 hours	See Note 1 See Note 1 See Note 1 or 2 See Note 1 or 2 See Note 2
Aerodrome warnings	Aerodrome MET office	TWR APP COM station Aerodrome services	When warranted	See Note 1 See Note 1 or 2 See Note 2
Upper-wind and temperature forecasts	Aerodrome MET office and/or MWO (data to be obtained through the WAFS)	ACC FIC	Every 6 hours (if required)	See Note 2 See Note 2
Significant en-route weather forecast	Aerodrome MET office and/or MWO (data to be obtained through the WAFS)	ACC FIC	Every 6 hours	See Note 2
SIGMET and AIRMET	MWO	TWR APP ACC FIC COM station	When warranted	See Note 1 See Notes 1 and 2 See Notes 1 and 2 See Notes 1 and 2 See Note 2
Wind shear warnings and alerts	Aerodrome MET office	TWR APP	When warranted	See Note 1 See Note 1
Tropical cyclone advisory	TCAC/MWO	ACC FIC	When warranted	See Notes 1 and 2
Volcanic ash advisory	VAAC/MWO	ACC FIC	When warranted	See Notes 1 and 2

<i>Information</i>	<i>Distributor</i>	<i>Destination</i>	<i>Frequency</i>	<i>Communications means</i>
Information on release of radioactive material, i.e. location of the release and forecast trajectories of the radioactive material	MWO (normally, the information obtained from the WMO RSMC concerned) VAAC London (focal point)	ACC FIC	When warranted	See Notes 1 and 2
Information on volcanic eruptions and volcanic ash for which a SIGMET has not yet been issued.	MWO VAAC	TWR APP ACC FIC	When warranted	

* Trend forecasts to be added to local reports and METAR/SPECI for those stations so identified in the air navigation plan.

** Or half-hourly if so decided by regional air navigation agreement.

Note 1.— Communications by intranet, video display unit or similar. If none of these are available, or during unserviceability periods, communications by phone, followed if possible by confirmation by other means.

Note 2.— Communications by teleprinter or by Internet for non-time-critical operational meteorological information.

Chapter 4

METEOROLOGICAL INFORMATION RECEIVED BY ATS UNITS FROM SOURCES OTHER THAN THE ASSOCIATED METEOROLOGICAL OFFICES AND STATIONS

4.1 OBSERVING AND REPORTING OF METEOROLOGICAL INFORMATION BY ATS UNITS

4.1.1 As ATS units may have to provide information to aircraft at very short notice, and as even the best observation methods and the fastest communication means between aerodrome meteorological offices and ATS units cause some time lag between the occurrence of a change in the meteorological conditions and the transmission of relevant information to aircraft, arrangements often exist whereby ATS personnel are given sufficient training to allow them to update routine observations provided by meteorological stations so as to reflect the changed conditions. Such arrangements, of course, require close coordination between the ATS unit and the meteorological office or station, and the type of information to be observed and reported is subject to specific local agreements between MET and ATS authorities.

4.1.2 In view of their location on high towers, aerodrome controllers can often observe certain meteorological features of operational significance better than meteorological personnel. Such observations, which may include, for example, meteorological conditions in approach and climb-out directions, would not only be used by controllers to update or amplify observations provided by the meteorological station (where such actions are agreed), but would also normally be provided to the meteorological station or office.

4.1.3 Adequate basic training in meteorological observations is to be provided to the ATS personnel concerned. In some States, ATS personnel are given training in meteorology to a level commensurate with their responsibilities in making these supplementary meteorological observations at aerodromes. These States may also issue specific “meteorological validations” to the air traffic controller licence on the basis of successful completion of concentrated meteorological-observing courses. This has the advantage of satisfying all concerned of their proficiency in this field.

Note 1.— The required qualifications for air traffic controllers making the meteorological observations described in 4.1.1 to 4.1.3 are specified by WMO (Annex 1 — Personnel Licensing, Note to 4.5.1 refers).

Note 2.— In some States, selected ATS personnel may also assume responsibility for the manual insertion into automatic meteorological observing stations/systems at aerodromes of data and phenomena that cannot be observed satisfactorily by the automatic system in use. Such activity by ATS personnel must be based on an agreement between the meteorological and ATS authorities. A syllabus for training courses in this respect can be found in the ICAO Training Manual (Doc 7192).

4.2 REPORTS OF AIRCRAFT OBSERVATIONS RECEIVED IN ATS UNITS

4.2.1 Detailed provisions for air-reporting, including those concerning automated air-reporting using data link in the CNS/ATM systems environment, are included in Annex 3, Chapter 5 and Appendix 4, and in Chapter 4 of the PANS-ATM. Specific instructions for air-reporting using voice communications are spelled out in Appendix 1 to the PANS-ATM.

Procedures in the SUPPS-Air Traffic Services part of Doc 7030 provide the specifications applicable to individual ICAO Regions.

4.2.2 The responsibilities of pilots and ATS and meteorological authorities in ensuring the efficient implementation of the air-reporting procedures are outlined below. It should be stressed that the implementation of these procedures is of vital importance and that all parties involved should do their utmost to adhere to the procedures to ensure the timely issuance of safety-related SIGMET which is largely dependent on the prompt receipt by MWOs of special air-reports from ATS units.

Air-reporting: action required by the parties involved

Pilots: CNS/ATM systems environment

4.2.3 When automatic dependent surveillance (ADS) or secondary surveillance radar (SSR) Mode S is being applied, routine air-reports are part of the reporting contract which is controlled by the ATS.

4.2.4 With regard to special air-reports, it is *essential* that pilots initiate a special air-report when any of the following conditions are encountered or observed:

- a) severe turbulence;
- b) severe icing;
- c) severe mountain wave;
- d) thunderstorms, without hail, which are obscured, embedded, widespread or in squall lines;
- e) thunderstorms, with hail, which are obscured, embedded, widespread or in squall lines;
- f) heavy duststorm or heavy sandstorm;
- g) volcanic ash cloud; or
- h) pre-eruption volcanic activity or volcanic eruption.

Note.— Pre-eruption volcanic activity in this context means unusual and/or increasing volcanic activity which could presage a volcanic eruption.

In spite of the fact that special air-reports will be included in the D-FIS applications in the future, it is worth emphasizing that these special air-reports will still have to be initiated by the pilot by selecting (e.g. from a menu displayed in the cockpit) the appropriate condition (e.g. heavy sandstorm). The additional information required by the MWOs (e.g. latitude, longitude, altitude, time, wind and temperature) is automatically included in the special air-report, without any pilot intervention.

Note.— Detailed information concerning D-FIS is provided in the ICAO Manual of Air Traffic Services Data Link Applications (Doc 9694).

Pilots: voice communications environment

4.2.5 Aircraft not equipped with air-ground data link are altogether exempted from making routine aircraft observations. This exemption was introduced in view of the availability of a large number of routine aircraft observations through the WMO aircraft meteorological data relay (AMDAR) system.

4.2.6 Special voice reports, however, will continue to be required whenever the D-FIS application is not available and whenever conditions listed under 4.2.4 are encountered. Detailed instructions for reporting are included in the MODEL AIREP SPECIAL form in Appendix 1 to the PANS-ATM.

4.2.7 Finally, it should be noted that the requirement for written post-flight reports continues for volcanic ash but has been deleted for all other phenomena.

ATS personnel: CNS/ATM systems environment

4.2.8 In the CNS/ATM systems environment, the requirement to make routine air-reports will be met by sending ADS or SSR Mode S reports with the basic ADS/SSR Mode S data block combined with the meteorological information data block. The appropriate ATS authority must ensure that the ADS/SSR Mode S contract is such that the meteorological information is provided every 15 minutes during the en-route phase and every 30 seconds during the climb-out phase for the first 10 minutes of the flight.

4.2.9 There will be no exemptions in the CNS/ATM systems environment. However, designation procedures may be prescribed in individual regions by regional air navigation agreement for flights on routes with high-density air traffic (e.g. organized tracks). Such designation procedures to be applied by ACCs, i.e. the FIRs and times for which the term "high-density air routes" is applicable, must be identified by the ICAO regional planning and implementation groups concerned and included in the SUPPS-Air Traffic Services and SUPPS-Meteorology parts of Doc 7030. It is envisaged that one aircraft per air route and per flight level from among those aircraft operating on these high-density air routes will be designated, at approximately hourly intervals, to report to the ACC concerned.

4.2.10 In addition to the requirement to establish an ADS/SSR Mode S contract with the appropriate reporting frequency, the ATS authority concerned is obliged to route the relevant blocks of the ADS/SSR Mode S message (i.e. the basic ADS/SSR Mode S data block and the meteorological information data block) automatically to WAFCs London and Washington and to their associated MWOs. Since the routing and processing of messages will be carried out by automated computerized communications systems, the ATS authority concerned need only ensure that the addresses of the WAFCs and the associated MWOs are included in the software and that the computer programme strips off the unnecessary blocks of the full ADS/SSR Mode S message (leaving only the basic ADS/SSR Mode S and meteorological information data blocks) before transmitting it to the WAFCs and MWOs. On receipt of the air-reports, the WAFCs will make them available to States, as necessary, through the WMO global telecommunication system (GTS), as basic data. It may also be noted that routine air-reports are increasingly being used in automated ATM systems (i.e. for accurate flight trajectory forecast purposes).

4.2.11 With regard to special air-reports in the CNS/ATM systems environment, ATS personnel have a two-fold responsibility:

- a) to pass on the information to other aircraft concerned (for details on the methods to be used in the CNS/ATM systems environment, see 4.2.13); and
- b) to route the information to the associated MWO and to WAFCs London and Washington.

It is essential that, in addition to the WAFCs, the associated MWO be included as an addressee in the telecommunications software since the issuance of SIGMET is largely based on the timely receipt of special air-reports.

ATS personnel: voice communications environment

4.2.12 On receipt of special air-reports through voice communications, ATS personnel should compile a message and send it without delay to their associated MWO. To assist in the compilation of this message and to ensure a standard structure, instructions have been included in Appendix 1 to the PANS-ATM.

4.2.13 ATS personnel must ensure that special air-reports are passed on to all aircraft concerned without delay. Special air-reports should be treated as the equivalent of SIGMET until such time that a corresponding SIGMET, superseding the special air-report, is received from the associated MWO.

MET personnel: CNS/ATM systems environment

4.2.14 MWOs and aerodrome meteorological offices receiving routine air-reports use them as any other basic meteorological data (e.g. upper-air soundings); no ICAO provisions exist concerning their use. The aeronautical requirement to use routine air-reports as briefing material has been deleted from Annex 3.

4.2.15 On receipt of special air-reports, the MWO has two options:

- a) to issue corresponding SIGMET information; or
- b) to decide that the issuance of SIGMET information is not warranted and to so inform the ACC/FIC (e.g. the phenomenon concerned is of a transient nature).

In the former case, no further distribution of the underlying air-report is required; in the latter case, the MWO has to disseminate the special air-report in the same way as a SIGMET for a period of sixty minutes after its issuance to ensure that recipients, including the ACCs/FICs concerned, are aware that the phenomenon has been reported by an aircraft.

MET personnel: voice communications environment

Note.— No routine air-reports by voice communications are issued.

4.2.16 Special air-reports received by the MWO through voice communications must be routed without delay to WAFCs London and Washington. Furthermore, as in the case of special air-reports received through data link, the MWO must decide whether or not the special air-report warrants the issuance of SIGMET information. If it does not, the special air-report itself must be distributed in the same manner as SIGMET information and the ACC/FIC informed accordingly.

4.2.17 Finally, if the MWO receives a special air-report related to pre-eruption volcanic activity, volcanic eruptions or volcanic ash cloud, it has the additional obligation to transmit that message without delay to the associated VAAC.

4.2.18 Table 4-1 summarizes the action to be taken on air-reports received by ATS units.

4.2.19 In addition to the requirements for aircraft observations and air-reports discussed in the previous paragraphs, a requirement also exists for non-routine aircraft observations. These are prompted when meteorological conditions are encountered that are not on the list of criteria for special aircraft observations and special air-reports (see 4.2.4) and which, in the opinion of the pilot-in-command, may markedly affect the safety or efficiency of other aircraft operations (e.g. wind shear). Reports of these meteorological conditions should, on their receipt in ATS units, be transmitted without delay to all aircraft concerned and to associated meteorological offices and stations (as agreed locally).

Table 4-1. Action to be taken on air-reports received by ATS units

Action	Air-reports		
	Via data link (CNS/ATM environment)		Via voice communications
	Routine	Special	Special
Received in:	ATS data link centre	ATS data link centre ACC/FIC APP/TWR	ACC/FIC ¹⁾ APP/TWR
Used by:	— ²⁾	ACC/FIC ³⁾ APP/TWR ⁴⁾	ACC/FIC ³⁾ APP/TWR ⁴⁾
Relayed to:	MWO ⁵⁾ WAFCs ⁵⁾	MWO ⁵⁾ WAFCs ⁵⁾	MWO WAFCs ⁶⁾

Notes:

- 1) Special air-reports may be received by an air-ground control radio station related, in particular, to certain ACCs/FICs. All the special air-reports received by such a station must be transmitted without delay to the ACC/FIC concerned and to the MWO associated with the ACC/FIC.
- 2) Air-reports (e.g. winds reported from the climb-out phase of flight) could be used in ATM automated systems for the sequencing of aircraft approaches.
- 3) Pass on all special air-reports received to all aircraft concerned until the ACC/FIC receives the corresponding SIGMET superseding the special air-reports, or for a period of 60 minutes.
- 4) Pass on all special air-reports received (including non-routine reports) to all aircraft concerned, for a period of 60 minutes.
- 5) Automatic relay by the ATS data link centre.
- 6) The MWO or the meteorological authority arranges for the transmission of the air-reports to WAFCs.



Chapter 5

COORDINATION BETWEEN ATS UNITS AND METEOROLOGICAL OFFICES AND STATIONS

5.1 GENERAL

5.1.1 As shown in the preceding chapters, both ATS units and meteorological offices and stations provide meteorological information for aviation. In many cases, the ATS units and the meteorological offices and stations are at the same aerodrome and serve the same aircraft, air routes and/or areas. To achieve the best service for aviation, close coordination of their efforts is necessary, and there is therefore an important need for continuing consultation and coordination between these units, offices and stations at the local level, and for an efficient exchange of information between them.

5.1.2 The following information and guidance is aimed at improving the coordination between ATS units and meteorological offices and stations, both at the administrative level (i.e. between the ATS authority and the meteorological authority) and at the operational level (i.e. between the ATS units and aerodrome meteorological offices and aeronautical meteorological stations serving the same aerodrome and the ACCs/FICs and MWOs concerned).

5.1.3 At the administrative level, proper coordination can best be achieved by concluding a written Letter of Agreement between the ATS authority and the meteorological authority (see Annex 3, Chapter 4, 4.2). Such agreements are especially necessary where the provision of ATS and aeronautical meteorological services are not the responsibility of the same government department. An agreement is a very desirable instrument because:

- a) it provides a systematic listing of services and responsibilities which, taking into account the complexity of the subject, can assist greatly in ensuring a complete and efficient meteorological service to air navigation;
- b) the meteorological service is often provided by offices and stations of the meteorological authority different from that responsible for the ATS; the preparation of the agreement assists in bringing about a better understanding of the needs and capabilities of the parties involved; and
- c) the provision of meteorological service to air navigation may at times involve legal aspects (e.g. during inquiries into incidents or accidents) for which clear and unambiguous allocation of responsibilities is essential.

5.1.4 In fact, agreements between the ATS and meteorological authorities concerned are not only desirable and useful but are also explicitly called for in the various Standards and Recommended Practices (SARPs) and Procedures of Annexes 3, 11 and 12 and the PANS-ATM (see Annex 11, 2.20, 4.2.3 and 7.1.1.3, and the PANS-ATM, Chapter 11). In other cases, the need for agreements is strongly justified, i.e. where services or the methods with which they are to be rendered are to be carried out "in consultation".

5.1.5 The Letter of Agreement should normally specify the following:

- a) arrangements for meetings, at operational and administrative levels, between the heads of ATS units and meteorological offices and stations to discuss requirements for meteorological information,

methods of meeting these requirements and changes in local procedures necessitated by changes in operations. The arrangements should also provide for the involvement, as necessary, of AIS, communications, airport management and operator representatives for coordination purposes;

- b) in broad terms, the:
 - 1) requirements for meteorological information;
 - 2) means to be used for exchanging/supplying that information;
 - 3) responsibilities and functions of the ATS units and meteorological offices and stations involved; and
 - 4) designation of the meteorological offices associated with individual ATS units and search and rescue services centres;
- c) arrangements for automatic air-reporting (i.e. routine and special air-reports via data link) and manual air-reporting (i.e. special air-reports via voice communications) in the FIRs/control areas concerned, including:
 - 1) arrangements for automatic air-reporting, including the climb-out phase of flight (i.e. contracts for ADS/SSR Mode S reports containing meteorological information) and relevant automated dissemination procedures; and
 - 2) if applicable, designation procedures for air-reporting on air routes with high-density traffic;

taking into consideration the relevant provisions in Annex 3, Chapter 5 and Appendix 4, described in 4.2 of this manual;

Note.— Doc 7030 should be also consulted for the procedures regarding air-reporting.

- d) where necessary, arrangements regarding the dissemination of information received and/or obtained on pre-eruption volcanic activity, volcanic eruptions and volcanic ash cloud, with special emphasis given to information/notifications of these events from non-aeronautical sources and, in the case of FIRs and control areas having active or potentially active volcanoes, to the arrangements for information from the State vulcanological agency;

Note.— Further guidance is provided in the Handbook on the International Airways Volcano Watch (IAVW) — Operational Procedures and Contact List (Doc 9766) and the Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds (Doc 9691). These documents also apply to e) below.

- e) arrangements between the ATS and meteorological authorities regarding the dissemination of information on the release into the atmosphere of radioactive materials and toxic chemicals;
- f) arrangements for the periodic familiarization of ATS, search and rescue, and meteorological personnel with each other's facilities, functions and procedures;
- g) where necessary, arrangements for meteorological training of ATS personnel; and
- h) arrangements for the provision of aeronautical climatological information to support ATS activities, e.g. development of ATS procedures.