AIR TRAFFIC SERVICES
PLANNING MANUAL

FIRST (Provisional) EDITION — 1984

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and published under his authority

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Foreword

1. INTRODUCTION

The Air Traffic Services Planning Manual (ATSPM) has been prepared by the Secretariat at the request of the Air Navigation Commission after obtaining comments of States and selected international organizations to a proposal that such a manual be developed.

2. PURPOSE AND SCOPE

2.1 The manual not only contains information which can, or should, be taken into account in the formulation of development programmes within States or regions, but also material which can, or should, be applied directly to the planning and operation of the ATS system.

2.2 To this extent, the manual consists of the guidance material previously contained in various attachments to Annex 11 Air Traffic Services and the Procedures for Air Navigation Services — Rules of the Air and Air Traffic Services (PANS-RAC, Doc 4444), updated as necessary to reflect latest developments, and also new material concerning important aspects of ATS planning which had not been covered until now. Such new material has, for the greater part, been extracted from various sources; however, this was done only once it had been established that the material was of general interest and that its application was not limited to specific circumstances only.

2.3 The material in this manual is intended to supplement the provisions governing ATS as specified in Annexes 2 and 11 and the PANS-RAC and it should therefore be used in conjunction with these documents. As a consequence, provisions contained in these documents are not reiterated in this manual but, where found useful, have been expanded to indicate their most practical application.

3. ORGANIZATION AND CONTENTS

3.1 For convenience of reference, the manual has been divided into five basic parts, four of which deal with a specific aspect of ATS planning. The fifth part provides a useful reference for additional information. The five parts are:

a) Part I — Planning Factors. This part deals primarily with matters pertaining to the concept and continued development of an ATS plan, the need for and types of ATS, their establishment and their requirements for associated facilities and services.

b) Part II — Methods of Application Employed by ATS. This part deals with subjects which are of particular interest in the provision of ATS and, where appropriate, describes methods which, by experience, have been found to assist in dealing with them.

c) Part III — Facilities Required by ATS. This part contains brief descriptions of the functions and the use which can be made of navigation aids as well as the requirements which facilities and equipment used by ATS should meet.

d) Part IV — ATS Organization, Administration and Facility Management. This part deals with matters concerning the organization and administration of ATS in general, including personnel matters, and the management of ATS units.

e) Part V — Terms and References. This part presents definitions of ATS terms and commonly used abbreviations contained within the manual. It also contains a quick reference index to facilitate locating specific subjects covered in this manual.

3.2 While much of the material in this manual has been derived from guidance material previously contained in Annex 11 and the PANS-RAC, much of the material was, however, updated in the light of the latest experience available to ICAO. New material, covering aspects which
were previously mentioned in ICAO documents, has been developed wherever it was found that a widespread need for guidance existed. In the latter case, the material in this manual is based on provisions of those States having already had a need to cover these aspects in their national documentation, on condition that experience had shown that such provisions were effective and did not cater only to a specific set of local conditions.

3.3 The material in this manual should not only be used as guidance by States in the continued development of their own national services but it should also serve as a basis for bilateral or multilateral discussions aimed at the harmonization, to the greatest extent possible, of planning activities on a regional scale, thus facilitating the development and updating of regional air navigation plans.

4. ACTION BY CONTRACTING STATES AND INTERNATIONAL ORGANIZATIONS

4.1 As it is intended that this manual should reflect, in consolidated form, the collective experience gathered over the years in the field of ATS, States and international organizations are encouraged to provide ICAO with their views, comments and suggestions regarding its contents, or its need for modification and/or extension to cover new aspects. Suggestions and recommendations should, in all cases, be made by addressing appropriate comments to the Regional Office which is accredited to the State concerned. International organizations should address their comments directly to ICAO Headquarters, Montreal.

4.2 Whenever material received from States, in accordance with the above procedure, makes it apparent that an amendment of the manual is required, such amendment will be issued by ICAO in the form most convenient for its insertion in the manual.

5. SPECIFIC REMARKS RELEVANT TO THE FIRST (PROVISIONAL) EDITION OF THE MANUAL ONLY

5.1 As indicated in 3.2, efforts have been made to use material from States in the preparation of the ATSPM whenever this appeared possible. However, in so doing, and also when determining the scope and extent of the manual, it became clear that a satisfactory solution to these questions could not be found in the relative isolation from practical needs in which, by necessity, the manual was prepared. From the beginning it was, therefore, clear that the only way to render the manual of optimum use was to prepare a provisional edition (and make it available to its potential users) in a form which would make it clear that it was not only to be reviewed in the established sense (i.e. correction, updating, expansion) but that its review should cover all aspects of its presentation, i.e. layout, content, style, depth and detail of subjects covered, usefulness in practical application and any other related aspects. Hence, the issue of this manual in the form of a provisional edition is to make this intent clear.

5.2 It is therefore in the direct interest of all States and international organizations that their review of the provisional edition of the manual be particularly thorough and that this be conducted by drawing on comments made by those for whom this manual is intended, so that the next edition, which is planned to be issued as soon as the comments received have been incorporated in it, will then, in its form as well as its content, meet States’ requirements to the optimum extent.

5.3 It is intended that this first (provisional) edition of the manual be replaced by a second edition in about one or two years. States and international organizations are therefore encouraged to forward their comments as early as practicable.
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PART I

PLANNING FACTORS
PART I

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SECTION 1
HOW TO DEVELOP AN AIR TRAFFIC SERVICES PLAN

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Chapter 1
Factors Affecting Planning

1.1 INTRODUCTION

1.1.1 Before entering into the discussion of the factors affecting planning, and in order to avoid any possible misunderstanding, it is necessary to establish the meaning of a number of terms which will be used frequently in this manual. To this extent, it is recalled that the term “air traffic services (ATS)” has been defined in Annex 11, as being “a generic term meaning variously flight information service, alerting service, air traffic advisory service, air traffic control service, area control service, approach control service or aerodrome control service”.

1.1.2 In addition, in dealing with air navigation matters, the following terms are frequently used and, for the purpose of this manual, they should be understood to have the following meaning:

a) Assumed operating parameter. The performance of an aircraft, which, by common agreement, can be assumed by the ground services in providing assistance to aircraft regarding their flights.

Note.- This performance relates to such factors as the broad operating characteristics of the aircraft, to their navigation or communication capability, etc., as it governs the behaviour and/or response of the aircraft to particular situations. Unless specifically stated otherwise by a pilot, it is understood that the applicable operating parameters apply to all flights.

b) Basic operational requirement. A need upon which agreement has been reached between the users of a given service and/or facility and its provider that it constitutes a requirement which has to be met in order for the system to perform in a satisfactory manner.

c) Planning criteria. The sum of principles which need to be taken into account in the planning and implementation of the air navigation system, or of its parts in order to facilitate its uniform operation in the most efficient, economic and practical manner.

d) Method of application. A method of operation of specific parts of the air navigation system which, by practical application has proved to be an efficient and economic manner of operation and which, when applied on a wider scale, could ensure optimum uniformity in the operation of the air navigation system in a given area.

1.1.3 In general, planning is understood as a dynamic process which involves seeking out facts, questioning established or newly proposed methods and searching for information. It is also a continuing process which, in the interpretation of available data and in the formulation of concepts, requires vision, imagination and the courage to support and justify one's convictions. Since ATS planning is an activity which cannot be disassociated from the overall development of civil aviation, it must therefore be assumed that there is already a civil aviation infrastructure established and that the commencement or continuation of ATS planning by an administration is complementary to, and forms a part of, a national civil aviation plan. Also, ATS planning cannot be done in isolation with regard to other aspects of aviation but must take into account information concerning established commercial air route networks and existing or forecast traffic flows, the navigation aids programme, the airports development programme, the operators fleet composition and their future procurement programme and the over-all priorities of the many and varied civil aviation flying activities. It will also be necessary to give due regard to the sometimes conflicting demands of specialized military flying operations and airspace provisions for national security.

1.1.4 A plan does not become a reality overnight; therefore, early in the process of planning, consideration must be given to the various stages of implementation. The plan can then be converted to a progress chart on which every factor affecting the desired end result can be taken into account and entered in its proper order of progression. Planning involves many disciplines, for example, once the need has been justified, planning for a new control tower involves associated disciplines involving civil engineering, architectural design. electrical, mechanical and telecommunications engineering, post and telegraph systems, to mention only a few of the more important ones. To function effectively, planners must have timely advice and
access to accurate and significant information, e.g. the evaluation of advanced technology may be beyond the resources of the planners and in this case they must seek the advice of specialists or consultants.

1.1.5 Economic studies are an essential element of planning. From this source costs and benefits can be analysed and equated in monetary terms and planning budgets prepared. The ATS priorities within the total civil aviation development programme can then be established.

1.1.6 Aviation has developed at a remarkable speed and complexity when compared with the rail or maritime services. In ATS planning, local circumstances and conditions will inevitably lead to some differences in the methods, procedures and systems used between States and even between units within the same State. However, planners should resist temptations to be original unless there are very convincing arguments in favour of new approaches or change. ICAO provisions have been developed collectively by member States. Therefore, the best platform from which to commence a planning project is to use ICAO provisions and also to profit from collective work already done by other States.

1.2 OBJECTIVES

1.2.1 The art of planning is to forecast future requirements as accurately as possible, to develop alternative ways of meeting these requirements and to devise the ways and means of implementing the agreed plan to meet the objectives.

1.2.2 To do this it is necessary to clearly define the objectives. In ATS planning, objectives will include:

a) planning the organization and management of the airspace with all the ramifications and complexities which arise from the conflicting demands of the users;
b) investigating and recommending the best methods and technical equipment to operate the system;
c) planning for personnel and their appropriate qualifications;
d) functional planning and layout of the controllers' working environment and changes or additions to operational and technical buildings.

1.2.3 In order to know how to arrive at the objectives, answers to the following questions are required:

a) What are the most reliable data sources?
b) What are the objectives of the users, the military, the commercial sector, the private sector, the specialized operators such as gliding clubs, helicopter associations, etc.?
c) Have the needs of all users of the airspace been fully considered?
d) Are the objectives common to or in line with those of neighbouring States; will the respective systems be compatible so as to ensure the facilitation of international air traffic?
e) What are the alternatives available, particularly where such alternatives could benefit resource conservation, i.e. saving money, saving manpower, saving materials?
f) Does the plan allow for some flexibility in the application or allocation of resources?
g) What are the consequences of delay in implementation of planning objectives?

1.2.3.1 These interests and many more of local significance must be analysed and resolved so that planners can be confident that the objectives of the plan can in fact be achieved in practice. Planners have a responsibility to the future and their planning will fall short of requirements if the objectives of the plan are ill-conceived, poorly researched or incorrectly defined.

1.3 GENERAL CONSIDERATIONS

1.3.1 Apart from specific project planning, ATS planning can form the basis for establishing many of the day-to-day requirements of the service. These include such important issues as:

a) determining the type of airspace required for the most effective system;
b) developing standardized working methods;
c) identifying existing shortcomings or potential problems;
d) developing new and improved facilities to best satisfy the ATS task;
e) determining future personnel requirements;
f) investigating and developing improved training techniques.

1.3.2 Sound planning will also provide policy guidance on many issues significant to the efficiency of the ATS system. Such matters include:

a) forecasts of long-term budgets;
b) early warning of the need for negotiation and consultation between neighbouring States' airport authorities or other interests;
c) the determination in advance of likely environmental problems and methods of resolution;
d) providing expert advice to associated aviation disciplines such as airport engineering services; identifying the cost/benefit advantages of providing navigation aids specifically to facilitate traffic flows;
e) the need for improvements in taxiways, holding areas, security parking and other problems confronting controllers in the movement of aircraft on the ground.

All of these matters are pertinent to the work of planners and their role in establishing and maintaining an efficient ATS system. Finally, planners must arrange for a regular feedback on operating problems which are being encountered by ATS units so that these can be taken into account in their efforts to develop the plan along the most efficient channels.

1.3.3 Even though planning along orderly lines is essential to achieve progress in obtaining the desired objectives, the proper timing of implementation is of equal importance. It must therefore be borne in mind that overriding issues can emerge and create situations which require the immediate and urgent attention of planners even if it means departing from originally agreed proposals. Examples in this respect could include unexpected excessive traffic volumes creating unacceptable controller workload; functional environmental problems such as inadequate workspace or poor working conditions; outmoded equipment with consequential increased failure rate or prolonged outages due to unavailability of spare parts. Unless rapid corrective actions are arranged, staff morale will suffer and unit efficiency will drop.

1.4 TYPES OF ACTIVITY INVOLVED

1.4.1 Co-ordinated policy. This element covers the need for planning administrations to arrange for the establishment of data collection and evaluation methods, preparation of work programmes, including schedules and target dates, the establishment of co-ordination procedures with associated disciplines, arrangements for staffing programmes and the establishment of an efficient monitoring system.

1.4.2 Physical planning. This element includes the study of such matters as personnel environment, accommodation and technical furnishings, facility location and essential supporting services.

1.4.3 Economic planning. This element involves the preparation of analyses of applicable ATS data concerning aerodrome, approach and en-route traffic, both actual and forecast. From these analyses planners can determine the limitations affecting the orderly flow of traffic, study alternative methods of resolving problems encountered including detailed cost-effectiveness calculations for each proposal, and prepare economic studies for use not only in determining preferred methods but also for the benefit of associated planners.

1.4.4 Financial planning. This element involves the preparation of estimates and proposals for budgeting after final agreement is reached on a planning proposal.

1.5 OPERATIONAL FACTORS

1.5.1 A safe and adequate ATS system should result from sound planning techniques. All relevant operational factors must be taken into account and close meaningful co-ordination between planners and users is essential.

1.5.2 To ensure that an ATS system functions properly it must cover the following main factors:

a) a navigation aid system which provides for both air navigation and ATS requirements;
b) communications both point-to-point and air-ground;
c) specialist equipment for use by ATS personnel;
d) adequately trained and qualified controllers;
e) provision of flight data permitting controllers to constitute a picture of the existing and expected traffic situation;
f) provision of information on the status of air navigation facilities and services, both air and ground derived, including meteorological information.

1.5.2.1 The system must have sufficient capability and flexibility to accommodate traffic peaks and reasonable expansion possibilities to cover forecast traffic increases during a period at least equal to the lifetime of the facility. Facilities must be available for controller training and there must be a unit management structure which ensures adequate constant supervision and standardization of operating methods.

1.5.3 In ensuring that all operational factors are taken into account at the planning stage, planners will be faced with many conflicting considerations and it is in this area particularly that the judgement and experience of interested aviation activity groups can contribute to a balanced and logical proposal.
13.4 Operational procedures, orders or instructions arising as a result of planning must be considered in relation to the established national rules and regulations. Relevant international provisions should be used as a basis for national regulations to the maximum extent possible and differences to established ICAO provisions should only be applied when this is unavoidable.

1.5.5 At the earliest stage of planning there will invariably be the need to consider the question of compatibility with procedures adopted by adjoining States. ICAO provides the means for such negotiations by formal and informal meetings between States and in those cases where the air traffic to be handled is composed of a significant number of international operations, the expertise available within ICAO through its Regional Offices can assist in the early stages of planning.

1.5.6 Likewise within national airspace, planners will be confronted with conflicting demands from the military in particular and from the wide diversification of commercial and general aviation activities whose representatives must be given the opportunity to comment on planning proposals at an early stage of their development.

1.5.7 Poorly evaluated planning may not only affect or restrict the use of airspace but may also unduly restrict flying operations should the limitations of equipment preclude compliance with a proposed procedure.

1.5.8 Circumstances affecting the assumed operational considerations can change drastically with little or no forewarning to the planners and it is in this area that provision must be made for constant monitoring of planning forecasts vis-à-vis actual trends so that timely corrective action is taken to amend the plan accordingly.

1.6 DATA COLLECTION AND USE

1.6.1 General

The collection of meaningful and relevant statistical data is basic to sound ATS planning. Such data can be used to determine short- or long-term policy. They should include the volume and composition of traffic, split into arriving, departing and overflights, direction of flight, the levels used and types of aircraft. From the statistics thus produced, forecasts can be prepared concerning systems planning and planning of services facilities and equipment (including navigation aids).

1.6.2 Sources of data

1.6.2.1 The sources of data include:

a) air traffic services (ATC) records from flight plans and flight progress strips, or computer print-outs where automation has been introduced into an ATS system;
b) records of flights monitored by radar;
c) the records of offices responsible for the collection of en-route charges;
d) the result of studies carried out to determine methods and workload factors at ATS units;
e) those statistical returns which are rendered to governments by airports and airlines (these would indicate airport movements of all categories of traffic and the number of hours flown by the airlines);
f) the responses to appropriate questionnaires circulated to users.

Care should be exercised in data collection that the workload resulting from the use of complex and time-consuming methods is not beyond the realistic capacity of those expected to perform the task. Simpler methods, requiring less work may produce equally useful information and better co-operation from personnel involved.

1.6.2.2 Statistics can be a useful source in respect of the following:

a) guidance to determine short- and long-term needs of the ATS system by:
   1) documenting existing conditions;
   2) identifying potential problem areas;
   3) indicating facility requirements;
   4) indicating personnel needs;
   5) providing a data base for the determination of future demands;
   6) providing information indicating an appropriate alternative to a plan;
b) providing guidelines for new system design and procurement;
c) establishing criteria for the navigation aids required to facilitate air traffic flows;
d) providing a basis for taking remedial actions in the event that navigational guidance is inadequate for ATS purposes;
e) as a prerequisite to studies into the reduction of separation standards and the preparation of collision risk formulas;
f) assessment of the relationship between air traffic incidents and the volume of traffic;
g) the provision of data to programme simulators used in ATS training.
1.6.2.3 For specified portions of an air route network which has to accommodate particularly heavy or otherwise critical traffic demands, planners should arrange, as a matter of routine, the regular collection and exchange of data and the publication of consequent analyses. These data should include information on:

a) commercial air transport operations;
b) military operations;
c) other matters such as:
   1) the number of landing, departing and overflying flights affecting an airport, a route segment or an airspace sector;
   2) the vertical distribution of the traffic including an indication of the amount of traffic climbing or descending;
   3) the types of aircraft involved (turbo-jet, turboprop, piston).

Collection of the above data should be made during a predetermined representative time span (seven days) in the high and low density travel seasons. Once the task has been undertaken it must be repeated regularly in order to assess the growth or decline in activity.

1.6.2.4 It should be mentioned that, for some statistical purposes, the Manual on the ICAO Statistics Programme (Doc 9060) may be a useful source of information especially as regards financial statistics for route facilities and services, en-route traffic movement statistics and aerodrome traffic statistics. Valuable statistical data concerning international air traffic can also be obtained from the International Air Transport Association (IATA). However, material from these sources is no substitute for detailed national data obtained directly from operational sources.

1.6.3 Forecasting methods

The method of forecasting will depend on the data available. Where an ATS system has been in operation for several years, historical data may be available which will indicate trends and growth areas and should supplement current data. Forecasts should be expressed in terms commonly used by those concerned with the planning of air navigation systems and should indicate likely seasonal, weekly or daily changes in the future traffic demand. Factors affecting the accuracy of forecasting include:

a) the availability of an adequate data base;
b) the use of proven forecasting methods, e.g. extrapolation or trend analysis;
c) introduction of factors not previously considered such as changes in airspace requirements or alterations to routes;
d) the influence of factors which are difficult to quantify — changes in government policy regarding civil aviation, re-orientation of traffic flows due to changing customer habits especially in respect of holiday areas, airline operation costs, fuel economies or the introduction of new aircraft types.

Particularly in the case of c) and d) above, the preparation of differing sets of assumptions will assist planners in building up alternative pictures of the economic, social, technological and commercial considerations and assist in identifying and quantifying future traffic probabilities. Poor interpretation of data can distort the accuracy of forecasts which in turn may lead to inadequate provision for the future.

1.6.4 Analysis and evaluation

1.6.4.1 It is necessary to identify the information required under specific headings, and in peak values by the analysis of instantaneous traffic, movements per clock hour and movements per day as follows:

a) total traffic movements, including:
   1) outbound flights;
   2) inbound flights;
   3) overflights;
   4) crossing flights;
   5) direction of flights;

b) flight level distribution according to performance category (turbo-jet, turboprop, piston);
c) category of flight:
   1) commercial;
   2) military;
   3) other.

1.6.4.2 Emphasis should be placed on presenting data in a comprehensive manner, preferably in graph form for easy comparison. When the analysis of the total traffic is prepared, the figures for the “average day” are obtained by adding the total number of movements for each day according to each route and dividing the sum by the number of days in the data collection period. Traffic figures for the “busy day” are obtained by selecting for each of the routes the highest figure recorded during the collection period. This figure, together with the relative day of the week on which the figure was recorded, will constitute the “busy day”. 
1.6.4.3 Traffic figures for the “busy hour” are obtained by selecting for each of the routes the highest traffic figure recorded in one clock hour during the “busy day”. This figure, together with an indication of the hour within which it was recorded, will constitute the “busy hour” figure. The determination of the “busy day” and the “busy hour” value should also include a breakdown of the types of aircraft on the route during these periods and the operationally preferred height bands.

1.6.4.4 Considerable work has been carried out by the North Atlantic and European traffic forecasting groups in the field of providing forecasts for systems planning and more detailed information on this may be obtained upon request to any Regional Office of ICAO.

1.7 ENVIRONMENTAL FACTORS

1.7.1 Environmental considerations require special study at an early stage in ATS procedural planning, particularly in respect of the effect of aircraft noise and possible atmospheric pollution onto the area exposed to these phenomena.

1.7.2 Environmental control is an essential element of aerodrome planning and the ATS planning policies should be co-ordinated within the over-all aerodrome planning framework. The most significant problems arise in the arrival and departure/climb-out areas and, to the extent that a choice is available, decisions regarding the alignment of runways can be of great significance to future traffic management. Departure clearances calling for evasive flight manoeuvres in the interests of noise abatement can present many problems for the pilot and the controller.

1.7.3 Studies on the noise impact generated beneath an aerodrome circuit can necessitate non-standard patterns and acrobatic, low-flying and training areas require particular study. Where possible, procedures should be designed to avoid flying closer than 600 m (2 000 ft) vertically over hospitals, educational institutions and similar noise-sensitive activities, e.g. zoological gardens. Pollution from jet efflux can cause discomfort to homeowners and could damage valuable crops. Consideration need also be given to fuel dumping areas in case aircraft are required to return to their departure point shortly after take off.

1.7.4 Studies on the environmental impact generated beneath a proposed flight path should be simulated by exercises to establish their acceptability. The responsibility rests with the planners to recognize a potential problem area and discuss it with the appropriate authority. An environmental impact report should be prepared so that every party concerned can understand and comment on the problem from their own viewpoint. In the event that a planning proposal is unfavourably received, planners have a responsibility to endeavour to establish alternative routing or other alleviating proposals, bearing in mind the overriding need for safety of flight operations.

1.7.5 Final decisions regarding environmental aspects do not rest with the ATS planners, therefore it is essential that the information provided to the appropriate authorities for the purpose of studies and decision is both detailed and accurate. Information based on incomplete data could result in unnecessarily restrictive decisions which in turn could limit the capability of ATS to efficiently manage traffic.

1.7.6 More detailed information on land use and environmental control concerning an aerodrome and its environs, is contained in the Airport Planning Manual (Doc 9184, Part 2).
Appendix A

Typical ATS Planning Organization

- APPROPRIATE ATS AUTHORITY
- GOVERNMENT AVIATION POLICY DEPARTMENTS
- FOR LEGISLATION INTERNATIONAL AGREEMENTS SECURITY DEFENCE
- ATS MASTER PLAN OPERATIONAL REQUIREMENTS
- ICAO TECHNICAL ADVISERS MILITARY REQUIREMENTS
- AIRCRAFT USER OPERATIONS IFALPA, IFATCA, IATA EQUIPMENT MANUFACTURERS
- PLANNING TEAM DIRECTOR
- PLANNING TEAM STAFF
- BUILDING AND SERVICES PLANNING AUTHORITIES
- MET TELECOMMS AIS SERVICES
- PERSONNEL MANAGEMENT
- STATISTICS ECONOMICS TECHNICAL RESEARCH ADVISERS

- TECHNICAL PLANNING
- POLICY
- ADVISORY CO-ORDINATIVE
Chapter 2
Establishment and Maintenance of the ATS plan

2.1 INTRODUCTION

Air traffic services (ATS) planning covers both short-term and long-term requirements and may be necessary for technical facilities, personnel and training requirements, or to provide for unforeseen or temporary circumstances. In all cases it is necessary to develop a framework within which the problem can be analysed and solutions formulated to assist in the decision-making process. Processes involved in the development of an ATS plan are illustrated in Appendix A.

2.2 PERIOD COVERED BY THE PLAN

2.2.1 Planners should expect that there will be a delay between the approval of a plan and its implementation. The time may vary from several months for the introduction of new airspace procedures, to many years for the introduction of new technology or facilities. As any plan is based on forecasts, studies and reports, it will become apparent that planning is heavily reliant on the accuracy and reliability of such source information. Misinformation and poor planning can be reflected in the economics of air operations, through the provision of inadequate equipment and insufficient trained personnel to operate and maintain a system. In view of the likely timespan between initial planning and implementation, methods must be introduced to ensure the plan remains current and up to date. This requires a constant review of current data, simulation of the project objectives in the light of new developments and frequent study of comments from user groups.

2.2.2 Long-term planning demands that ATS requirements be forecast five or even ten years ahead of time. The implementation of the plan is likely to take place in stages which, whilst they may be affected by factors such as finance or equipment or personnel availability, should primarily be established so as to ensure the continued safe and expeditious handling of air traffic and to avoid increasingly costly delays or system limitations. The advantage of formulating a long-term plan with a staged implementation is that it provides planners with the opportunity to review the plan in the light of developments before finalizing the details of each successive stage.

2.3 PREPARATION AND PRESENTATION

2.3.1 After having obtained and evaluated the best forecasts from all relevant sources, it will then be possible to prepare alternative proposals for the solution of specific problems in the form of a plan. In preparing alternatives it is essential to record explicitly and clearly the data source and the forecasting techniques used so that all parties concerned with the execution of the plan can conduct their individual studies. Assumptions or personal judgements injected into the planning must be explained and the logic defended. The presentation of a plan as a working document is a significant step in the planning process and can assume a major role in its ultimate acceptance, deferral or cancellation. Appropriate format and a clear and concise style can contribute significantly to its presentation. The body of the presentation must contain the maximum descriptive detail of the need for the plan and its proposed implementation. Changes to established methods, systems or technology must be justified by sound arguments; advantages of proposed change can best be illustrated by examples of their successful application by other States. In addition, pictorial presentation is important, particularly where planning involves facility changes and, whenever possible, photographic or sketch illustrations should be used to amplify text descriptions. Whilst statistics and graphical diagrams may be necessary, they are generally of lesser impact and should therefore be presented in the form of appendices rather than be included in the main text of the plan.

2.3.2 The preparation and presentation of a plan is incomplete unless it reaches clear conclusions, states
recommendations and proposes an implementation programme. The presentation should therefore be arranged in the following sequence:

a) definition of the objectives;
b) detailed explanation of the research methods used;
c) explanation of the proposals, including alternative solutions;
d) description of advantages and disadvantages of each proposal made;
e) assessment of cost-effective factors and priorities;
f) conclusions reached and recommendations made;
g) proposals for an implementation programme with realistic target dates.

2.4 REVIEW AND UPDATE

2.4.1 In all planning activities a time will arise when circumstances indicate the need for review and probably an updating of the plan. At this stage the inaccuracies of the original planning forecasts should have become evident and those parts of the plan in need of review can therefore be more easily identified. Without abandoning forecasts, planners should arrange follow-up communications with user groups and establish planning exercises which actively encourage their critical but constructive contributions. Based on the outcome of these reviews, alternatives may be examined or simulated or live trials may be staged and decisions taken to change or update the original concept.

2.4.2 The updating process itself follows, to some extent, the methods used in the original planning, in that the same checks and balances of personnel involvement, financial considerations, resource availability and over-all work priorities within an administration will apply.

2.4.3 In addition to reviewing forecasts, planners should carry out studies to ensure that any updating of the plan is based on current operational requirements. This periodic review should be incorporated into the planning programme from the outset. Planners should be alert to economic, environmental, financial and operational changes as they occur, not only in ATS, but also in the aviation industry as a whole so that they develop a sense of timing and anticipation which enables them to remain ahead of current developments.

2.5 THE REALITIES OF PLANNING

2.5.1 The variations of air transport affecting the air route networks, the introduction of advanced technology, the changes in operators fleet composition, taxes, as well as the capacity of established systems make the need for sound planning more urgent. Such variables, however, interact with and affect the accuracy of forecasts and make the planning task more formidable. As previously stated, inadequate, inaccurate or unco-ordinated planning can result in misuse of personnel and material resources thus placing a heavy responsibility on planners to strive for accuracy, and ensure that only relevant and accurate data are used and anything which cannot be fully relied upon is discarded.

2.5.2 ATS planning cannot be done as an isolated activity; it involves everyone contributing to or using the ATS system. Planning is the function of gathering, assembling and disseminating the collective knowledge of many experts in such a way that there is a programmed advancement of the art and practice of ATS. This planning manual is intended to assist operational and technical personnel to appreciate the fact that planning develops objectives, which in turn lead to guidelines which develop into a planning exercise, followed by decisions and finally implementation and thus ensures the safe, orderly and expeditious movement of both national and international aircraft.
Appendix A

The Development of an ATS Plan

REQUIREMENTS

- POLICIES
- AIR TRAFFIC DATA
- ICAO SARPs
- ENVIRONMENTAL FACTORS
- COST/BENEFIT

EVALUATION:
- Analysing the problem
- Defining the objectives
- Building the framework
- Studying alternatives
- Making recommendations
- Proposing decisions

- MANAGEMENT
- CURRENT OPS/TECHNICAL STATUS
- RESEARCH STUDIES
- NEW TECHNOLOGY
- PERSONNEL
- PLANNING CO-ORDINATION

AIR TRAFFIC SERVICES PLAN
(Long-term — Short-term)

- Definition of required services
- Airspace organization
- Working methods, sectorization
- Facilities, systems, equipment
- Instructions, manuals, letters of agreement

- Personnel
- Training
- Implementation programme
- Budget

IMPLEMENTATION

REVIEW OF OPERATIONS AND UPDATING THE PLAN
PART I

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SECTION 2
ESTABLISHMENT OF AIR TRAFFIC SERVICES

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Chapter 1
Need for Air Traffic Services

1.1 INTRODUCTION

1.1.1 As for any other form of transportation, there is an inherent need to provide certain services to air traffic so that it can be conducted in a safe and orderly manner. There are, however, two aspects of air traffic which impose specific requirements on these services and these are:

a) the fact that, once air traffic is under way, it cannot be held en route for prolonged periods of time and can only be brought to a halt by a landing;
b) the world-wide scope of aviation activities is dictated more by considerations of an international character than any other form of transport.

1.1.2 In addition, air transport, and more particularly that conducted at the international level, has now assumed such a role in the economic development of our civilization that its disturbance generally results in consequences which are not restricted only to the area where they occur, but can also have repercussions which extend far beyond that area.

1.1.3 The planning for and the execution of air traffic services (ATS) is essentially a national responsibility unless agreements have been concluded amongst States to conduct this planning as a joint effort for a defined area covering more than one State, or for areas where no sovereign rights are exercised (e.g. the high seas). It is, therefore, of prime importance that both the planning and execution of ATS be done so that optimum uniformity is maintained to the largest possible extent. While this objective is normally pursued by ICAO through its efforts in world-wide standardization and in regional planning of air navigation services, it should, for the reasons given, be supplemented by bilateral or multilateral co-ordination among States. This bilateral or multilateral co-ordination should cover those generally more detailed aspects which have not been covered by the efforts made within the framework of ICAO.

1.1.4 In many States, the military services constitute a rather important part of the airspace users. In some States, military authorities have therefore established their own ATS in parallel with the civil ATS system in order to provide for their specialized operations (e.g. fighter training, interceptions, low-level missions, special air exercises, etc.) as well as for those flight operations which are conducted in a manner similar to those of civil users (e.g. air transport, liaison and navigation training flights). The co-existence of a civil as well as a military ATS has, in many cases, resulted in competition and an inefficient use of the airspace. For this reason, in a number of States where these problems became particularly acute, it was decided to create an integrated ATS system to provide for both the civil and military needs. Experience gained by these States seems to indicate that this solution offers promising results regarding the equitable and efficient sharing of the airspace and avoids many of the problems created by the co-existence of two competing services.

1.1.5 The cost-effectiveness aspect of ATS, which has become much more important since user charges have been established by a large number of States, is a further consideration to be taken into account in determining the need for ATS. It has been found that not everything that is desirable is also necessary and that a balance must therefore be reached between the requirements put forward for the improvement of the ground services and the cost involved in putting them into effect. In establishing the needs for ATS, their users should therefore be given an opportunity during the planning stage to express their views and these views should receive due consideration.

1.1.6 Furthermore, the close interrelationship between national services of adjacent States, as mentioned above, makes it necessary that, once a basic air traffic service has been established, its development and improvement should be pursued in close co-ordination with affected adjacent States. Isolated action, especially as far as en-route services are concerned, will frequently deprive the State concerned from achieving the expected results if other affected national services do not follow with consequential and timely improvements of their services. As a consequence, situations may arise where States will be required to improve their services, not because there is an urgent national requirement to do so, but in order to ensure that
other, more or less adjacent States, being confronted with such needs, are not deprived of the benefits of their efforts.

1.1.7 In summary, it would appear that the need for ATS at and in the vicinity of specific aerodromes can, to a large extent, be determined on a local or national level and in consultation with operators concerned up to the point when these services will have consequences on the en-route flow of air traffic over a wider area. The need for ATS en-route traffic will, however, in the majority of all cases require the closest possible co-ordination amongst all those participating in the provision of such services over a wide area (generally an ICAO region).

1.2 OBJECTIVES OF ATS

1.2.1 The objectives of the ATS as specified in Annex 11, 2.2 are briefly:

a) to prevent collisions between aircraft and between aircraft on the ground and obstructions;
b) to maintain an orderly and expeditious flow of air traffic;
c) to provide aircraft with advice and information required for the safe and efficient conduct of flights;
d) to notify those involved in search and rescue of aircraft in need of this service and assist them in this task.

1.2.2 From these objectives, it follows that the emphasis of the ATS is placed on the word “service”. This emphasis means that ATS should, to the optimum extent, be at the disposition of its users and that any action on its part which is likely to interfere with the intention of any of its individual users, will only be justified if the results in improved services apply to the majority of users of the services there. In no case should it be permissible for ATS to take action affecting its users which is motivated by the convenience of ATS only.

1.2.3 In addition, since ATS is normally the only ground service which is in direct contact with aircraft in flight, care must be taken in assigning additional responsibilities emanating from other national requirements to ATS (i.e. diplomatic authorization to operate over the territory of a State), operational supervision of flights, etc. (i.e. national security), so as not to dilute the service provisions of ATS to a point where it will become difficult for controllers to draw a clear line in distinguishing the different capacities in which they are expected to act. In general, experience seems to indicate that the less additional responsibilities that are given to ATS the better it is able to meet its primary objectives.

1.2.4 Similar considerations apply with respect to the provision of information by ATS to aircraft not directly derived from the activities of ATS (e.g. information on the status of other than ATS facilities and services, meteorological information, etc.). Such information should be provided to ATS for onward transmission in a manner and form which requires the least amount of interpretation and/or responsibility for the accuracy and timeliness of the information in question.

1.3 ESTABLISHMENT OF AUTHORITY

1.3.1 While the ICAO Convention specifically recognizes the sovereignty of each State within the airspace over its territory, ICAO also recognizes that the provision of air navigation services should primarily be dictated by operational considerations inherent in air navigation. Therefore, while in most cases the provision of ATS by a State will be confined to the airspace over its territory, there are nevertheless numerous cases, especially in areas where the political configuration was well established before aviation became a significant factor in world developments, where the political boundaries do not lend themselves as evident operational dividing lines between the areas of responsibility of adjacent national ATS services.

1.3.2 For this reason, Annex 11, 2.1, makes specific provisions for arrangements whereby adjacent States are encouraged to conclude mutual agreements which allow for the delegation of responsibility for the provision of ATS from one State to another, on the understanding that this will in no way affect the question of sovereignty over the airspace so delegated.

1.3.3 As regards the provision of services over the high seas or other areas where no sovereign rights are exercised (i.e. Antarctica), ICAO has envisaged that ATS services shall be established in accordance with regional air navigation agreements whereby the totality of interested States in a particular region entrust a State, or a selected number of States, with the provision of air navigation services and more especially ATS, in a specified portion of such airspace (typical examples are those in the North Atlantic (NAT) and the Pacific (PAC) regions). In this respect it should be noted that the assumption of such delegated responsibility by a State, by virtue of a regional air navigation agreement, does not imply that this State is then entitled to impose its specific rules and provisions in such airspace at its own discretion. In fact, conditions of operation therein will be governed by applicable ICAO provisions of a world-wide and supplementary regional nature.
and specific national provisions may only be applied to the extent that these are essential to permit the State the efficient discharge of the responsibilities it has assumed under the terms of the regional air navigation agreement.

1.3.4 A further problem which concerns ATS over the high seas has recently come to light in relation to oil exploration activities in the sea bed. In a number of cases, the division of oil exploration areas among States, bordering on the sea bed in question, bears no relationship to the airspace division made for the same area. Therefore, while this airspace division may be found satisfactory to cater for the needs of en-route operations by aeroplanes, it generally does not cover the case of helicopter (and aeroplane) operations conducted specifically in support of the oil exploration activities. Experience already gained in some complex cases (e.g. the North Sea and the Gulf of Mexico) indicates that the solution to these specific problems should not be sought so much by re-organizing the airspace in question, but rather by concluding special arrangements between States concerned, following appropriate consultation with operators, covering the delegation of responsibility for the provision of specific services in accordance with the operational needs and relevant cost-effectiveness considerations, both for the ground services and for the operators concerned. An example for such arrangements is the agreement concluded between Norway and the United Kingdom covering North Sea helicopter operations. If desired, copies of their latest agreement may be obtained on request to any ICAO regional office.

1.3.5 Experience seems to show that the establishment of an ATS authority on a national level should best be done so that it can operate with an optimum of flexibility, both on the internal level and with adjacent ATS authorities. Flexibility is essential if ATS authorities are to be able to keep pace with the dynamic development of air navigation and respond to resulting new operational requirements in an efficient and timely manner. In practice, this would imply that, while national ATS authorities will obviously be required to operate within the legal, administrative and budgetary confines applicable to all national administrations, they should be given optimum autonomy as regards their handling of operational and technical matters without being excessively inhibited in their activities by non-technical supervisory agencies.

1.4 DIVISION OF ATS

1.4.1 In accordance with Annex 11, 2.3, the air traffic services are sub-divided into the following three services; air traffic control (ATC) service, flight information service (FIS) and alerting service. It should, however, be clearly understood that the provision of alerting service is not an isolated function but is rather incorporated in the provision of flight information and/or ATC service. The same condition applies for the provision of flight information service whenever an ATC service has been established, except in those cases where, due to traffic density and workload considerations, flight information service may be provided by personnel specifically designated for this task.

1.4.2 The ATC service is sub-divided into three parts, depending on the stage of flight to which it is applied. At and in the vicinity of aerodromes, ATC is normally provided by the aerodrome control service, which operates from a control tower, hence its abbreviation (TWR) aerodrome control tower. Approach control service (APP) is also provided in the vicinity of aerodromes, but is a service which is mainly concerned with flights operating on an instrument flight rules (IFR) flight plan and in instrument meteorological conditions (IMC). Area control service (ACC) is that part of the ATC service which is provided to controlled flights while they are en route and is normally done from an ACC.

1.4.3 The division of responsibilities between TWR and APP and between APP and ACC cannot be rigidly defined because the responsibilities depend very much on local conditions which vary from location to location. They must therefore be determined in each case and with due regard to traffic conditions, its composition, the airspace arrangements, prevailing meteorological conditions and relative workload factors. However, arrangements governing the division of responsibilities between these different parts of the ATS service, should not result in increased requirements for co-ordination and/or an undesirable inflexibility in the use of airspace, nor in an increased workload for pilots because of unnecessary transfers of control and associated radiocommunication contacts.

1.4.4 It should also be noted that, depending on traffic conditions, the provision of certain parts of the ATC service may be restricted to those times or periods when the service in question is actually required and that, outside these times or periods a more limited type of service (e.g. in the case of an APP, only aerodrome control or aerodrome flight information service (AFIS)) may be provided. Resorting to such arrangements presupposes, however, that this will, under no circumstances, result in a decrease of flight safety, or result in other consequences having an unduly detrimental effect upon flight operations conducted under these conditions.
1.4.5 The division of responsibilities between APP and ACC requires particularly careful consideration because it can have a significant effect on the capacity of the ATC system at the location concerned, especially as regards the requirement for co-ordination and the workload imposed on both controllers and pilots. It has, for instance, been found that at some rather busy major aerodromes, the arrangement whereby departing traffic is transferred directly from the aerodrome control tower to a departure control position in the associated ACC, or only that part of arriving traffic which has been brought into a position where it no longer constitutes traffic to other departing or overtaking traffic is released to APP by the associated ACC, has contributed to an optimum flow of considerable amounts of air traffic while keeping the workload within manageable proportions. It should, however, be noted that such arrangements depend specifically on the local situation and that they should only be applied after careful consideration of all relevant factors by all parties concerned.

1.4.6 In numerous cases it has also been found that arrangements between APP and ACC, which leave the transfer of control of departing as well as arriving traffic between them to ad hoc agreements made in the light of the over-all traffic situation, have worked well whenever the will on both sides to obtain results has prevailed over the thinking in pure categories of competence.

1.5 PROGRESSIVE DEVELOPMENT OF ATS

1.5.1 From the above, it follows that, initially, the simplest form of providing ATS is to establish a flight information centre (FIC), covering a given area, which provides flight information and alerting service to en-route traffic; see Chapter 2, 2.2 below regarding flight information regions (FIRs). At the same time, at those aerodromes where air traffic tends to concentrate, it would then be appropriate to establish an AFIS which, in addition to alerting service and normal FIS, will provide aircraft with detailed information regarding other traffic operating in the vicinity of the aerodrome in question, so as to permit the pilots to arrange their flights so that a safe and expeditious flow of air traffic results.

1.5.2 In most cases, fairly early in the development of traffic at specific aerodromes, the point will be reached where the responsibility for the arrangement of such a safe and expeditious flow of traffic can no longer be left to the discretion of individual pilots. This case applies particularly when IFR operations of a commercial nature are conducted at such an aerodrome. However, experience has also shown that, if the traffic at a specific aerodrome is composed largely of pilots who are thoroughly familiar with the local conditions and their operations consist primarily of visual flight rules (VFR) flights, the decision to establish an aerodrome control may not need to be taken as early as would otherwise be needed.

1.5.3 The establishment of an aerodrome control service does not necessarily imply the immediate provision of a special ATC facility (control tower) but it is rather intended to mean that the service will be provided by adequately qualified ATC personnel, having means and facilities at their disposal appropriate for the given situation. These means and facilities can range from relatively simple arrangements to a complete system of ATC services, including radio voice communication and electronic data processing and display equipment.

1.5.4 The area of responsibility for control of such a tower should, in addition to aerodrome traffic, also consider all traffic operating within a reasonable distance of the aerodrome. While no precise limitations can be imposed because the distance will vary in accordance with the traffic handled at the moment, experience seems to show, however, that it should normally not exceed 25 NM. Where only VFR traffic is controlled, the designation of a controlled airspace is not necessary and also not generally desirable. However, if the density of VFR traffic reaches proportions which would make the traffic pattern of departing and arriving aircraft difficult because of overflying aircraft, an aerodrome traffic zone may be established to permit the control tower either to exercise control over aircraft not intending to land at the aerodrome in question or to make them avoid that zone.

1.5.5 It should be mentioned here that an aerodrome traffic zone may also be established around uncontrolled aerodromes when the activities conducted at those aerodromes (i.e. flying school, specific military activities) make it undesirable for other aircraft, not engaged in these activities, to penetrate or otherwise disturb the traffic pattern. In this case, the aerodrome traffic zone is primarily reserved for use by aircraft participating in the activities having caused the zone to be established.

1.5.6 When further developments determine that it is necessary for an aerodrome to also be available to traffic operating under IFR, it will be necessary to protect such traffic by extending control to such traffic by imposing such restrictions on VFR flights as are necessary to ensure the safety of both types of operations while operating in the same general area. To accomplish this, sufficient controlled airspace should be established to encompass the arrival,
departure and, where necessary, the holding flight paths of the IFR flights. To achieve this in the most efficient manner, it will generally suffice to establish a comparatively small control zone (which, by definition extends from the ground upwards) and to superimpose on it a control area (which, again by definition, extends from a given lower limit above the ground upwards) of a size sufficient to contain the flight paths of departing, holding and arriving IFR flights. In doing so, the lateral extent of the control zone must be determined in relation to the lower limit of the superimposed control area so that average flight trajectories during departure and arrival are fully contained within the totality of the controlled airspace formed by the control zone and the control area. In addition, care should be taken in establishing the control zone and associated control area, that unnecessary restrictions are not imposed on other VFR air traffic wishing to operate in airspace close to the controlled aerodrome but not wishing to use that aerodrome itself (see also Appendix A to Part I, Section 2, Chapter 3).

1.5.7 Further increases in the number and frequency of IFR traffic at an aerodrome will lead to the need to establish an APP as a separate service which, while closely co-operating with the control tower, may occupy a different location on the aerodrome in question and be administered as a separate ATS unit. The requirement for means and facilities for the provision of this service depend very much on the amount of IFR traffic to be handled, the type of traffic and the complexity of operations, the meteorological and topographical conditions at and around the aerodrome and workload considerations. It may also be possible, depending on demands for this type of service, to limit its availability to those periods of the day where it is likely to be required.

1.5.8 Normally in parallel with the development of air traffic at and around aerodromes, the requirement for the control of air traffic operating between such aerodromes also increases and the need to provide area control service is mainly determined by the assessment of the risk involved in the fact that a number of aircraft operate simultaneously in the same portion of airspace in IMC. If, in addition, a number of these aircraft are engaged in commercial air transport, safety considerations involved in this assessment become even more pressing. However, if such en-route traffic is composed of VFR flights of a non-commercial nature only, it can reach very appreciable proportions before it becomes necessary to institute any type of control over such en-route flights.

1.5.9 In planning ATS it must therefore be ensured that early and timely provisions are made for this eventual increase in traffic because the lead times required for the initial implementation of an area control service, both as regards staffing and training of personnel and the provision of adequate means and facilities, especially communications, are significantly different from those required for the development and improvement of aerodrome control and APP, which tend to progress along much more envisageable and thus predictable lines. It is for this reason that ICAO has recognized the progressive development of ATS in its provisions of air traffic advisory service as a temporary, intermediate stage in the progression from flight information to area control service in order to permit an orderly transition from a service which is primarily informative in nature to one which requires the assumption of increased responsibilities by controllers for the safety of flight operations.

1.5.10 In providing control areas for area control service, their shape and extent will be dictated primarily by the flow of air traffic requiring control. At present, control areas are mainly formed by terminal control areas (TMAs) around major aerodromes connected with each other by air routes. Channelling of air traffic along routes has, however, the advantage that intersections of flight paths will be kept to manageable numbers and that their presentation to controllers on appropriate displays remains within normal limits of human perception.

1.5.11 Other, more liberal forms of organization of the traffic flow, such as the provision of an area control service based on an area type control combined with the possibility of pilots planning their flights along the most direct flight path have been found to be very difficult to accept by controllers. Such arrangements create an instant and continually changing ad hoc route system, determined by the individual intentions of pilots, require an inordinate amount of additional work by controllers in recording and updating flight progress strips, and also seem to render effective control much more difficult because possible conflicts between the intentions of individual flights cannot be projected on to well-established geographical locations but have to be worked out for each case individually.

1.5.12 The development of ACC should, however, provide for the case that, while pilots may still be required to plan their flights along a published route structure, ACC will clear them to fly the most direct route between any two points whenever this is possible at the time the flight comes under the control of the ACC concerned. Such a method of control will have to depend to a large measure on the discretion of the controller concerned without the obligation on his part to apply it systematically on each and every occasion. In addition, it must also be ensured that the navigation guidance provided, or the monitoring of flight progress by radar, is adequate to permit pilots to fly such
direct routes with the degree of accuracy upon which separation between aircraft is based.

1.5.13 Finally, the establishment of an ATS route network to support the provision of area control service also offers the possibility of accommodating the various, often diverging interests regarding the channelling of air traffic. It is therefore essential that, in its establishment, ample opportunity is offered to all airspace users, including the military, as well as other interested parties (e.g. those concerned with the safeguarding of installations on the ground) to participate in the development process and make their views known so that acceptable compromises can be found.
2.1 INTRODUCTION

The types of air traffic services (ATS) to be provided depend on the objectives of ATS, which are specified in Annex 11, 2.2. As a result, much of what can be said in general terms about type of service has already been covered in the preceding chapter. It is therefore intended that, under this chapter, only a number of specific requirements, peculiar to a particular type of ATS, will be discussed.

2.2 FLIGHT INFORMATION SERVICE

2.2.1 General

2.2.1.1 In general, the flight information service (FIS) is intended to supplement and update during the flight, information on weather, status of navigation aids and other pertinent matters (exercises, airspace reservations, etc.) the pilot received prior to departure from the meteorological (MET) and aeronautical information service (AIS) so as to be fully aware at all times of all relevant details regarding matters influencing the safe and efficient conduct of his flight. The fact that FIS has been entrusted to ATS, even though the information emanates or is generated by other ground services (airport operators, the MET and communications (COM) services), is due to the fact that ATS is the ground service which is most frequently in communication with the pilot. From this it follows that, while ATS is responsible for the transmission of that information, the responsibility for its initiation, accuracy, verification and timely transmission to ATS must rest with its originators.

2.2.1.2 This fact does not, however, apply to information provided in uncontrolled airspace regarding other air traffic operating in the vicinity of a given aircraft. This traffic information should be given whenever it is likely that such information will assist pilots concerned to avoid the risk of collision. In addition, since, in uncontrolled airspace, such information can only be given about aircraft whose presence is known and since even that information may be of doubtful accuracy as to position and intentions of the aircraft concerned, the unit providing FIS will not assume responsibility for its provision at all times nor for its accuracy once it is issued. Pilots should be given an appropriate indication of this fact when such information is provided to them.

2.2.1.3 Where FIS is the only service provided for en-route traffic, it is generally provided to aircraft by a flight information centre (FIC). Where this service is provided to aircraft on and in the vicinity of a given aerodrome it is referred to as aerodrome flight information service (AFIS). Units providing AFIS need not necessarily form part of the national ATS but may act under delegated authority.

2.2.1.4 With regard to the provision of FIS to en-route traffic, planners should keep in mind that a proper balance must be struck between the obligations imposed on pilots as regards filing of flight plans, reporting of position and closing of flight plans and the possibilities of FIS to use such information effectively in rendering service. It is, for instance, of little use to require flights to make frequent position reports when these are not used to provide an effective collision avoidance service, nor is it useful to have pilots close their flight plans when it serves only administrative purposes. Therefore, the provisions governing uncontrolled flights in FIRs should be seen in relation to the intended development of the FIS to be provided and this, in turn, should be governed by a realistic assessment of potential needs, especially as regards flight safety, and also take into account cost-effectiveness. The provision of air-ground communication cover is particularly relevant in this respect.

2.2.1.5 In a number of States which provide service to a large amount of general aviation flight operations and which cover large areas, it has been found that, rather than to try and provide FIS to these flights from central FICs or special FIS sections, attached to area control centres (ACCs), better service can be provided from strategically located FIS stations, manned by personnel which, while
fully qualified to provide this service, are not fully qualified air traffic controllers. This arrangement may also eliminate the possible need to provide for costly, remotely-controlled very high frequency (VHF) communication coverage from one central location in each flight information region (FIR).

2.2.1.5.1 Once established, it was found that it would be both operationally convenient for pilots concerned and economic, if these stations were also to serve as pre-flight briefing stations for pilots not operating from aerodromes where separate MET and AIS units were established. In fact, experience has shown that, with comparatively little additional effort in training and costs, these stations can provide a satisfactory service to general aviation which, otherwise, would have been either very costly and/or would have imposed on pilots undesirable additional efforts to obtain a pre-flight briefing by forcing them to contact two or three different services.

2.2.1.5.2 An example of the above-described method of combining FIS with other services is described in Appendix A.

2.2.2 Aerodrome flight information service

2.2.2.1 Further to the relevant provisions in Procedures for Air Navigation Services — Rules of the Air and Air Traffic Services (PANS-RAC, Doc 4444) regarding AFIS, it should be noted that as traffic at and around an aerodrome develops, this type of service should be adjusted so that its provision and its contents meet, at all times, the existing practical requirements. In addition, in many cases, it has been found that the initial stages of AFIS may well be provided by personnel other than ATS, who are required to be available at the aerodrome for other purposes, but have been adequately trained for this task and clear-cut arrangements covering duties and responsibilities have been concluded (see also Part IV, Section 1, Chapter 2, 2.4).

2.2.2.2 However, in those cases where it is envisageable that further aerodrome developments will require the establishment of an aerodrome control tower in the foreseeable future, planning for AFIS should be implemented well ahead of the actual requirement, especially as regards the availability of suitably trained personnel.

2.2.2.3 Use of broadcast for FIS

2.2.2.3.1 The provisions in Annex 11 regarding operational flight information service (OFIS) and automatic terminal information service (ATIS) by means of broadcasting specify what type of information should be provided and how. It is therefore believed unnecessary to repeat these provisions here. However, in the course of development of these services, detailed guidance on the composition of relevant messages has also been developed and is shown in Appendices B to D to this chapter.

2.2.3 Operational flight information service

Trials, conducted in the European (EUR) region with respect to operational flight information service (OFIS) broadcasts, seem to have indicated that OFIS could lead to economies when compared with other methods of providing the same service, provided that:

a) the information included therein is carefully selected so that it meets the demands of the majority of aircraft using the broadcasts;

b) the locations from which broadcasts are made are carefully selected so as to cover major terminal areas and traffic arteries with a minimum of overlap;

c) full advantage is taken of latest developments in the field of automated radio transmission equipment;

d) requirements in management for the application of the OFIS concept are kept to a minimum.

In addition, it is felt that OFIS would be useful because it could assist users materially in the most economic conduct of their flight operations.

2.2.4 Automatic terminal information service

2.2.4.1 Automatic terminal information service (ATIS) is determined much more by local considerations than is the case for OFIS. It is therefore essential that the question of replacing the individual request/reply method of providing required information to aircraft by a broadcast be reviewed with particular care at each aerodrome, in order to ensure that such action not only offers noticeable operational advantages to the users and the providing ATS unit, but that these advantages are also reasonably cost-effective. Relevant considerations in determining need for ATIS are:

a) the traffic density at the aerodrome over prolonged periods of time. Practical experience noted by one important State seems to show that a minimum of 25 operations per hour during a period of three hours should be the lower limit for establishing a requirement for ATIS;
b) the frequency with which critical conditions regarding operation to and from the aerodrome in question occur, both meteorological and otherwise;
c) the composition of the air traffic using the aerodrome from the point of view of aircraft characteristics and resulting departure and approach procedures.

2.2.4.2 In order to be of value, a systematic routine transmission of information must cover the most demanding case, both as regards its contents as well as the range at which it must be received. It could thus well be that, depending on the traffic composition, the provision of ATIS may be dictated by the needs of comparatively few users — a fact that should be kept in mind at all times.

2.2.4.3 It should also be noted that, because of the demand on the coverage of such broadcasts (based on the highest justified demand), implementation of ATIS may result in significant demands on the available radio spectrum (VHF). This, in turn, could increase the difficulties of frequency assignment planners to meet the total demand on VHF channels if these demands are particularly high in a specific area (e.g. the EUR region).

2.2.4.4 It would therefore appear essential that the decision to implement ATIS at a specific location should be made dependent on a study showing that the advantages obtained by it (essentially a reduction in workload imposed on ATS personnel) will outweigh the disadvantages, including those resulting from increased equipment cost involved in the use of this service. In some cases, it may also be advisable to restrict the provision of ATIS to those periods of the day when only traffic density makes ATIS desirable in order to reduce the air-ground communication load on ATS to manageable proportions. It should, however, be noted that such action will do little to resolve frequency congestion problems where they are likely to occur.

2.2.5 Traffic information broadcasts by aircraft and related operating procedures

Where there is a need to supplement collision hazard information to aircraft operating outside of control areas and control zones or in the case of temporary disruption of FIS, traffic information broadcast by aircraft (TIBA) may be applied in designated areas. Guidance material on TIBA and related procedures are contained in Appendix E.

2.3 ALERTING SERVICE

2.3.1 The provision of alerting service is a task incumbent on all ATS and with respect to all air traffic which is known to an ATS unit. Since the procedures required to perform this service are adequately covered in the relevant part of Annex 11, it is believed sufficient in this manual to stress only one aspect which, in some cases, has given rise to difficulties. This aspect concerns the co-operation with other agencies involved in cases where an aircraft is known or believed to be in a state of emergency, or the subject of unlawful interference.

2.3.2 To cover such co-operation, necessary agreements should be concluded between the parties concerned. These agreements should cover not only procedural aspects as to who is to do what in a given set of circumstances, but should cover also all available communication means which may be used to assist an aircraft in emergency or an aircraft subjected to unlawful interference. Additionally, the names of persons to be contacted along with other relevant information should be included in the agreement. Although cases requiring alerting service are rare, when they do occur they require a perfect functioning of all parties concerned. It is therefore necessary that these arrangements be reviewed at regular intervals and that communication trials be made rather frequently in order to ensure that everybody concerned is fully aware of the agreed provisions and applies them with optimum efficiency. These trials should also permit existing arrangements to be assessed and amended in the light of developments in order to keep them current.

2.3.3 As a number of the organizations involved in a case of unlawful interference with an aircraft will not be too familiar with aviation and its special operating conditions of ATS, it would also appear useful if selected personnel from these organizations were invited to visit ATS installations in order to familiarize themselves with those ATS procedures which may have an effect on the planning of interventions. Such visits could also provide an opportunity for discussion and resolution of problems which are of mutual interest.

2.4 AERODROME CONTROL SERVICE

2.4.1 Further to the provisions in Annex 11 regarding aerodrome control service, there are two aspects which need to be taken into account in their planning and operation. These concern:

a) the co-operation between the aerodrome control tower and other agencies responsible for the provision of services at the aerodrome where that aerodrome control tower is located;
b) the internal arrangement for sharing the task of providing aerodrome control service where more than one controller on duty is needed.
2.4.2 With respect to co-operation between the aerodrome control tower and other agencies it is essential that detailed arrangements be concluded between the aerodrome control tower and all those agencies likely to conduct activities on the manoeuvring area of the aerodrome, ensuring that the aerodrome control tower can exercise its control function over aircraft in that area without interference and without creating hazards to aircraft under its control. This applies particularly in those cases when maintenance and/or construction work is being undertaken on the manoeuvring area.

2.4.3 As to the provision of service to aircraft and other traffic operating on the apron, it is now accepted practice that this task should be referred to as the apron management service and that this service should be conducted so as to assist pilots and persons in charge of vehicles on the apron to avoid collisions as well as to obtain a coherent pattern of movements on the apron. This service may be achieved by systematic arrangements defining tracks to be followed by the different participants constituting the overall traffic on the apron and/or, by the provision of individual guidance, either by voice or by other, appropriate signal devices. At small and medium aerodromes, where the apron can be fully overseen by the aerodrome control tower, the provision of apron management service is best entrusted to the aerodrome control tower because it retains the unity of service and avoids a change in responsibility for services in the transition area between the apron and the manoeuvring area.

2.4.4 However, at larger aerodromes with extended apron areas, there often exists a situation where the aerodrome control tower cannot oversee the entire apron because of its complexity and it would therefore be unfeasible to entrust the aerodrome control tower with the apron management service. In such cases it will be necessary to have apron management service performed by a special agency which is normally provided by the aerodrome operator. If a special agency performs apron management service it must, however, be ensured that specific agreements are concluded between the ATS unit in question and the aerodrome operator which define, in detail, the respective areas of responsibility on the aerodrome, as well as the procedures to be employed for serving ground traffic. Such arrangements apply especially to methods used in the transition area between the apron and the manoeuvring area so as to avoid any possible incompatibilities between the methods employed.

2.4.5 As to internal arrangements for sharing tasks where more than one controller is on duty (2.4.1 b above), it is obviously a question which falls largely into the field of facility management (see Part IV, Section 2, Chapter 1).

However, it should also be realized that any arrangements made in this respect should in the first place be dictated by operational considerations, i.e. the safety and efficiency of the service rendered to traffic and not by considerations of administrative convenience or other non-operational considerations.

### 2.5 APPROACH CONTROL SERVICE

2.5.1 Whenever it has been decided that there is a justified requirement for the provision of approach control (APP) at a specific aerodrome, or for more than one aerodrome if these aerodromes are located in close proximity to each other and it is therefore more effective to provide this service from a single APP, the following aspects, further to the relevant provisions in Annex 11, need to be taken into account in the planning and operation of such a unit:

- a) the co-operative arrangements between APP and the associated aerodrome control tower or aerodrome control towers;
- b) the internal arrangements between controllers for the task of providing APP service;
- c) measures required to ensure that a possible mix of instrument flight rules (IFR) and visual flight rules (VFR) operations at and around the aerodrome(s) in question do not impair the safety of flight operations.

2.5.2 It is evident that the co-operative arrangements between an APP and the associated aerodrome control tower or between APP and aerodrome control towers, when more than one aerodrome is served by a common APP, should be based on considerations of an operational nature only so as to ensure the optimum flow of air traffic, i.e. prevailing MET conditions, composition of arriving and departing air traffic, etc. It is also evident that both APP and the aerodrome control tower(s) should apply maximum flexibility in their operation to obtain best results under any given set of circumstances. One way to achieve flexibility is to provide both APP and the aerodrome control tower(s) with means permitting them to be aware of the traffic situation at each location and assist with appropriate action when the need arises and without the need for lengthy and time-consuming verbal coordination.

2.5.3 Means to achieve flexibility could be the installation of a radar display in the control tower, the use of closed-circuit television or other visual displays (video), showing current flight data information for each location. In addition, it must be ensured that voice communication links between APP and the aerodrome control tower are instan-
taneous, reliable and of sufficiently good quality to reduce difficulties to a minimum.

2.5.4 As concerns the internal arrangements for sharing the task of providing APP between controllers (2.5.1 b) refers), experience seems to show that a basic split between those controlling arriving and those controlling departing traffic is the most suitable arrangement, unless other arrangements have been made whereby departing air traffic is directly transferred from the aerodrome control tower to the associated ACC (see Part I, Section 2, Chapter 1, 1.4). In any case, operational considerations aimed at the safe and efficient flow of air traffic should take precedence over any other considerations in the development of such arrangements.

2.5.5 Since approach control is primarily concerned with controlled IFR flights operating at or in the vicinity of aerodromes, it will be faced with the problem of avoiding dangerous situations which could be created by the simultaneous presence of controlled IFR flights and VFR flights in the same airspace. While methods to overcome, or at least reduce, this problem to an acceptable level are at present considered, a reasonable degree of interference with the freedom of operation of VFR flights must be accepted, be it that pilots of such flights may be required to have skills not normally required for the conduct of a VFR flight (radio-communication and/or certain navigation capabilities) and that aircraft must be equipped with certain radio-communication and/or navigation equipment, or that VFR flights are restricted to certain areas and/or routes and required to comply with procedures additional to those normally required when operating at or around an aerodrome.

2.5.5.1 One point which needs to be made first, from an ATS point of view, is that the prohibition of VFR flights at aerodromes where IFR flights are conducted is certainly not the preferred solution to the problem of mixed IFR/VFR flights in the same airspace. Such a course of action will deprive certain users of airspace and facilities which should normally be available to everybody on an equal basis. However, it is also evident that, if there is a likelihood of collision risks, a reasonable degree of interference with the freedom of operation of VFR flights must be accepted, be it that pilots of such flights may be required to have skills not normally required for the conduct of a VFR flight (radio-communication and/or certain navigation capabilities) and that aircraft must be equipped with certain radio-communication and/or navigation equipment, or that VFR flights are restricted to certain areas and/or routes and required to comply with procedures additional to those normally required when operating at or around an aerodrome.

2.5.5.2 The choice of measures taken will, to a very large extent, depend on local conditions at the aerodrome in question, as well as on the types of traffic using the aerodrome. It should however, in any case, not be made without full consultation of all parties concerned and should not place unjustifiable demands on VFR pilots, be it in costs required to install supplementary equipment on board their aircraft or in costs associated with the acquiring and retention of additional skills in the form of special licences, etc. (see also Part II, Section 4, Chapter 2).

2.6 AREA CONTROL SERVICE

2.6.1 In providing area control service the procedures to be applied by an ACC are specified in Annex 11 and are therefore not repeated here. However, there are a number of aspects regarding the provision of area control service which need to be highlighted because they can significantly affect the procedure applied by an ACC. These aspects concern:

a) the co-ordination and co-operative arrangements made with other air traffic control (ATC) units;
b) general working arrangements;
c) control based on the integration and use of radar.

2.6.2 Co-ordination plays an essential part in the provision of area control service and the efficiency of operation of an ACC can be significantly affected by the manner in which this question has been resolved. It should also be noted that co-ordination aspects in an ACC can be broken down into:

a) co-ordination with adjacent ACCs;
b) co-ordination with ATC units providing services within the same FIR and served by the ACC in question; and
c) co-ordination within the ACC concerned.

2.6.3 Co-ordination with adjacent ACCs needs to be conducted frequently because, on an international level, one or more of the ACCs adjacent to the facility in question may be located in a different State due to the geopolitical configuration of a given area. In cases where only one ACC provides services throughout the territory of a given State, it is frequently found that co-ordination of an ACC with any of its adjacent ACCs involves dealing with the administration of an adjacent State, thus involving different administrative rules and procedures and possibly even different ways of thinking. In those cases, therefore, it is of the utmost importance that the development of appropriate co-ordination arrangements be conducted strictly at the operational level, based on purely operational considerations, and that, to the maximum extent possible, they be kept free of any interference of an administrative or non-technical nature. It should also be pointed out that, whenever possible, such co-ordination arrangements should be developed in meetings between those directly concerned, rather than by correspondence, because it has
been found that such meetings permit the resolution of even complicated issues in appreciably shorter times and with better results than can otherwise be obtained.

2.6.4 Furthermore, any such co-ordination arrangements should be kept under constant review with the objective of their being up-dated whenever it is found that updating is required, either because the conditions upon which the arrangements were based have changed or experience with their application has shown that improvements are possible.

2.6.5 As to co-ordination between an ACC and its associated ATC units, i.e. APP and aerodrome control tower (2.6.2 b) refers), much of what has been said in the previous paragraph also refers, except that this co-ordination normally does not involve two different administrations. However, it is important that in concluding such arrangements they are not influenced by questions of competence or considerations regarding the relative importance of each of the units concerned in relation to the other. This issue is stressed only because past experience in certain areas seems to indicate that, whenever such questions arise, they can seriously affect the efficiency of the arrangements agreed upon and generally take years to correct because of the emotional elements involved.

2.6.6 As regards the internal working arrangements and co-ordination within an ACC (2.6.1 b) and 2.6.2 c) refer), such issues are dealt with in detail in Part IV, Section 2 of the manual. It will therefore be sufficient to state here that internal working arrangements can have a considerable effect, positive as well as negative, on the operation of an ACC in terms of its efficiency and its capacity to handle traffic. Therefore, it is again important that early in the planning stage internal working arrangements for operational personnel be fully incorporated in the planning process and that, wherever possible, simulation trials be conducted, aimed at the determination of the most efficient operational layout of the ACC.

2.6.7 In addition, since the situation in an ACC is subject to frequent changes, mainly due to changes in the amount, density and orientation of traffic flows, it is essential that this matter be kept under review and study so that necessary changes can be effected in good time.

2.6.8 Another aspect relevant to co-ordination involves the situation where an ACC is provided with radar for controlling traffic in part of or throughout its area of responsibility. Normally, the initial control arrangements will be that radar control will be supplementary to the control based on conventional means and that the full integration of radar as a routine means of control will be effected gradually and only after it has been established that such integration can be done safely. Experience has also shown that, during the period of side-by-side operation of conventional and radar control, increases in the amount of internal co-ordination required generally make it necessary to provide the ACC with air-ground communication channels over and above those required for a fully integrated operation. This side-by-side operation obviously places additional requirements on the available frequency spectrum and can lead to difficulties of an international scale whenever the use of the radio spectrum has already reached critical proportions. It is therefore essential that this stage of the use of radar be kept as short as possible, commensurate with the primary requirement to ensure the continued safety of the service provided and that, upon its completion, the additional voice channel and other requirements be withdrawn so that they again become available to satisfy other justified requirements.

2.7 AIR TRAFFIC ADVISORY SERVICE

2.7.1 As of its inclusion into the relevant ICAO provision, it was intended that air traffic advisory service was to be considered as a temporary intermediary form of ATS in order to allow for an orderly and progressive transition from FIS (en-route or around aerodromes) to the provision of ATC. It should therefore be understood that air traffic advisory service cannot and should not constitute an end in itself but should only be instituted to permit control personnel, during a limited period of time, to acquire the necessary experience in the provision of full ATC by allowing them to act as if they were controlling air traffic without assuming the full range of responsibilities which are inherent in its provision.

2.7.2 It is therefore essential that, whenever air traffic advisory service is instituted, it should be clearly explained to users so that no misunderstandings exist as to the quality of service they can expect. It is, however, equally important to request full co-operation in this service so that this transitory stage of development of the ATS can be kept as short as possible. At the same time, it would appear desirable that, from the outset, planners determine a target date (or target dates), in co-operation with the operational personnel concerned, at which time such service will be reviewed with the objective of its upgrading to full ATC.

2.7.3 It should be noted that recently, and in connexion with the problems created by the mixture of IFR and VFR flights around busy aerodromes, some States have insti-
tuted an "air traffic advisory service" to VFR flights which is intended to:

a) keep such flights separated from IFR flights operating in the same general area;
b) provide them with advice on the conduct of their flight and on other VFR traffic operating in their vicinity.

Such service is extended to reduce potential risks of collision without the need to impose too restrictive conditions on VFR flights. Should this service become more widespread and thus acknowledged by ICAO, it could change the fundamental concept of the air traffic advisory service.
Appendix A

Flight Information Service Combined with other Services

1. In the United States, flight information service (FIS) to flights not requiring ATC service is normally provided by flight service stations (FSS). In some cases this service is also provided by aerodrome control towers. FSS accept flight plans, provide pre-flight briefing both as regards MET and AIS and provide normal FIS to aircraft in flight.

2. The meteorological information is not only obtained from current weather reports, forecasts, information on winds aloft, weather maps, etc., as prepared by the meteorological service but is also up-dated by in-flight reports from pilots. Some stations have a telephone connexion to suitably located radar stations, while others located near weather stations provided with such equipment are provided with a repeater display from the weather radar.

3. Other aeronautical information is received through communication connexion to the normal NOTAM distribution system.

4. In many parts of the United States, a limited pre-flight weather briefing can be obtained via a commercial telephone connexion to automatic recording equipment which provides continuously up-dated information. In some parts of the United States, this service has already been further refined to the point where a pilot can dial a number which will connect him with a computer and where, through a series of computer-generated synthetic voice queries and touch-tone telephone replies by the pilot, a more complete weather briefing by synthetic voice is provided. Additionally, the pilot has still the option to call the nearest flight service station or a MET office for additional details, if these are required. However, experience so far has shown that this latter possibility is used only by a small number of pilots.
Appendix B

Contents of the VHF OFIS message

1. INTRODUCTION

1.1 The VHF OFIS message, for use during the en-route phase of the flight, is intended to provide the pilot with the complete range of necessary information about an aerodrome to allow him to make provisional operational decisions about his approach and landing capabilities at that aerodrome. The content of a VHF OFIS message is not as detailed as that in an ATIS message but it should be sufficient to allow pilots to establish general relationship between the aerodrome conditions and the operating capabilities of their aircraft and crew.

1.2 The VHF OFIS message is considered suitable, without variation, both for directed transmissions and for incorporation in broadcasts covering a number of aerodromes. It should be noted that the VHF OFIS broadcast, as well as relieving the load on ATS, serves to present to the pilot, in one convenient package, the options open to him for continuation of his flight to destination or for diversion to an alternate aerodrome.

1.3 The VHF OFIS message should not include information concerning facilities when it can be reasonably expected that pilots have received that information prior to flight by other means, e.g. NOTAM.

1.4 The contents of a VHF OFIS message for a specific aerodrome may be reduced as deemed necessary when the aerodrome is closed.

2. CONTENTS OF VHF OFIS MESSAGES

VHF OFIS messages should contain the following elements of information in the order listed:

a) name of aerodrome;
b) time of observation;
c) landing runway;
d) significant runway surface conditions and, if appropriate, braking action;
e) changes in the operational state of the navigation aids, if appropriate;
f) holding delay, if appropriate;
g) surface wind direction and speed; if appropriate, maximum wind speed;
h) visibility and, when applicable, RVR;
i) present weather;
j) clouds below 1 500 m (5 000 ft), or below the highest minimum sector altitude, whichever is greater; cumulonimbus; if the sky is obscured, vertical visibility when available;
k) air temperature;
l) dew point temperature;
m) QNH altimeter setting;
n) trend-type landing forecast, when available.

As determined on the basis of regional air navigation agreement.

3. DETAILS ON THE CONTENTS OF EACH ITEM IN THE VHF OFIS MESSAGE

It is emphasized that certain details should, of necessity, be left to the local knowledge and discretion of the originator of the message, bearing in mind the need to adjust the length of the message to the available transmission time. The objective should be to give relevant information which will be applicable for the period during which the message will be transmitted.

3.1 Item 1: Name of aerodrome

The name of the aerodrome should be the official name published in the aeronautical information publication (AIP). When only one aerodrome is associated with a town or island, the name should only be that of the town or island. When the broadcast is made in the English language, the English version of the name, as generally understood, should be used, e.g. AMSTERDAM, MILAN-LINATE; MILAN-MALPENSA.

3.2 Item 2: Time of observation

The time of observation given should be the time in Co-ordinated Universal Time (UTC) included in the
routine report or selected special report (MET report). The other items in the OFIS message, not covered by the MET report, should have the same time of applicability, or as close as is feasible to the time of the MET report. Where the time of observation of operations (OPS) items is significantly different from that of the MET items, the time applicable to each group of items should be stated.

3.3 Item 3: Landing runway

3.3.1 The runway(s) should always be referred to by using the designator established in conformity with Annex 14, 5.2.2.4.

3.3.2 The main runway(s) in use at the time of the observation should be given, e.g. RUNWAY 19; RUNWAY 09 LEFT; RUNWAY 25 LEFT AND 25 RIGHT.

3.3.3 If it is expected that a change in runway is to take place during the period of validity of the broadcast, this change should be included in the item, e.g. RUNWAY 09 EXPECT 24 AFTER 1500.

3.3.4 When the landing runway in use is not a preferential runway, or may be subject to a limiting crosswind, or has degraded approach aids, the non-availability of the preferential runway(s) should be stated, together with the reason and expected duration of this situation, e.g. RUNWAY 34 IN USE; RUNWAY 23 CLOSED SNOW CLEARANCE UNTIL 1930.

3.3.5 When an aerodrome is closed by the aerodrome authority, the reason should be given, e.g. AERODROME CLOSED: SNOW; AERODROME CLOSED: SNOW CLEARANCE; AERODROME CLOSED: EMERGENCY.

3.3.6 When it is possible to estimate the time at which an aerodrome is to be re-opened, then a landing runway should be given if the time until re-opening is less than one hour and it is reasonably certain which runway will then be used. A predicted time should be given, e.g. AERODROME CLOSED SNOW: EXPECT RUNWAY 24 AFTER 1500.

3.4 Item 4: Significant runway surface conditions and, if appropriate, braking action

3.4.1 Significant runway surface conditions affecting the braking action should be briefly described using terms such as the following, e.g.:

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Estimate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 and above</td>
<td>5</td>
<td>good</td>
</tr>
<tr>
<td>39 to 36</td>
<td>4</td>
<td>medium to good</td>
</tr>
<tr>
<td>35 to 30</td>
<td>3</td>
<td>medium</td>
</tr>
<tr>
<td>29 to 26</td>
<td>2</td>
<td>medium to poor</td>
</tr>
<tr>
<td>25 and below</td>
<td>1</td>
<td>poor</td>
</tr>
</tbody>
</table>

3.4.1.1 The contaminants shall consist of one of the following:

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PATCHES</td>
<td>COMPACTED SNOW</td>
</tr>
<tr>
<td>COVERED</td>
<td>DE-ICED</td>
</tr>
<tr>
<td>DAMP</td>
<td>SANDED</td>
</tr>
<tr>
<td>WET</td>
<td>DRIFTING SAND</td>
</tr>
<tr>
<td>FLOODED</td>
<td>RUBBER DEPOSITS</td>
</tr>
<tr>
<td>FROZEN RUTS OR</td>
<td>RUTS</td>
</tr>
<tr>
<td>Ridges</td>
<td></td>
</tr>
</tbody>
</table>

3.4.2 Where appropriate and feasible the depth of the runway contaminant should be given, measured in millimetres.

3.4.3 If runway available dimensions are less than those published, the length and width of the cleared area on that runway should be given.

3.4.4 The braking action shall consist of the abbreviation “BA” followed by one of the following:

a) braking action coefficient for each third of the runway and the type of measuring equipment used;

b) estimated braking action for each third of the runway;

c) the abbreviation “UNREL” (unreliable).

3.4.4.1 The braking action coefficient shall consist of a six digit group, two digits for each third of the runway, representing the coefficient without the decimal point.

3.4.4.2 The estimated braking action shall consist of a three digit group, one digit for each third of the runway.

3.4.4.3 The type of measuring equipment used shall be one of the following:
3.5 Item 5: Changes in the operational state of the navigation aids, if appropriate

3.5.1 Reports of degradation or unserviceability of facilities should be confined to those facilities upon which approach limitations or procedures directly depend, since at the stage of the flight concerned, the pilot is more interested in knowing whether or not an approach and landing is theoretically possible, vis-à-vis the weather conditions. An instrument landing system (ILS) is the most obvious example of a facility which has a marked effect on approach limitations. When failure of a terminal radar could lead to protracted approach procedures, with consequent effect on fuel margins, it should be given. These reports should normally be restricted to those facilities associated with the approach to the landing runway, unless the degradation or unserviceability (associated with another runway) is the reason for the landing runway being in use.

3.5.2 Facilities which have no effect on approach limitations or procedures should not be reported.

3.5.3 Reports should give a brief description of the degradation or unserviceability, e.g. ILS 14 GLIDE PATH UNRELIABLE; ILS 19 UNSERVICEABLE.

3.5.4 Unserviceability of an ILS and degradation of an operational performance should be given.

3.5.5 If at all possible, an indication of the time at which the unserviceability is expected to be corrected should be given.

3.5.6 A report of restoration of facilities which affect operational limitations should be made immediately upon restoration of the facility in question.

3.6 Item 6: Holding delay, if appropriate

3.6.1 Holding delay for the purpose of VHF OFIS messages is understood to be the total holding time at or immediately prior to the initial approach to the destination aerodrome, i.e. holding in specified areas over the outer fix(es) and/or over the main navigation aid(s) serving the aerodrome of intended landing, as estimated by ATC.

3.6.2 The information about delays should be based on the actual delays being experienced at the time of the observation and may include an element of forecasting. It may be misleading to give precise delay times; the object must be to give the pilot a broad indication of the average delay so that he may derive a delay expectation for his own flight. The following method is therefore recommended. When the average arrival delay is:

a) less than 20 minutes, no report should be made;
b) 20 minutes or more, but less than 45 minutes, the delay should be reported as:
   1) DELAY 20 MINUTES; or
   2) DELAY 20 MINUTES OR MORE;
c) 45 minutes or more, the delay should be given as:
   1) DELAY 45 MINUTES; or
   2) DELAY 45 MINUTES OR MORE.

3.6.3 Where precise delay times are available they may be given, otherwise the method described above should be adhered to.

3.6.4 When available, a trend should be attached to the delay report, indicating whether the delay is increasing or decreasing, e.g. DELAY 45 MINUTES, DECREASING RAPIDLY.

3.7 Item 7: Surface wind direction and speed; if appropriate, maximum wind speed

Guidance on this item should be derived from Annex 3, 4.5. The information should be that contained in the report disseminated beyond the aerodrome (Annex 3, 4.5.5 a) and 4.5.8 refer).

3.8 Item 8: Visibility and, when applicable, runway visual range

Observing and reporting of visibility and runway visual range (RVR) are governed by the relevant ICAO provisions in Annex 3, 4.6 and 4.7. The criteria applicable to reports disseminated beyond the aerodrome should be used as given in 4.7.14. With regard to RVR, only the value representative of the touchdown zone should be given and no indication of location on the runway should be included. When there is more than one runway in use and there are significant differences in runway visual range between those runways, values for more than one runway
should be included in accordance with agreement between the meteorological authorities and the operators concerned and the runways to which the values refer should be indicated in the form “RWY 26 RVR 500 M RWY 20 RVR 800 M” (Annex 3, 4.7.14 refers).

3.9 Item 9: Present weather

Guidance on observing and reporting of present weather is given in Annex 3, 4.8.

3.10 Item 10: Clouds below 1 500 m (5 000 ft), or below the highest minimum sector altitude, whichever is greater; cumulonimbus; if the sky is obscured, vertical visibility when available

Guidance on observing and reporting of cloud is given in Annex 3, 4.9.

3.11 Items 11, 12 and 13: air temperature, dew point temperature and QNH altimeter setting

Annex 3, 4.10 and 4.11 provide guidance on the air temperature, dew point temperature and QNH altimeter setting. It should be noted that in accordance with 4.10.4 and 4.11.5 the above parameters should only be included if required by regional air navigation agreement.

3.12 Item 14: Trend-type landing forecasts, when available

The description and procedures applicable to the preparation of trend-type landing forecasts are indicated in Annex 3, 6.3.4 to 6.3.12. Aerodromes originating this type of forecast are listed in the regional air navigation plan.
Part I.— Planning factors
Section 2, Chapter 2.— Types of service

Appendix C

Contents of the HF OFIS Message

1. INTRODUCTION

1.1 The HF operational flight information service (OFIS) message, for use during the en-route phase of the flight, is intended to provide the pilot with necessary information about an aerodrome to allow him to make provisional, operational decisions about his approach and landing capabilities at that aerodrome. The contents of an HF OFIS message are not as detailed as that in an ATIS message but should be sufficient enough to allow pilots to establish a general relationship to be established between the aerodrome conditions and the operating capabilities of their aircraft and crew.

1.2 The HF OFIS message is considered suitable, without variation, both for directed transmissions and for incorporation in broadcasts covering a number of aerodromes. It should be noted that the HF OFIS broadcast, as well as relieving the load on ATS, serves to present to the pilot, in one convenient package, the options open to him for continuation of his flight to destination or for a diversion to an alternate aerodrome.

1.3 The HF OFIS message should not include information concerning facilities when it can be reasonably expected that pilots have received that information prior to flight by other means, e.g. NOTAM.

1.4 The contents of an HF OFIS message for a specific aerodrome may be reduced as deemed necessary when the aerodrome is closed.

2. CONTENTS OF HF OFIS MESSAGES

2.1 The contents of HF OFIS messages should be as determined on the basis of regional air navigation agreement. In areas where VHF OFIS broadcasts are not available or are rarely employed, the contents of the HF OFIS broadcast may have to be altered to comprise items listed under VHF OFIS broadcasts.

2.2 Normally HF OFIS messages should contain the following elements of information in the order listed:

   2.2.1 Item a: Information on significant en-route weather phenomena

   Information on significant en-route weather phenomena should be in the form of available SIGMETs as prescribed in Annex 3.

   2.2.2 Item b: Aerodrome information including:

   a) name of aerodrome;
   b) time of observation;
   c) holding delay, if appropriate;
   d) surface wind direction and speed; if appropriate, maximum wind speed;
   e) visibility and, when applicable, RVR;
   f) present weather;
   g) cloud below 1 500 m (5 000 ft), or below the highest minimum sector altitude, whichever is greater; cumulonimbus; if the sky is obscured, vertical visibility when available;
   h) aerodrome forecast.

3. DETAILS ON THE CONTENTS OF THE HF OFIS MESSAGE

   Procedures associated with preparation, format and exchange of SIGMET messages are described in Annex 3, 7.1 and 7.2. These messages should be included in HF OFIS broadcasts if time is available; otherwise, reference should be made to the existence of SIGMET messages. If there is no SIGMET message, the provisions in 11.4.6 of Annex 3, concerning the reporting of “NIL SIGMET” should apply.

3.1 Item 1: Name of aerodrome

   The name of the aerodrome should be the official name published in the AIP. When only one aerodrome is associated with a town or island, the name should only be that of the town or island. When the broadcast is made in the English language, the English version of the name, as generally understood, should be used, e.g. AMSTERDAM, MILAN-LINATE, MILAN-MALPENSA.
3.2 Item 2: Time of observation

The time of observation given should be the time in UTC included in the routine report or selected special report (MET report). The other items in the OFIS message, not covered by the MET report, should have the same time of applicability, or as close as is feasible to the time of the MET report. Where the time of observation of OPS items is significantly different from that of the MET items, the time applicable to each group of items should be stated.

3.3 Item 3: Holding delay, if appropriate

3.3.1 Holding delay for the purpose of HF OFIS messages is understood to be the total holding time at or immediately prior to the initial approach to the destination aerodrome, i.e. holding in specified areas over the outer fix(es) and/or over the main navigation aid(s) serving the aerodrome of intended landing, as estimated by ATC.

3.3.2 The information about delays should be based on the actual delays being experienced at the time of the observation and may include an element of forecasting. Since it may be misleading to give precise delay times; the object must be to give the pilot a broad indication of the average delay so that he may derive a delay expectation for his own flight. The following method is therefore recommended. When the average arrival delay is:

a) less than 20 minutes, no report should be made;
b) 20 minutes or more, but less than 45 minutes, the delay should be reported as:
   1) DELAY 20 MINUTES; or
   2) DELAY 20 MINUTES OR MORE;
c) 45 minutes or more, the delay should be given as:
   1) DELAY 45 MINUTES; or
   2) DELAY 45 MINUTES OR MORE.

3.3.3 Where precise delay times are available they may be given, otherwise the method described above should be adhered to.

3.3.4 When available, a trend should be attached to the delay report, indicating whether the delay is increasing or decreasing, e.g. DELAY 45 MINUTES, DECREASING RAPIDLY.

3.4 Item 4: Surface wind direction and speed; if appropriate, maximum wind speed

Guidance on this item should be derived from Annex 3, 4.5. The information should be that contained in the report disseminated beyond the aerodrome (Annex 3, 4.5.5 a) and 4.5.8 refer).

3.5 Item 5: Visibility and, when applicable, RVR

Observing and reporting of visibility and RVR are governed by the relevant ICAO provisions in Annex 3, 4.6 and 4.7. The criteria applicable to reports disseminated beyond the aerodrome should be used as given in 4.7.14; specifically that with regard to RVR, only the value representative of the touch-down zone should be given and no indication of location on the runway should be included. When there is more than one runway in use and there are significant differences in RVR between those runways, values for more than one runway should be included in accordance with agreement between the meteorological authorities and the operators concerned and the runways to which the values refer should be indicated in the form “RWY 26 RVR 500 M RWY 20 RVR 800 M’’ (4.7.14 refers).

3.6 Item 6: Present weather

Guidance on observing and reporting of present weather is given in Annex 3, 4.8.

3.7 Item 7: Clouds below 1 500 m (5 000 ft), or below the highest minimum sector altitude, whichever is greater; cumulonimbus; if the sky is obscured, vertical visibility when available

Guidance on observing and reporting of cloud is given in Annex 3, 4.9.

3.8 Item 8: Aerodrome forecast

Annex 3, Chapter 6, 6.2 provides guidance on the preparation and use of aerodrome forecasts.
Appendix D
Contents of the ATIS Message

1. INTRODUCTION

1.1 The automatic terminal information service (ATIS) message is intended to provide the pilot with the complete range of information about an aerodrome necessary to allow him to make a definite decision about his approach and landing or his take-off.

1.2 The ATIS message is transmitted in the form of a broadcast at those aerodromes where, due to traffic density, there is a requirement for a reduction in communication load on the ATS VHF air-ground channels and thus a consequent reduction on the workload of controllers. However, there are times when it is also suitable for controllers to provide for individual direct transmission to pilots when the use of a broadcast is not warranted.

1.3 Where ATIS broadcasting is used, the ATIS message may be combined into one broadcast, serving both arriving and departing traffic or, where required by circumstances, it may be split into one addressed specifically to arriving and one addressed to departing traffic. In the latter case, the contents of the respective ATIS messages need to be adjusted accordingly (see 4).

2. CONTENTS OF THE ATIS MESSAGE

ATIS messages should contain all or part of the following elements of information in the order listed:

a) name of aerodrome;
b) designator;
c) time of observation, if appropriate;
d) type of approach to be expected;
e) the runway(s) in use; status of arresting system constituting a potential hazard, if any;
f) significant runway surface conditions, and if appropriate, braking action;
g) holding delay, if appropriate;
h) transition level, if applicable;
i) other essential operational information, if appropriate;
j) surface wind direction and speed, including significant variations;
k) visibility and, when applicable, RVR;
l) present weather;
m) cloud below 1 500 m (5 000 ft) or below the highest minimum sector altitude, whichever is greater; cumulonimbus; if the sky is obscured, vertical visibility when available;
n) air temperature;
o) dew point temperature;
p) altimeter setting(s);
q) any available information on significant meteorological phenomena in the approach, take-off and climb-out areas;
r) trend-type landing forecast, when available;
s) specific ATIS instructions.

3. DETAILS OF THE CONTENTS OF EACH ITEM IN THE ATIS MESSAGE

3.1 Item 1: Name of aerodrome

The name of the aerodrome should be the official name published in the AIP. When only one aerodrome is associated with a town or island, the name should only be that of the town or island. When the broadcast is made in the English language, the English version of the name, as generally understood, should be used, e.g. AMSTERDAM, MILAN-LINATE, MILAN-MALPENSA.

3.2 Item 2: Designator

Following the name of the aerodrome each ATIS message should commence with one of the following terms as appropriate, e.g. INFORMATION, ARRIVAL INFORMATION, DEPARTURE INFORMATION; followed by the specific letter of the ICAO radiotelephony spelling alphabet used sequentially, e.g. for combined arrival/departure ATIS — INFORMATION ALPHA; for arrival ATIS — ARRIVAL INFORMATION ALPHA; for departure ATIS — DEPARTURE INFORMATION ALPHA.
3.3 Item 3: Time of observation

The time of observation given should be the time in Co-ordinated Universal Time (UTC) included in the routine report or selected special report (MET report). The other items in the OFIS message, not covered by the MET report, should have the same time of applicability, or as close as is feasible to the time of the MET report. Where the time of observation of operations items is significantly different from that of the MET items, the time applicable to each group of items should be stated.

3.4 Item 4: Type of approach to be expected

Where a number of approach procedures are available to a runway, the one in use is to be advised, e.g. VHF omnidirectional radio range (VOR), distance measuring equipment (DME), APPROACH or ILS APPROACH.

3.5 Item 5: The runway(s) in use, status of arresting system constituting a potential hazard, if any

3.5.1 When different runways are used for landing and take-off, the landing runway(s) should be specified first followed by the significant runway surface conditions, and where appropriate, the braking action. This information should be followed by stating the runway(s) to be used for take-off and significant runway surface conditions, and if appropriate, the braking action.

3.5.2 The runway(s) should always be referred to by using the designator established in conformity with Annex 14, 5.2.2.4.

3.5.3 The runway(s) in use at the time of the observation should be given, e.g. RUNWAY 19; RUNWAY 09 LEFT; RUNWAY 25 LEFT AND 25 RIGHT; ARRIVALS RUNWAY 25 LEFT, DEPARTURES RUNWAY 25 RIGHT.

3.5.4 If it is expected that a change in runway is to take place during the period of validity of the broadcast, this change should be included in the item, e.g. RUNWAY 09 EXPECT 24 AFTER 1500.

3.5.5 When the runway in use is not a preferential runway, or the runway may be subject to a limiting crosswind, or the landing runway has degraded approach aids, the non-availability of the preferential runway(s) should be stated, together with the reason and expected duration of this situation, e.g. RUNWAY 34 IN USE; RUNWAY 23 CLOSED SNOW CLEARANCE UNTIL 1930.

3.5.6 Where an arresting system constitutes a potential hazard on the runway, information should be provided accordingly.

3.6 Item 6: Significant runway surface conditions

3.6.1 The significant runway surface conditions affecting braking action should be briefly described to both arrival and departure runways, as appropriate, using terms such as the following, e.g.

(Contaminant) PATCHES COMPACTED SNOW
(Contaminant) COVERED DE-ICED
WET SANDING DRIFTING SAND
FLOODED RUBBER DEPOSITS
FROZEN RUTS OR RIDGES

3.6.1.1 The contaminants shall consist of one of the following:

RIME or FROST DRY SNOW
ICE WET SNOW
SLUSH WATER

3.6.2 Where appropriate and feasible the depth of the runway contaminant should be given, measured in millimetres.

3.6.3 If runway available dimensions are less than those published the length and width of the cleared area on the runway should be given.

3.6.4 The braking action shall consist of the abbreviation "BA" followed by one of the following:

a) braking action coefficient for each third of the runway and the type of measuring equipment used;

b) estimated braking action for each third of the runway;

c) the abbreviation "UNREL" (unreliable).

3.6.4.1 The braking action coefficient shall consist of a six digit group, two digits for each third of the runway, representing the coefficient without the decimal point.

3.6.4.2 The estimated braking action shall consist of a three digit group, one digit for each third of the runway.
### Part I.— Planning factors

Section 2, Chapter 2.— Types of service

#### Coefficient Estimate Description

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Estimate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 and above</td>
<td>5</td>
<td>good</td>
</tr>
<tr>
<td>39 to 36</td>
<td>4</td>
<td>medium to good</td>
</tr>
<tr>
<td>35 to 30</td>
<td>3</td>
<td>medium</td>
</tr>
<tr>
<td>29 to 26</td>
<td>2</td>
<td>medium to poor</td>
</tr>
<tr>
<td>25 and below</td>
<td>1</td>
<td>poor</td>
</tr>
</tbody>
</table>

3.6.4.3 The type of measuring equipment used shall be one of the following:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DBV</td>
<td>Diagonal Braked Vehicle</td>
</tr>
<tr>
<td>JBD</td>
<td>James Brake Decelerometer</td>
</tr>
<tr>
<td>MUM</td>
<td>Mu-meter</td>
</tr>
<tr>
<td>SFT</td>
<td>Friction Tester</td>
</tr>
<tr>
<td>SKH</td>
<td>Skiddometer (high pressure tire)</td>
</tr>
<tr>
<td>SKL</td>
<td>Skiddometer (low pressure tire)</td>
</tr>
<tr>
<td>TAP</td>
<td>Tapley meter</td>
</tr>
<tr>
<td>OTH</td>
<td>Other equipment</td>
</tr>
</tbody>
</table>

### 3.7 Item 7: Holding delay

3.7.1 Holding delay for the purpose of ATIS broadcast messages is understood to be the total holding time at or immediately prior to the initial approach to the destination aerodrome, i.e. holding in specified areas over the outer fix(es) and/or over the main navigation aid(s) serving the aerodrome of intended landing, as estimated by ATC.

3.7.2 The information about delays should be based on the actual delays being experienced at the time of the observation and may include an element of forecasting.

3.7.3 The following method is therefore recommended when the arrival delay is:

a) less than 20 minutes, normally no report should be made except when more precise information is possible;
b) 20 minutes or more, delay should be reported in 10-minute intervals, e.g. DELAY 20 MINUTES; DELAY 30 MINUTES.

3.7.4 When available, a trend should be attached to the delay report, indicating whether the delay is increasing or decreasing, e.g. DELAY 40 MINUTES, DECREASING RAPIDLY.

3.7.5 Information on precise holding delay should be given by ATC through directed transmission in the form of expected approach time in accordance with procedures as laid down in the PANS-RAC, Part IV, 12.1.

### 3.8 Item 8: Transition level

If the transition level is variable, or if it differs from the published level, it should be included.

### 3.9 Item 9: Other essential operational information, if appropriate

Pertinent operational information should be included.

### 3.10 Item 10: Surface wind direction and speed

Guidance on reporting surface wind direction and speed should be derived from Annex 3, 4.5. The information should be that contained in the reports used at the aerodrome of origination, i.e. 4.5.5 a) and 4.5.8 of Annex 3 are not applicable.

### 3.11 Item 11: Visibility and, when applicable, RVR

Guidance on this item is contained in Annex 3, 4.6 and 4.7. The information should be that contained in the reports used at the aerodrome of origin, i.e. the last sentence of 4.6.2 and 4.7.14 of Annex 3 are not applicable.

### 3.12 Item 12: Present weather

Guidance on observing and reporting of present weather is given in Annex 3, 4.8.

### 3.13 Item 13: Clouds below 1 500 m (5 000 ft)

Guidance on observing and reporting of cloud is given in Annex 3, 4.9.

### 3.14 Item 14: Air temperature

The air temperature should be air temperature representative of the runway(s). Relevant guidance material as contained in Annex 3, 4.10.

### 3.15 Item 15: Dew point temperature

Guidance on observing and reporting dew point is given in Annex 3, 4.10.
3.16 Item 16: Altimeter setting(s)

QNH value should always be given and, if locally agreed, the QFE value may be added.

3.17 Item 17: Any available information on significant meteorological information in the approach, take-off and climb-out areas

3.17.1 Available information on meteorological conditions in the approach, missed approach or climb-out area relating to the location of cumulonimbus or thunderstorm, moderate or severe turbulence, hail, severe line squall, moderate or severe icing, freezing rain, marked mountain waves, sand storm, dust storm, blowing snow, tornado or waterspout, as well as any information on fog dispersal operations in progress should be included.

3.17.2 In addition any information on wind shear along the flight path and on marked temperature inversion should be given.

3.18 Item 18: Trend-type landing forecast

The description and procedures applicable to the preparation of trend-type landing forecasts are indicated in Annex 3, 6.3.4 to 6.3.12. Aerodromes originating this type of forecast are listed in Table MET 1 of the regional air navigation plan.

3.19 Item 19: Specific ATIS instructions

Instructions should be given to the pilot to acknowledge receipt of the ATIS message upon initial contact with the appropriate control agency using the phonetic alphabetic code given in the ATIS broadcast. Special communication instructions may be added.

4. COMPOSITION OF SPECIFIC ATIS MESSAGES

Paragraph 2 specifies the various items to be included in an ATIS message, while 3 gives the details of the contents of each of these items. It is, however, specified that, depending on circumstances, ATIS can be provided either as a combined arrival/departure ATIS message, or that it can be split into an arrival and a departure ATIS message. The following table shows, therefore, which items, as described in 2 and 3, should be included in each of these three possible ATIS messages:

<table>
<thead>
<tr>
<th>Item</th>
<th>Combined ARR/DEP</th>
<th>ARR only</th>
<th>DEP only</th>
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<tr>
<td>1</td>
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<tr>
<td>19</td>
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<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

1. Related to the approach area only.
2. Related to the take-off and climb-out area only.
INTRODUCTION

Traffic information broadcasts by aircraft are intended to permit reports and relevant supplementary information of an advisory nature to be transmitted by pilots on a designated VHF radio telephone (RTF) frequency for the information of pilots of other aircraft in the vicinity.

TRAFFIC INFORMATION BROADCASTS BY AIRCRAFT (TIBA)

1. INTRODUCTION AND APPLICABILITY OF BROADCASTS

1.1 TIBAs should be introduced only when necessary and as a temporary measure.

1.2 The broadcast procedures should be applied in designated airspaces where:

a) there is a need to supplement collision hazard information provided by air traffic services outside controlled airspace; or

b) there is a temporary disruption of normal air traffic services.

1.3 Such airspaces should be identified by the States responsible for provision of air traffic services within these airspaces, if necessary with the assistance of the appropriate ICAO regional office(s), and duly promulgated in aeronautical information publications or NOTAMs, together with the VHF RTF frequency, the message formats and the procedures to be used. Where, in the case of 1.2 a) above, more than one State is involved, the airspace should be designated on the basis of regional air navigation agreement and promulgated in Regional Supplementary Procedures (Doc 7030).

1.4 When establishing a designated airspace, dates for the review of its applicability at intervals not exceeding 12 months should be agreed by the appropriate ATS authority(ies).

2. DETAILS OF BROADCASTS

2.1 VHF RTF frequency to be used

2.1.1 The VHF RTF frequency to be used should be determined and promulgated on a regional basis. However, in the case of temporary disruption occurring in controlled airspace, the States responsible may promulgate, as the VHF RTF frequency to be used within the limits of that airspace, a frequency used normally for the provision of air traffic control service within that airspace.

2.1.2 Where VHF is used for air-ground communications with ATS and an aircraft has only two serviceable VHF sets, one should be tuned to the appropriate ATS frequency and the other to the TIBA frequency.

2.2 Listening watch

2.2.1 A listening watch should be maintained on the TIBA frequency 10 minutes before entering the designated airspace until leaving this airspace. For an aircraft taking off from an aerodrome located within the lateral limits of the designated airspace listening watch should start as soon as appropriate after take-off and be maintained until leaving the airspace.

2.3 Time of broadcasts

2.3.1 A broadcast should be made:

a) 10 minutes before entering the designated airspace or, for a pilot taking off from an aerodrome located within the lateral limits of the designated airspace, as soon as appropriate after take-off;

b) 10 minutes prior to crossing a reporting point;

c) 10 minutes prior to crossing or joining an ATS route;

d) at 20-minute intervals between distant reporting points;

e) 2 to 5 minutes, where possible, before a change in flight level;

f) at the time of a change in flight level; and

g) at any other time considered necessary by the pilot.
2.4 Forms of broadcast

2.4.1 The broadcasts other than those indicating changes in flight level, i.e., the broadcasts referred to in 2.3.1 a), b), c), d) and g), should be in the following form:

- **ALL STATIONS** (necessary to identify a traffic formation broadcast)
- (call sign)
- **FLIGHT LEVEL** (number) (or CLIMBING* TO FLIGHT LEVEL (number))
- (direction)
- (ATS route) (or DIRECT FROM (position) TO (position))
- **POSITION** (position**) AT (time)
- ESTIMATING (next reporting point, or the point of crossing or joining a designated ATS route) AT (time)
- (call sign)
- **FLIGHT LEVEL** (number)
- (direction)

*For the broadcast referred to in 2.3.1 a) in the case of an aircraft taking off from an aerodrome located within the lateral limits of the designated airspace.

**For broadcasts made when the aircraft is not near an ATS significant point, the position should be given as accurately as possible and in any case to the nearest 30 minutes of latitude and longitude.

Fictitious example:

"ALL STATIONS WINDAR 671 FLIGHT LEVEL 350 NORTHWEST BOUND DIRECT FROM PUNTA SAGA TO PAMPA POSITION 5040 SOUTH 2010 EAST AT 2358 ESTIMATING CROSSING ROUTE LIMA THREE ONE AT 4930 SOUTH 1920 EAST AT 0012 WINDAR 671 FLIGHT LEVEL 350 NORTHWEST BOUND OUT"

2.4.2 Before a change in flight level, the broadcast (referred to in 2.3.1 e)) should be in the following form:

- **ALL STATIONS**
- (call sign)
- (direction)
- (ATS route) (or DIRECT FROM (position) TO (position))
- LEAVING FLIGHT LEVEL (number) NOW FOR FLIGHT LEVEL (number)

2.4.3 Except as provided in 2.4.4, the broadcast at the time of a change in flight level (referred to in 2.3.1 f)) should be in the following form:

- **ALL STATIONS**
- (call sign)
- (direction)
- (ATS route) (or DIRECT FROM (position) TO (position))
- LEAVING FLIGHT LEVEL (number) NOW FOR FLIGHT LEVEL (number)

followed by:

- **ALL STATIONS**
- (call sign)
- MAINTAINING FLIGHT LEVEL (number)

2.4.4 Broadcasts reporting a temporary flight level change to avoid an imminent collision risk should be in the following form:

- **ALL STATIONS**
- (call sign)
- LEAVING FLIGHT LEVEL (number) NOW FOR FLIGHT LEVEL (number)

followed as soon as practicable by:

- **ALL STATIONS**
- (call sign)
- RETURNING TO FLIGHT LEVEL (number) NOW

2.5 Acknowledgement of the broadcasts

2.5.1 The broadcasts should not be acknowledged unless a potential collision risk is perceived.

3. RELATED OPERATING PROCEDURES

3.1 Changes of cruising level

3.1.1 Cruising level changes should not be made within the designated airspace, unless considered necessary by pilots to avoid traffic conflicts, for weather avoidance or for other valid operational reasons.
3.1.2 When cruising level changes are unavoidable, all available aircraft lighting which would improve the visual detection of the aircraft should be displayed while changing levels.

3.2 Collision avoidance

3.2.1 If, on receipt of a traffic information broadcast from another aircraft, a pilot decides that immediate action is necessary to avoid an imminent collision risk to his aircraft, and this cannot be achieved in accordance with the right-of-way provisions of Annex 2, he should:

a) unless an alternative manoeuvre appears more appropriate, immediately descend 1,000 ft if above FL 290, or 500 ft if at or below FL 290;

b) display all available aircraft lighting which would improve the visual detection of the aircraft;

c) as soon as possible, reply to the broadcast advising action being taken;

d) notify the action taken on the appropriate ATS frequency; and

e) as soon as practicable, resume normal flight level, notifying the action on the appropriate ATS frequency.

3.3 Normal position reporting procedures

3.3.1 Normal position reporting procedures should be continued at all times, regardless of any action taken to initiate or acknowledge a traffic information broadcast.
Chapter 3
Airspace Organization

3.1 INTRODUCTION

3.1.1 Ideally, the organization of the airspace over a given area should be arranged so that it corresponds to operational and technical considerations only. This is a concept which, in view of the many divergent and sometimes contradicting demands made on its use can, however, never be achieved other than by approximation of a more or less satisfactory nature. It is therefore believed to be more useful, if a number of principles were listed here which, when judiciously applied, should permit an acceptable compromise to be reached in this field of airspace organization.

3.1.2 In planning the organization of the airspace, the first point to be made is that none of those laying claim to its use should attempt to exploit his advantages because he finds himself momentarily in a position of strength (be it political or numerical) when compared with that of other parties. Experience has shown that, over a longer period, such positions tend to change with the effect that, when they do, others will then exploit their temporary advantages, thus setting the stage for a course of events which, in the long run, is damaging to all parties concerned and to the air traffic services (ATS) system of the States concerned.

3.1.3 The second point, following directly from the first, is that any airspace organization must provide for an equitable sharing of its use by all those having a legitimate interest in it. In this respect, it has been found that, to resort to segregation of the airspace, i.e. its splitting and subsequent systematic allocation to the exclusive use by a specific party, generally results in the least efficient over-all use of the available airspace as it invariably leads to a sterilization of large portions of the airspace for prolonged periods of time. The objective should therefore be to organize the airspace so that it can be used in the most flexible way, through co-ordinated, or better yet, combined use by as many parties as possible. This applies particularly with respect to the two major groups of users, i.e. the civil and military (see also Part I, Section 2, Chapter 1, 1.1.4 and Part II, Section 1, Chapter 2).

3.1.4 A third point to be borne in mind in this respect is that, because of the international character of many aircraft operations, the organization of the airspace over one State can hardly be looked at in isolation but must, by necessity, be seen as an integral part of a much wider system covering, in general, not less than an ICAO region. It is therefore essential that States co-ordinate any modifications to airspace organizations at the required level.

3.2 DESIGNATION AND ESTABLISHMENT OF SPECIFIC PORTIONS OF THE AIRSPACE

3.2.1 The relevant provisions in Annex 11, 2.5 specify that, once it has been decided that ATS are to be provided, the airspace, wherein such services are rendered, should be designated by the following terms:

a) flight information region (FIR);

b) control area (CTA);

c) control zone.

In addition, aerodromes where air traffic control (ATC) is provided, should be designated as controlled aerodromes.

3.2.2 FIRs normally encompass the entire airspace over the territory of a State. Adjacent FIRs should be contiguous and, if possible, be delineated so that operational considerations regarding the route structure encompassed by them take precedence over their alignment along national borders (see also Part I, Section 2, Chapter 1, 1.3). The decision to establish more than one FIR to cover the airspace over a State is, for obvious reasons, not only primarily dependent on the size of the State concerned but also dependent on the air route structure extending over the State, its topography and, last but not least, cost-effectiveness considerations and the need to keep facility management problems of the ATS units providing services in them to manageable proportions.

3.2.3 With regard to the delineation of FIR boundaries over the high seas, these will, in any case, be subject to
regional air navigation agreement and should be based on the existing and expected air route structure as well as on the ability of selected provider States to furnish the required services without undue efforts.

3.2.4 CTAs should be established so that they cover that airspace which will encompass the flight paths of those instrument flight rules (IFR) flights within an FIR to which it is believed necessary to provide ATC. When deciding whether or not ATC should be provided, the following should, among other factors, be taken into account:

a) the desire of operators of flights concerned to obtain that service;

b) the types and density of air traffic at any moment or during specific periods and the resulting risk of possible collisions between flights;

c) the prevailing meteorological conditions;

d) other relevant factors of a local nature, i.e. the general topography; hospitality of the area overflown, etc.

3.2.5 ATC service may be suspended under the following conditions:

a) when traffic density and/or complexity along certain routes followed by aircraft decreases below the critical point; or

b) when traffic density and/or complexity, on which the requirement for ATC is based, is limited to definable periods of time.

3.2.6 CTAs can be formed by:

a) terminal control areas (TMAs) of sufficient size to contain the controlled traffic around the busier aerodromes;

b) interconnecting airways of:

1) a lateral extent determined by the accuracy of track-keeping of aircraft operating on them, as well as the navigation means available to aircraft and their capability to exploit them;

2) a vertical extent covering all levels required to be provided with control service;

c) area-type control areas within which specific ATS routes have been defined for the purpose of flight planning and which provide for the organization of an orderly traffic flow;

d) in the case of oceanic airspace, control areas may be achieved by the establishment of one or more route structures serving specific traffic flows; or if the complexity of oceanic ATS routes so warrants, by the establishment of an area type oceanic control area.

3.2.7 Control area arrangements have the advantage that, whenever traffic conditions permit, ATC may authorize specific flights under its control to deviate from the established ATS routes or route structure, normally in order to follow a more direct flight path between specified points along its route, without aircraft leaving controlled airspace and thus losing the benefit of ATC.

3.2.8 In certain areas, it could also be desirable to divide FIRs and CTAs so that an upper and a lower airspace is provided along a vertical plane. When this is done, an FIR and/or CTA in the upper airspace may laterally encompass the areas of more than one lower FIR or CTA. However, the lateral limit of such an upper FIR or CTA should, in any case, coincide with the corresponding peripheral lateral limits of the underlying FIRs or CTAs encompassed by the upper FIR/CTA, in order to retain the necessary compatibility in the transfer of responsibility for aircraft between adjacent ATS units in the lower and in the upper airspace (see Appendix A, Figure A-6).

3.2.9 The reasons for the vertical division of airspace as described above can be two-fold:

a) either to split the workload of ATS so that the workload imposed on one ATS unit remains within manageable proportions, both as to its area of responsibility and the amount of traffic it is required to handle; or

b) to apply to air traffic operating in the upper airspace, operating conditions which are different from those applied in the lower airspace and which are motivated by operating parameters which are peculiar to traffic operating in that airspace (e.g. prohibition to operate in accordance with visual flight rules (VFR), use of the area-type control versus the airway type, etc.); or

c) a combination of a) and b) above.

In any case, if such a vertical split is made, it should be ensured that the plane of division, chosen for the reasons under a) above, is not different from that chosen for the reasons given in b) above because it will complicate procedures for pilots as well as for controllers. Furthermore, the plane of division chosen by one State should be carefully co-ordinated with adjacent States in order to avoid transition and co-ordination difficulties at the transfer points. Whenever possible, such a plane should be established uniformly over the largest possible area and the borderlines between different planes of division, if these must exist, should be placed where they have the least detrimental effect on pilots and ATC.

3.2.10 Further to what has already been said (Part I, Section 2, Chapter 1, 1.5.5 and 1.5.6) with respect to control zones and aerodrome traffic zones, it appears
sufficient to stress once more that control zones should be kept as small as possible, consistent with the need to accommodate the flight paths of controlled IFR flights between the lower limits of a CTA and the aerodrome for which the control zone is established. In addition, their size may also be influenced by the need to permit special VFR operations around the aerodrome in question. As to aerodrome traffic zones, these should only be established where the activities requiring their establishment are of sufficiently frequent duration and involve a reasonably large number of aircraft.

3.2.11 From the nature of the air traffic advisory service, as described in Part I, Section 2, Chapter 2, 2.7, it follows that the establishment of advisory airspace should be governed by what has been said for the establishment of CTAs and control zones as to their extent and configuration. In fact, such airspace should be considered as the precursor of controlled airspace during that period when air traffic advisory service is provided in anticipation of full ATC.

3.3 AIRSPACE RESTRICTIONS AND RESERVATIONS

3.3.1 General

3.3.1.1 Since the demands on the use of airspace are manifold, some of which are not compatible with civil aviation (e.g. rocket firing) and because there exist sensitive areas on the ground which need protection from possible disturbance by overflying aircraft, it is recognized that there will be a need for States to establish airspace restrictions of varying degrees of severity. In addition, there are aerial activities by specific users or user groups which may require the reservation of portions of the airspace for their exclusive use for determined periods of time.

3.3.1.2 Whenever such restrictions and/or reservations have to be imposed, they invariably constitute a limitation to the free and unhampered use of that airspace with the associated restrictive effects on flight operations. It is therefore evident that the scope and duration of restrictions established should be subject to very stringent scrutiny in order to keep undesirable effects to the minimum consistent with the reasons causing their creation. To achieve this, it will be essential to create appropriate methods or organizations, in which all users and providers are adequately represented, for screening requests for airspace restrictions or reservations.

3.3.1.3 Such methods or organizations should:

- a) ensure that the activities leading to the request for the establishment of an airspace restriction or reservation are in fact valid and justify such action;
- b) determine the minimum needs, in terms of space and time and the conditions of use, required to confine the activities so that potential hazards and disruptions to other users of the airspace are minimized or avoided;
- c) keep established airspace restrictions and/or reservations under frequent review in order to determine whether they are still required or may be abandoned when their need has ceased to exist, or whether modification in the light of changed requirements may be necessary.

3.3.1.4 With respect to a) above, one important aspect is the determination of how a request can best be met with the least interference to other users of the airspace. In many cases, experience has shown that requests have led to restrictions of the airspace when in fact the same purpose could have been achieved by an airspace reservation. If appropriate co-ordination had been effected between all parties concerned, granting an airspace reservation versus an airspace restriction would have resulted in significantly less detrimental effects on other users of the airspace in question.

3.3.2 Types of restrictions

3.3.2.1 Airspace restrictions can take the following form:

- a) danger area; or
- b) restricted area; or
- c) prohibited area.

3.3.2.2 According to their definitions, a danger area implies the least degree of restriction, while the prohibited area constitutes its most stringent form. It should also be noted, however, that this definition is applied only with respect to airspace which is situated over the territory of a State. In areas where no sovereign rights are exercised (e.g. over the high seas) only danger areas may be established by that body responsible for the activities causing their establishment.

3.3.2.3 The establishment of a danger area by a State over its territory is justified when the activity in that area is of such a nature that the risk involved requires non-participating aircraft to be aware of the risk. Since, in all cases, it is mandatory that the reason causing the establishment of an airspace restriction be given in its publication, it remains then at the discretion of the pilot to decide
whether or not he can face the risk with a reasonable degree of certainty that it will not have serious consequences for his flight.

3.3.2.4 Over the high seas, regardless of the risk involved, only danger areas can be established. Those who initiate danger area restrictions over the high seas are under an increased moral obligation to judge whether establishment of the danger area is unavoidable and if it is, to give full details on the intended activities therein. It would also appear that activities exceeding a certain risk level should not be conducted in such airspace and that other methods of achieving the desired objective, such as temporary airspace reservations, should be applied.

3.3.2.5 Restricted areas are generally established when the risk level involved in the activities conducted within the area is such that it can no longer be left to the discretion of individual pilots whether or not they want to expose themselves to such risk. In many cases the activities within a restricted area are not permanently present, it is therefore of particular importance that the times when these areas are actually required be closely surveyed and monitored.

3.3.2.6 The establishment of prohibited areas should be subject to particularly stringent requirements because the use of that portion of the airspace encompassed by the prohibited area is completely forbidden to aircraft. It has therefore become general practice to establish such areas only to protect important State installations, critical industrial complexes whose damage as a result of an aircraft accident could assume catastrophic proportions (atomic power plants, sensitive chemical complexes) or especially sensitive installations which are essential for the national security.

3.3.3 Airspace reservations

3.3.3.1 It is generally accepted practice that airspace reservations should only be applied during limited periods of time and should be abolished as soon as the activity having caused their establishment ceases. In addition, establishment of airspace reservations is governed much more by ATS considerations than is the case with airspace restrictions. In fact, airspace reservations should be coordinated primarily with the ATS units directly concerned because they will be in the best position to propose and develop the procedural means required to put the reservation into effect.

3.3.3.2 In general, there exist two types of airspace reservations — namely, those which are established in a fixed relation to defined areas on the surface of the earth and those which are "mobile" because they follow activities which move in relation to the surface. Fixed airspace reservations generally cover specific flying or other events which are restricted to a specific area (military exercises, flying displays, etc.) while mobile airspace reservations are used to cover activities such as aerial refuelling, en-route mass formation flights, etc. For both types of reservations it is, however, essential that, depending on the activities conducted therein, adequate buffer areas be established around the reserved areas in order to ensure that ATS can provide an adequate margin of safety between non-participating aircraft and the activity concerned.

3.3.3.3 While it is recognized that there may exist legitimate reasons for establishment of airspace reservations, experience also seems to indicate that, once established, their existence is maintained long after the conditions having caused their creation have ceased to exist. It is therefore important that such airspaces be critically reviewed by States, especially with regard to maintaining a reasonable balance between the purpose to be achieved by their creation and the appreciable additional workload and interference they impose on flight crews in the conduct of their flight.

3.3.4 Special designated airspace

In a number of cases, States have found it necessary to establish special portions of designated airspace where aircraft, when operating therein, are required to comply with procedures additional to those resulting from normal provision of ATS (mainly special identification and/or reporting procedures). Such areas are designated by a variety of names, i.e. Air Defence Identification Zone (ADIZ) being one of the more common ones, but they all have in common the understanding that non-compliance by aircraft with the imposed provisions generally result in prompt retaliatory action (interception, forced landing, etc.).
1. When the provision of ATC service to IFR flights is limited to traffic arriving at and departing from an aerodrome used in instrument meteorological conditions (IMC), a control zone encompassing the flight path of the IFR traffic to be protected must be established. Since a control zone extends upwards from the surface of the earth and the provision of control therein will of necessity entail the imposition of certain restrictions on VFR flights operating within the control zone, it is essential that its lateral extent be kept to the minimum. However, in accordance with Annex 11, 2.7.5.2, the lateral limits of the control zone should not be less than 9.3 km (5 NM) from the centre of the aerodrome concerned, in the directions from which approaches may be made.

2. To keep the lateral limits of a control zone to a minimum, thereby enabling the maximum number of VFR operations to be conducted outside it, the control zone is invariably supplemented by additional controlled airspace normally in the form of a terminal control area (TMA), the lower limit of which, as may be noted in Annex 11, 2.7.3.2, must be established at a height of not less than 200 m (700 ft) above the ground or water.

3. Figure A-1 illustrates a simple combination of a control zone and a TMA which should be used unless problems due to the proximity of other controlled airspaces or obstructions dictate otherwise.

4. Where it appears desirable to increase the airspace within which special VFR flights may be authorized, the control zone may be extended upward so as to protrude into the TMA up to a specified limit.

5. When meteorological conditions do not permit a VFR flight to be conducted in a TMA or control zone, such flight may, within the meteorological conditions prescribed in Annex 2 — Rules of the Air, be operated below the TMA or, subject to special ATC authorization into, within or out of the control zone.
1. Figure A-2 is similar to Figure A-1 except that the lateral limits of the control zone are not shown circular in shape but are extended to at least 9.3 km (5 NM) only in the direction of approach when circumstances preclude its extension to that distance in all directions.
1. Where two (or more) control zones are located close together and it is operationally undesirable to supplement each with a separate TMA, the control zones should be supplemented by one common TMA.

2. Figure A-3 shows a combination of two control zones and one TMA centred half-way between them. The TMA can, however, take any other shape as long as it encompasses the airspace required by IFR flights to be protected, always bearing in mind that it should also permit VFR operations conducted outside its limits and not bound for aerodromes which it serves.
1. Figure A-4 depicts a typical organization of airspace into control zones and control areas of specific types (i.e., TMAs and airways) to meet the minimum requirements of IFR traffic during en-route, approach and departure phases of flight. As indicated, the TMA together with the airways extending therefrom, forms one homogeneous control area.

2. It is to be noted that whereas the control zones in the centre of the diagram are shown supplemented by a TMA, the control zone at the left extremity of the diagram is shown supplemented by an airway because the establishment of a TMA is not always warranted.
Part I.—Planning factors
Section 2, Chapter 3.—Airspace organization

1. Figure A-5 depicts a similar organization of airspace as Figure A-4, except that the lower limit of the airways has been established at a relatively high level, to that of the TMA, in order to give more freedom for the operation of VFR flight below the airways. However, in this case it is necessary to complement the airways with TMAs in the vicinity of aerodromes used for IFR operations, in order that the size of the control zones may be kept to the minimum.
Chapter 4
ATS Routes

4.1 INTRODUCTION

4.1.1 Ideally, aircraft want to fly on the most direct route between their points of departure and their destination because the medium in which aircraft operate makes this possible, except when severe weather phenomena are encountered. However, because of the many conflicting demands made on the use of airspace by its many different users and because of environmental and security considerations, it is frequently not possible to fly the most direct route. Therefore it is necessary to find a reasonable compromise between this desirable objective and reality.

4.1.2 A further point is that, as soon as any degree of control is exercised over air traffic aircraft (and this applies to all types), it is inevitable that it must be channelled into a defined pattern whose extent and complexity must not exceed the intellectual and physical capabilities of the person or persons charged with controlling such traffic. Control must be possible with a mental and physical effort, as far as presentation, analysis and resolution of conflicts is concerned, which can be sustained over prolonged periods of time, since otherwise the continuity in control assured by one person is lost. It is therefore essential that the various individual intentions of those participants making up the traffic are presented in such a manner that they can be related to other, possibly conflicting intentions.

4.1.3 In short, large amounts of air traffic are generally only manageable if they follow pre-established patterns which are arranged not only to facilitate the detection of possible conflicting intentions at an early stage, but which also lend themselves to resolution of such conflicts. At the same time, these pre-established patterns must also provide for the retention of the most direct routes for the majority of air traffic, if they are not to conflict with the need for economy and efficiency of flight operations.

4.1.4 Experience gained in areas where large amounts of air traffic are handled has shown that the most satisfactory manner to meet the general considerations mentioned above is by way of an air traffic services (ATS) route network.

4.2 ESTABLISHMENT OF AN ATS ROUTE NETWORK

4.2.1 The establishment of an actual ATS route network follows, in most cases, an approximate pattern outlined below:

a) operators identify their actual and anticipated requirements for routes between those aerodromes which they use;

b) the sometimes widely diverging demands of individual operators are then consolidated into a reasonably coherent pattern of route requirements;

c) these requirements are then measured against other demands made on the airspace traversed by these routes (military areas, avoidance of overflying sensitive installations on the ground, etc.) and alternative proposals for the exact alignment of individual routes are developed;

d) these alternatives are then presented to and negotiated with the operators concerned until a reasonable compromise is achieved;

e) in the comparatively few cases where the offers which can be made to operators are found to be unacceptable, it should be agreed that the original requirement should be retained for further consideration by all parties concerned until such time as more favourable circumstances permit an alignment which comes reasonably close to that requested by operators.

4.2.2 Experience has shown that adoption of the method described above has generally produced satisfactory results, especially as regards meeting those demands by operators which could not be initially met.

4.2.3 The establishment of a detailed ATS route network can follow two distinct patterns depending on the composition of the air traffic it is intended to serve. In those cases where national operations constitute the bulk of the traffic which is to be accommodated, States should give priority to satisfying these needs. However, adequate arrangements should be made to meet the needs of international operations through appropriate trunk routes and
development of these trunk routes must be co-ordinated on at least a regional basis. Where international operations constitute the majority of the traffic, establishment of an ATS route network needs to be undertaken from the outset on at least a regional basis.

4.2.4 From this it follows that, to a lesser or greater extent, isolated action by States in developing an ATS route network is only possible with respect to ATS routes serving strictly national purposes since such action will, in most cases, have direct and noticeable effects on the traffic flow beyond the area of responsibility of the State concerned. There is evidence available showing that changes made to ATS routes in one limited area can affect air traffic for a considerable distance and traffic which never even intends to operate into the area where the change was made.

4.2.5 Taking the above into account, it would appear that the detailed establishment or review of individual ATS routes, forming the ATS route network, should proceed along the following lines:

a) first establish or review the main trunk routes, serving the major traffic flow within a given area as well as those extending beyond that area;
b) establish or review those routes required to provide access to these trunk routes from and to locations not directly served by them;
c) establish or review those supplementary routes required to accommodate secondary traffic flows or which are required to alleviate the traffic load on the major trunk routes;
d) establish or review those routes of a more local nature which are required to satisfy either specific national needs or those of a specific user group (e.g. helicopter routes, visual flight rules (VFR) routes, military low-level routes, night flying, etc.) and determine if these local routes need to be integrated into the over-all route network.

4.2.6 Once the route network has been established or reviewed in accordance with the above, the detailed ATS route network should be reviewed as a whole to evaluate its coherence. Changes to the network should be made only after they have been co-ordinated with all parties concerned.

4.2.7 The majority of the ATS routes so established will be permanently available; however, there will be cases:

a) when routes are required only for specific periods of the year (seasonal routes) in order to accommodate transit traffic during the holiday season; or
b) where specific routes can be made available only during weekends because they traverse areas which, during the week, are reserved for other activities; or
c) where routes whose use depends on special co-ordination procedures can only be effected on an ad hoc basis for the specific flights involved and depending on the circumstances as they prevail at that time.

4.2.8 Such non-permanent routes should also be included in the ATS route network, however with a clear indication of the limitations imposed on their use. Such an indication will then serve as a reminder that these routes should be reviewed at frequent intervals with a view to changing their status whenever the use made of them requires.

4.2.9 ATS routes over the high seas should be established only if traffic density warrants a channelling of air traffic in order to ensure its safety and only for such times when traffic density justifies their establishment. In addition, since flight operations over the high seas are more dependent on prevailing meteorological conditions (especially winds aloft) with respect to specific routing, and thus their economy, than is the case for shorter routes over land, it is essential that this be taken into account in the route alignment. Therefore, frequent adjustments should be made, either on a daily basis, as it is now done in the case of the North Atlantic route structure, or at such intervals as are required to take account of significant changes in the operating environment.

4.2.10 The status given to individual ATS routes, either as controlled ATS routes (generally in the form of airways) or as advisory routes or as uncontrolled routes, is primarily determined by the amount and type of traffic which is using the route as well as other relevant factors (see also Part I, Section 2, Chapter 3).

4.2.11 After the alignment and status of the ATS routes have been established or reviewed, it will be necessary to determine the use of flight levels on each of those routes which are to be established as controlled ATS routes. To this extent a series of flight levels are prescribed (normally “ODD” and “EVEN”) which should be used in relation to the direction of flight on the route concerned. The principles governing such arrangements of flight levels include the following considerations:

a) the majority of air traffic operating along a controlled ATS route or portion thereof, should, while in level flight, be permitted to remain at its assigned flight level without a need for changing levels simply because the orientation of the route in relation to compass direction changes;
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b) at intersections of more than two controlled ATS routes, the likelihood that aircraft, operating on any of these routes and approaching the intersection, find themselves at the same level is kept to a minimum, thus avoiding the need for systematic control interventions in order to restore adequate separation between them.

4.2.12 Experience has shown that, in the case of more complex ATS route networks (e.g. European (EUR) region) this latter objective can only be achieved if the assignment of flight levels on certain routes is reversed at certain points along the route, depending on the situation at different intersections affecting the route in question. In this case, it is important that a change in flight level be established at a location well away from a flight information region (FIR) or control area (CTA) boundary or a transfer of control point (if different from the boundary) or at such a location where traffic along the route is least dense, thus permitting the change in level without undue difficulties to either the aircraft or ATS.

4.2.13 On ATS routes carrying a particularly high load of traffic, it may be advisable to establish one-way routings for each direction of flight between the points determining the terminals of such routes. In this case consecutive flight levels may be used on each of the two one-way routes, except when this is not feasible for the reasons stated in 4.2.11 b) above.

4.2.14 The world-wide designation of ATS routes is governed, in general, by provisions contained in Annex 11, Appendix 1. There are, however, a number of aspects involved in this matter which need more detailed consideration. These are:

a) regard for flight planning and description of the route of flight required for air traffic control (ATC) clearances;
b) avoidance of unnecessary complications in the co-ordination involved in the assignment of designators;
c) taking into account the effects of the use of automation.

4.2.15 With respect to flight planning and ATC clearances, the system, used to assign designators to individual ATS routes within an ATS route network, should be arranged primarily so that the large number of repetitive air transport operations (scheduled and non-scheduled commercial flights, certain routine military operations) are able to indicate, in their flight planning, the route of flight with the least number of designators. Fewer designators also permit ATC to keep clearances short and concise and to clear such flights with the least amount of effort. In addition, different designators, which in air-ground communications could be mistaken for each other, should be assigned so that, even when they are misunderstood, the error becomes obvious immediately by the difference in location of their assignment. In this respect account should also be taken of differences in pronunciation by pilots with different mother tongues.

4.2.16 In order to avoid duplication of designators, it will be necessary to co-ordinate their assignment on at least a regional basis. It is essential that the method chosen for doing this is as simple as possible, does not require excessive co-ordination and is done with the assistance of the regional office of ICAO concerned. It must also provide for ample capacity to accommodate future requirements for designators without requiring a change of the system itself.

4.2.17 Finally, the assignment of designators should be made so that changes to individual designators are kept to a minimum. This consideration is particularly important in those cases where ATC units providing service along the routes in question are using automatic ATC equipment, primarily because experience has shown that modifications to the computer programmes introduce considerable delays in bringing the changed designators into effect (see also Part II, Section 2, Chapter 9).

4.3 ESTABLISHMENT OF SIGNIFICANT POINTS

4.3.1 Significant points along ATS routes and/or in terminal control areas (TMAs) are normally established at those geographical locations where an event in the conduct of a flight takes place which is either significant to the pilot or to ATS or to both, i.e. a change in the alignment of an ATS route or of a routing in a TMA, an intersection of the centre lines of two or more ATS routes, a transfer of control point, etc. In many cases such points are also marked by the site of a ground-based radio aid to navigation (see Chapter 5 below) or with reference to navigational guidance derived from one or more such aids (intersection of two radials from different VHF omnidirectional radio ranges (VORs) or a point on a VOR radial determined by its distance from that VOR by means of the associated distance measuring equipment (DME)). In other cases, such points are established by reference to geographical co-ordinates only and navigation to and from these points will be made by reference to area coverage-type navigation aids (e.g. OMEGA) or by the use of self-contained navigation means (e.g. inertial navigation system.
4.3.2 As already mentioned, significant points can be subdivided into four types according to the operational purpose they serve. They are:

a) those points which are of interest to the pilot only in the conduct of his navigation, i.e. a change in the alignment of a route, change-over between successive radio navigation aids, etc.;

b) those points which are of interest to both the pilot and ATS because they:

1) define the intentions of pilots as to the route of flight to be followed (in flight plans); or

2) permit ATS to provide proper service to aircraft (obtain position reports, begin or terminate service rendered to an aircraft); or

3) allow ATC to define changes to the route of flight when required by the over-all traffic situation (re-clearance of flights as to route and/or level between specified points, etc.);

c) those points which are of interest to both the pilot and ATS but only for limited periods of time and specific phases of flight. These points normally do not form part of the data exchanged between ATS units and are usually used only to define specific flight paths to be followed when ad hoc clearances are issued by ATC (e.g. points along routings in a TMA, points where an aircraft can expect to be cleared to change levels or where a clearance to conduct the flight in a specific manner begins, or ends);

d) those which are of interest to ATS only such as transfer of communication and/or control points, exit and entry points into specified portions of controlled airspace, etc. Generally, these points are established only for use between two adjacent ATC units. Information regarding the flight progress in relation to these points will be confined to the two units in question.

4.3.3 The designation of such points is covered, in general terms, in Annex 11, Appendix 2. Much of what has already been said above, in 4.2.3.8 to 4.2.3.11, on some of the supplementary aspects regarding the designation of ATS routes also applies to establishment of significant points. In fact, world-wide experience with the administration of designators for significant points not marked by the site of a radio navigation aid (name codes) seems to indicate that establishment of significant points should be reserved for those significant points mentioned in 4.3.2 b) above, while the designation of all other points, mentioned in 4.3.2 a) and c) should be kept to local or, if necessary, regional arrangements. This limitation in application to cases mentioned in 4.3.2 b) above appears possible in view of the fact that the original requirement stipulated for the uniqueness of such name codes on a world-wide scale no longer seems valid.

4.4 ROUTINGS IN TERMINAL CONTROL AREAS

4.4.1 In accordance with the relevant provisions in Annex 11, 3.7.1.2, standard departure (SID) and standard arrival (STAR) routes may be established, when required, to facilitate:

a) the maintenance of a safe, orderly and expeditious flow of air traffic;

b) the description of the route and procedures in ATC clearances.

4.4.2 From this it follows that such routings in TMAs will normally be required only at the busier aerodromes where the initial departure and/or arrival routing may be complex in view of the use made of runways and/or the variable relationship between the departure and arrival patterns used under different meteorological and/or traffic conditions.

4.4.3 Once the requirement for such routes has been determined it should be ensured that their alignment is such that flight along them does not require excessive navigational skill on the part of pilots nor should they put the aircraft into a state which approaches its minimum safe operation with regard to speed and/or changes of direction. Such considerations are essential because, when using these routes, pilots find themselves in a critical phase of their flight and the cockpit workload is already heavy after take-off or when preparing for a landing. Material relating to the establishment of standard departure and arrival routes and associated procedures is given in Appendix A to this chapter.

4.4.4 The need to take into account noise abatement at certain aerodromes has become an important issue. Appropriate SIDs and STARS should be reviewed in the context of special noise abatement procedures and/or manoeuvres to ensure that they are fully integrated and constitute a coherent operational entity serving both purposes. In addition, noise abatement procedures should not jeopardize the safe and efficient conduct of the aircraft flight phase in question.
4.4.5 The question of designation of SIDs and STARs is covered in Annex 11, Appendix 3. However, in selecting designators in accordance with these provisions, care must be taken to ensure that no confusion will arise in their practical use in voice communications because of close similarities between different designators. It may also be necessary to consider pronunciation problems caused by the fact that pilots with different mother tongues may pronounce designators differently in their voice communications with the ATC unit assigning a SID or STAR.
Appendix A

Material relating to the establishment of standard departure and arrival routes and associated procedures

1. General

1.1 Standard departure and arrival routes should:

a) segregate traffic operating along different routes, and such traffic from traffic in holding patterns;

b) provide for adequate terrain clearance (see PANS-OPS (Doc 8168), Volume II);

c) be compatible with established radiocommunication failure procedures;

d) take account of noise abatement procedures;

e) provide for the shortest practical tracks;

f) provide, to the extent possible, for uninterrupted climb or descent to operationally advantageous levels with a minimum of restrictions;

g) be compatible with the performance and navigation capabilities of aircraft;

h) if possible, be designed so as to derive maximum economic and operational benefit from high performance and advanced navigation capabilities of aircraft.

1.2 The routes should involve a minimum of air-ground radiocommunications and reduce as much as possible cockpit and ATC workload.

1.3 Standard departure and arrival routes should normally be completely contained within controlled airspace.

1.4 For routes requiring navigation with reference to ground-based radio navigation facilities, the following should apply:

a) they should relate to published facilities only;

b) the number of facilities should be kept to the minimum necessary for navigation along the route and for compliance with the procedure;

c) they should require navigational reference to no more than two facilities at the same time.

1.5 The routes should normally be designed for use by aircraft operating in accordance with IFR. Separate routes designed for use by controlled flights operating in accordance with VFR may be established.

1.6 The number of standard departure and arrival routes to be established at an aerodrome should be kept to a minimum.

2. Standard departure and arrival routes — instrument

2.1 Standard instrument departure routes should link the aerodrome or a specified runway of the aerodrome with a specified significant point at which the en-route phase of a flight along a designated ATS route can be commenced.

2.2 Standard instrument arrival routes should permit transition from the en-route phase to the approach phase by linking a significant point on an ATS route with a point near the aerodrome from which:

a) a published standard instrument approach procedure can be commenced; or

b) the final part of a published instrument approach procedure can be carried out; or

c) a visual approach to a non-instrument runway can be initiated; or

d) the aerodrome traffic circuit can be joined.

2.3 Each standard instrument departure and arrival route should be established and published as an integral route. Any deviation of a permanent nature should be published as a separate route.

2.4 Standard instrument departure and arrival routes should be designed so as to permit aircraft to navigate along the routes without radar vectoring. In high density terminal areas, where complex traffic flows prevail due to the number of aerodromes and runways, radar procedures may be used to vector aircraft to or from a significant point on a published standard departure or arrival route, provided that:
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2.5 The routes should identify the significant points where:

a) a departure route terminates or an arrival route begins;

b) the specified track changes;

c) any level or speed restrictions apply or no longer apply.

2.6 Where the route requires a specified track to be followed, adequate navigational guidance should be provided.

2.7 Significant points of standard instrument departure and arrival routes requiring navigation with reference to ground-based radio navigation facilities, particularly points where a change of track is specified, should, whenever possible, be established at positions marked by the site of a radio navigation facility, preferably a VHF aid. When this is not possible, the significant points should be established at positions defined by:

a) VOR/DME; or

b) VOR/DME and a VOR radial; or

c) intersections of VOR radials.

The use of NDB bearings should be kept to a minimum, and fan markers should not be used.

2.8 Significant points established at positions defined by VOR/DME should relate to a VOR/DME facility defining the track to be flown.

2.9 The radio navigation facility to be used for initial track guidance on a standard instrument departure route should be identifiable in the aircraft prior to take-off.

2.10 Taking into account that the period immediately after take-off is one of high cockpit workload, the first significant point of a standard instrument departure route which requires reference to a radio navigation facility should, if possible, be established at a distance of at least 2 NM from the end of the runway.

2.11 Level restrictions, if any, should be expressed in terms of minimum and/or maximum levels at which significant points are to be crossed.

2.12 The designation of significant points as reporting points (compulsory or on request) should be kept to a minimum.

2.13 Standard instrument departure and arrival routes should be established in consultation with the representatives of the users and other parties concerned.

3. Standard departure and arrival routes — visual

3.1 Visual departure routes should link the aerodrome or a specified runway of the aerodrome with a specified significant point at which the en-route phase of a flight can be commenced.

3.2 Visual arrival routes should link a specified significant point where the en-route phase of a flight is terminated with a point where the aerodrome traffic circuit can be joined.

3.3 Significant points defining visual routes should be established at geographical locations which can be readily identified by visual reference to prominent landmarks. The locations of radio navigation aids may also be used as significant points, if practical.
Chapter 5
Alignment of ATS Routes

5.1 INTRODUCTION

5.1.1 The alignment of air traffic services (ATS) routes and their integration into a coherent ATS route network, as discussed in Chapter 4 of this section, is largely determined by the demands made on the use of airspace by its different users. However, national security, environmental and other considerations also play a part in determining the alignment of ATS routes. There is therefore a need to ensure that routes so established can be followed by aircraft under all conditions and that for this reason, suitable navigational guidance defining the centre lines of each of the established routes needs to be provided.

5.1.2 For areas over land and for comparatively short routes, such navigation guidance should be provided by ground-based, point source navigation aids. ICAO has established a policy that, wherever possible, the aid chosen should be a VHF omni-directional radio range, supplemented by distance measuring equipment (DME) as required. In many cases, due to historical developments, non-directional radio beacons (NDB) are also in use, even though their operational performance offers distinct disadvantages when compared with that of the VHF omni-directional radio range (VOR) or VOR/DME (see Part III, Section 1, Chapters 2 and 3).

5.1.3 Navigational guidance required over the high seas is generally provided from two different sources:

a) ground-based long-range navigation systems providing an area-type coverage (LORAN-C, OMEGA, etc.);
b) self-contained navigation aids which are practically independent from externally derived navigation inputs (INS).

While it is unnecessary in this chapter to discuss the use of long-range or self-contained aids for navigation purposes, it will nevertheless be necessary to discuss their role in the establishment and alignment of ATS route network systems over the high seas and the separation upon which such systems are based.

5.1.4 The manner in which navigational guidance is obtained by pilots has one very significant effect on the definition of ATS routes, both over land and over the high seas. It concerns the width and the spacing between parallel, converging or diverging routes. The reason for this concern is that certain allowances must be made in respect of the navigation accuracy of aircraft, be it because of the accuracy inherent in the system or to account for pilot reaction time and/or the response characteristics and capabilities of aircraft to correct action in case of noticed deviations or, last but not least, to compensate for the effects of wind on the flight path of the aircraft.

5.1.5 In the case of point-source aids, it should also be noted that the accuracy of navigation which can be achieved by aircraft in the horizontal plane is directly proportional to their distance from the site of the aid in question, i.e. the greater the distance, the bigger the lateral displacement from the ideal line. It should be noted, however, that when this displacement is expressed in angular terms it is independent of the distance involved. In the case of area-type navigation systems, accuracy can be expressed in constant terms which apply throughout the systems area of use, except in those cases where certain local phenomena (surface and/or electrical conditions in the atmosphere) may influence the performance of the system in specified areas only. As to self-contained navigation systems, accuracy tends to deteriorate as a function of the length of time they are used — a condition which results in a cumulative error that grows fairly regularly until such time as it can be eliminated by updated navigational information obtained from external sources.

5.1.6 A further, relevant point of general concern is, that navigation aids supporting an ATS route network, and especially point-source aids, should be planned on a system-wide basis whereby each aid is used in an optimum manner. Since the ATS route network in many parts of the world requires planning on a larger than national scale (see Part I, Section 2, Chapter 4, 4.2) the same planning applies to the supporting navigation aids if duplication and/or waste of effort are to be avoided.
5.1.7 In addition, the system of navigation aids should provide flight crews with information to enable them to determine their position to maintain their planned or cleared track with the required accuracy and to effect corrections or changes needed to complete the flight.

5.1.8 The system of navigation aids should also meet a level of availability and performance reliability consistent with the requirement for safety and efficiency. In addition, the system should provide for reporting and transfer of control points commensurate with the justified needs of ATS units.

5.1.9 Account should also be taken of the fact that certain aircraft may be able to meet the navigation and ATS needs during their flight by reference to navigation aids other than those specifically provided for this purpose, i.e. INS instead of VOR/DME. This fact should be taken into account, provided the accuracy obtained by such alternative means is compatible with that obtained by using the primary means. Furthermore, within a given zone where specific groups of users have been authorized by the competent authorities to use special aids for navigation (e.g. tactical air navigation aid (TACAN)), the respective ground facilities should, if possible, be located and aligned so as to provide for full compatibility with that obtained from the primary system, especially within controlled airspace.

5.1.10 It should be realized that, because of the various factors (e.g. pilot reaction time, aircraft response time, wind conditions, inherent system performance), the overall degree of navigation accuracy will vary continuously within certain tolerances. Therefore accuracy can be defined only in terms which have been found to be reasonable with regard to both navigation and the area wherein it is practised. It would seem, therefore, that such terms cannot be established other than by practical experience and, once determined for a specific environment, they cannot be indiscriminately used elsewhere. The point which needs to be kept in mind is that navigation is a pragmatic art and that the application of conclusions drawn from it should be dictated more by practical than by hypothetical or theoretical considerations.

5.2 ALIGNMENT OF ATS ROUTES BASED ON VOR

5.2.1 From the above, it follows that, apart from providing adequate track guidance along an ATS route (i.e. that aircraft can operate along the centre line of a route with reference to navigation signals provided by successive VORs), the main question to be resolved in relation to each route is its lateral dimension, i.e. the airspace which should be provided on either side of the centre line in order to ensure that aircraft do not find themselves in airspace where they are no longer ensured of the protection which they may expect while operating within the established limits of the route. This lateral protection applies particularly in the case of controlled ATS routes where the conditions of operation, and the associated level of protection while flying within the limits of the route, may be significantly different from those which prevail in the surrounding airspace.

5.2.2 It is therefore necessary to establish certain general criteria which should govern the establishment of ATS routes (and more so controlled ATS routes) and which should represent a consensus between providers (normally States through their ATS) and users. Experience, in areas where highly developed ATS route networks have been in existence for a long time, indicates that the following criteria are valid when considering alignment of ATS routes based on VOR:

a) the planning of ATS routes should be done so that aircraft can, in 95 per cent of all occasions, remain within a specified lateral distance from the centre line of a VOR defined ATS route:
   1) the most realistic method of determining this probability in relation to a navigation system based on VOR is the assessment of the total system error. The total system error of a VOR in the lateral plan is normally assumed to be ±5 degrees;
   2) where, due to exceptional circumstances, it may be required to use a higher value than ±5 degrees, the lateral limits of the affected ATS route or the permissible deviation from the intended flight track should be adjusted accordingly;
   Note.—Annex 10, Volume I, Part I, Attachment C provides additional guidance.

b) where it is planned to use values less than ±5 degrees, in respect of specific ATS routes, it should be agreed between the States and the operators concerned that the lesser values can be demonstrated in routine operations. The use of such values also presupposes that the performance of the ground aid concerned, and the related airborne equipment, are subject to appropriate calibration and continued monitoring;

c) the presentation of the ATS routes on maps and charts should be so that the use of such charts does not present undue difficulties or require an excessive amount of interpretation in practical operations.
5.2.3 The lateral width of an ATS route may vary depending on the distance between successive VORs used to provide track guidance (see Appendix A, 1 to this chapter). However, experience in those areas of the world where air traffic is dense has shown that, for the vast majority of cases, it is satisfactory to select one uniform value for the determination of the width of ATS routes. This value is ± 5 NM from the centre line, as defined by track guidance derived from successive VORs, which also meets the criterion mentioned in 5.2.2 c) above. A more sophisticated method of determining protection values for VOR-defined ATS routes is shown in Appendix A and has, as a rule, been reserved for application in those exceptional cases where either:

a) airspace is at a premium because of conflicting demands and utmost economy in its use is therefore required; or
b) the distance between successive VORs on an ATS route is excessive (Appendix A, 1 refers).

5.2.4 With regard to the spacing of parallel ATS routes defined by VORs (Appendix A, 2 refers) it is particularly important to keep in mind what has been said in 5.1.10 above regarding the need to remain practical and to take decisions only once all factors and assumptions having a bearing on this complex problem have been verified in routine operations.

5.2.5 A summary of the various considerations, relevant to the deployment of VOR and DME, in an ATS route network is shown in Appendix B. The general specifications regarding the publication of ATS routes and relevant supporting aids are shown in the Aeronautical Information Services Manual (Doc 8126). Specific guidance regarding the promulgation of the nominal centre lines of VOR-defined ATS routes is shown in Appendix C.

5.3 ALIGNMENT OF ATS ROUTES OVER THE HIGH SEAS

5.3.1 As indicated in 5.1.3 above, ground-based, point-source navigation aids are normally not used over the high seas. This fact is due not only to the fact that such aids are not capable of providing coverage over long distances or where they do, they do not provide the required degree of accuracy, but mainly because these aids are not suitable for providing the area-type coverage required to define the variable tracks needed in such areas to keep operations economical (see Chapter 4, 4.2.9).

5.3.2 Because ATS routes over the high seas have to be kept flexible, their establishment is even more dictated by the need to ensure that the protected airspace on either side of the routes is such that the required safety level against risks of collision between aircraft is guaranteed (see Part II, Section 2, Chapters 3 and 4). In addition, responsibility for the provision of air navigation services over the high seas is normally shared between a number of States and generally based on regional air navigation agreements. In most of the cases involving smaller oceanic areas, i.e. the Mediterranean Sea, the North Sea, the Baltic Sea and the Black Sea, the methods used to establish an ATS route network over land areas based on VORs are applied because the length of the over-water portions of the ATS routes concerned are not excessive.
Appendix A  
Protection Values for VOR-Defined ATS Routes

1. DETERMINATION OF PROTECTED AIRSPACE ALONG ATS ROUTES DEFINED BY VORs

Note 1.— The material of this section has not been derived by means of the conflict-risk/target level of safety method.

Note 2.— The word "containment" as used in this section is intended to indicate that the protected airspace provided will contain the traffic for 95 per cent of the total flying time (i.e. accumulated over all aircraft) for which the traffic operates along the route in question. Where, for example 95 per cent containment is provided, it is implicit that for 5 per cent of the total flying time traffic will be outside the protected airspace. It is not possible to quantify the maximum distance which such traffic is likely to deviate beyond the protected airspace.

1.1 For VOR-defined routes where radar is not used to assist aircraft in remaining within the protected airspace, the following guidance is provided. However, when the lateral deviations of aircraft are being controlled with the aid of radar monitoring, the size of the protected airspace required may be reduced, as indicated by practical experience gained in the airspace under consideration.

1.2 As a minimum, protection against activity in airspace adjacent to the routes should provide 95 per cent containment.

1.3 The work described in ICAO Circular 120 indicates that a VOR system performance based on the probability of 95 per cent containment would require the following protected airspace around the centre line of the route to allow for possible deviations:

- VOR routes with 93 km (50 NM) or less between VORs: ±7.4 km (4 NM)

- VOR routes with up to 278 km (150 NM) between VORs: ±7.4 km (4 NM) up to 46 km (25 NM) from the VOR then expanding protected airspace up to ±11.1 km (6 NM) at 139 km (75 NM) from the VOR.

1.4 If the appropriate ATS authority considers that a better protection is required, e.g. because of the proximity of prohibited, restricted or danger areas, climb or descent paths of military aircraft, etc., it may decide that a higher level of containment should be provided. For delineating the protected airspace the following values should then be used:

- for segments with 93 km (50 NM) or less between VORs, use the values in line A of the table below

- for segments with more than 93 km (50 NM) and less than 278 km (150 NM) between the VORs use the values given in line A of the table up to 46 km (25 NM), then expand linearly to the value given in line B at 139 km (75 NM) from the VOR.

![Figure 1](image-url)
Part I.— Planning factors
Section 2, Chapter 5.— Alignment of ATS routes

### Percentage containment

<table>
<thead>
<tr>
<th></th>
<th>95</th>
<th>96</th>
<th>97</th>
<th>98</th>
<th>99</th>
<th>99.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (km)</td>
<td>±7.4</td>
<td>±7.4</td>
<td>±8.3</td>
<td>±9.3</td>
<td>±10.2</td>
<td>±11.1</td>
</tr>
<tr>
<td>(NM)</td>
<td>±4</td>
<td>±4</td>
<td>±4.5</td>
<td>±5</td>
<td>±5.5</td>
<td>±6</td>
</tr>
<tr>
<td>B (km)</td>
<td>±11.1</td>
<td>±11.1</td>
<td>±12.0</td>
<td>±12.0</td>
<td>±13.0</td>
<td>±15.7</td>
</tr>
<tr>
<td>(NM)</td>
<td>±6</td>
<td>±6</td>
<td>±6.5</td>
<td>±6.5</td>
<td>±7</td>
<td>±8.5</td>
</tr>
</tbody>
</table>

1.5 If two segments of a VOR-defined ATS route intersect at an angle of more than 25 degrees, additional protected airspace should be provided on the outside of the turn. This additional space is to act as a buffer for increased lateral displacement of aircraft, observed in practice, during changes of direction exceeding 25 degrees. The amount of airspace added varies with the angle of intersection. The greater the angle, the greater the additional airspace to be used.

Note.— It may be necessary, particularly in the case of sharp turns, to provide additional protected airspace on the inside of the turn, in order to contain aircraft which start their turn at a significant distance before the VOR.

For example, the protected area for a route of 222 km (120 NM) between VORs and for which 99.5 per cent containment is required should have the shape as shown in Figure 2.

![Figure 2](image2)

![Figure 3](image3)
1.6 The following examples have been synthesized from the practices of two States which use templates to facilitate the diagramming of airspace for planning purposes. Design of the turning area templates took into account factors such as aircraft speed, bank angle in turns, probable wind velocity, position errors, pilot delays and an intercept angle of at least 30 degrees to achieve the new track, and provides at least 95 per cent containment.

1.7 A template was used to establish the additional airspace required to contain aircraft executing turns of 30, 45, 60, 75 and 90 degrees. The simplified figures below represent the outer limits of this airspace with the fairing curves removed to allow easy construction. In each case, the additional airspace is shown for aircraft flying in the direction of the large arrow. Where routes are used in both directions, the same additional airspace should be provided on the other outside boundary.

1.8 Figure 3 illustrates the application of two segments intersecting at a VOR, at an angle of 60 degrees.

1.9 Figure 4 illustrates the application for two segments meeting at a VOR intersection at an angle of 60 degrees beyond the point where boundary splay is required in order to comply with 1.3 and Figure 1.

1.10 The following table outlines the distances to be used in sample cases when providing additional protected airspace for route segments at and below FL 450, intersecting at a VOR or meeting at a VOR intersection not more than 139 km (75 NM) from each VOR.

Note.— Refer to Figures 3 and 4.

<table>
<thead>
<tr>
<th>Angle of intersection</th>
<th>30°</th>
<th>45°</th>
<th>60°</th>
<th>75°</th>
<th>90°</th>
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<tr>
<td><strong>VOR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Distance “A” (km)</td>
<td>5</td>
<td>9</td>
<td>13</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td>(NM)</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>*Distance “B” (km)</td>
<td>46</td>
<td>62</td>
<td>73</td>
<td>86</td>
<td>92</td>
</tr>
<tr>
<td>(NM)</td>
<td>25</td>
<td>34</td>
<td>40</td>
<td>46</td>
<td>50</td>
</tr>
<tr>
<td><strong>Intersection</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Distance “A” (km)</td>
<td>7</td>
<td>11</td>
<td>17</td>
<td>23</td>
<td>29</td>
</tr>
<tr>
<td>(NM)</td>
<td>4</td>
<td>6</td>
<td>9</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>*Distance “B” (km)</td>
<td>66</td>
<td>76</td>
<td>88</td>
<td>103</td>
<td>111</td>
</tr>
<tr>
<td>(NM)</td>
<td>36</td>
<td>41</td>
<td>48</td>
<td>56</td>
<td>60</td>
</tr>
</tbody>
</table>

* Distances are rounded up to the next whole kilometre/nautical mile.

Note.— For behaviour of aircraft at turns, see ICAO Circular 120, 4.4.

Figure 4
1.11 Measured data for routes longer than 278 km (150 NM) between VORs are not yet available. To determine protected airspace beyond 139 km (75 NM) from the VOR, the use of an angular value of the order of 5 degrees as representing the probable system performance would appear satisfactory. Figure 5 illustrates this application.

2. SPACING OF PARALLEL ROUTES DEFINED BY VORs

Note.— The material of this section has been derived from measured data using the conflict-risk/target level of safety method.

2.1 The collision risk calculation, performed with the data of the European study* indicates that, in the type of environment investigated, the distance between route centre lines (S in Figure 6) for distances between VORs of 278 km (150 NM) or less should normally be a minimum of:

- a) 33.3 km (18 NM) for parallel routes where the aircraft on the routes fly in opposite directions; and
- b) 30.6 km (16.5 NM) for parallel routes where the aircraft on the two routes fly in the same direction.

Note.— Two route segments are considered parallel when:

- they have about the same orientation, i.e. the angular difference does not exceed 10 degrees;
- they are not intersecting, i.e. another form of separation must exist at a defined distance from the intersection;

* The guidance material in this Appendix results from comprehensive studies, carried out in Europe in 1972 and the United States in 1978, which were in general agreement. Details of the European studies are contained in ICAO Circular 120 — Methodology for the Derivation of Separation Minima Applied to the Spacing Between Parallel Tracks in ATS Route Structures.
— traffic on each route is independent of traffic on the other route, i.e. it does not lead to restrictions on the other route.

2.2 This spacing of parallel routes assumes:

a) aircraft may either during climb or descent or during level flight be at the same flight levels on the two routes;

b) traffic densities of 25 000 to 50 000 flights per busy two-month period;

c) VOR transmissions which are regularly flight checked in accordance with ICAO Doc 8071 — Manual on Testing of Radio Navigation Aids and have been found to be satisfactory in accordance with the procedures in that document for navigational purposes on the defined routes; and

d) no real-time radar monitoring or control of the lateral deviations is exercised.

2.3 Preliminary work indicates that, in the circumstances described in a) to c) below, it may be possible to reduce the minimum distance between routes. However, the figures given have not been precisely calculated and in each case a detailed study of the particular circumstances is essential:

a) if the aircraft on adjacent routes are not assigned the same flight levels, the distance between the routes may be reduced; the magnitude of the reduction will depend on the vertical separation between aircraft on the adjacent tracks and on the percentage of climbing and descending traffic, but is not likely to be more than 5.6 km (3 NM);

b) if the traffic characteristics differ significantly from those contained in ICAO Circular 120, the minima contained in 2.1 may require adjustment. For example, for traffic densities of about 10 000 flights per busy two-month period a reduction of 900 to 1 850 m (0.5 to 1.0 NM) may be possible;

c) the relative locations of the VORs defining the two tracks and the distance between the VORs will have an effect on the spacing, but this has not been quantified.

2.4 Application of radar monitoring and control of the lateral deviations of the aircraft may have a large effect on the minimum allowable distance between routes. Studies on the effect of radar monitoring indicate that:

— further work is necessary before a fully satisfactory mathematical model can be developed;

— any reduction of separation is closely related to:

— traffic (volume, characteristics);
— radar coverage and processing, availability of an automatic alarm;
— monitoring continuity;
— sector work-load; and
— radiotelephony quality.

According to these studies and taking into account the experience some States have accumulated over many years with parallel route systems under continuous radar control, it can be expected that a reduction to the order of 15 to 18.5 km (8 to 10 NM), but most probably not less than 13 km (7 NM), may be possible as long as radar monitoring work-load is not increased substantially by that reduction. Actual operations of such systems using reduced lateral spacing have shown that:

— it is very important to define and publish change-over points (see also 4);

— large turns should be avoided when possible; and

— where large turns cannot be avoided, required turn profiles should be defined for turns larger than 20 degrees.

Even where the probability of total radar failure is very small, procedures to cover that case should be considered.

3. SPACING OF ADJACENT VOR-DEFINED ROUTES THAT ARE NOT PARALLEL

Note 1.— The material of this section is intended to provide guidance for situations where non-intersecting VOR-defined routes are adjacent and have an angular difference exceeding 10 degrees.

Note 2.— The material of this section has not been derived by means of the conflict-risk/target level of safety method.

3.1 For adjacent non-intersecting VOR-defined routes that are not parallel, the conflict-risk/target level of safety method is not, at its present state of development, fully appropriate. For this reason use should be made of the material in 1.
3.2 The protected airspace between such routes should not be less than that which will provide, without overlap, the 99.5 per cent containment values given in the table in 1.4 (see example in Figure 7).

3.3 Where there is an angular difference of more than 25 degrees between route segments, additional protected airspace, as indicated in 1.5 to 1.10, should be provided.

4. CHANGE-OVER POINTS FOR VORs

4.1 When considering the establishment of points for change-over from one VOR to another for primary navigational guidance on VOR-defined ATS routes, States should bear in mind that:

4.2 Nothing in 4.1 should be interpreted as placing a restriction on the service ranges of VOR installations meeting the specifications in Annex 10, Volume I, Part I, 3.3.

Figure 7
Appendix B

Criteria for the Deployment of VOR and DME

Note.— The material contained in this appendix is derived from satisfactory experience gained in the European (EUR) region.

1. EXPLANATION OF TERMS

In the deployment of radio navigation aids and related matters, the terms listed below are used with the following meaning:

a) designated operational range or height
The range or height to which an aid is needed operationally in order to provide a particular service and within which the facility is afforded frequency protection.

Note 1.— The designated value for range or height is determined in accordance with the criteria for the deployment of the aid in question.

Note 2.— The designated value for range or height forms the basis for the technical planning of aids.

b) designated operational coverage
The term designated operational coverage is used to refer to the combination of the designated operational range and the designated operational height (e.g. 200 NM/FL 500).

2. CRITERIA

2.1 Compatibility of different navigation systems

2.1.1 Number 1 — Combination of several requirements: Whenever possible, requirements (either civil, military or both) for en-route and/or terminal navigation guidance covering the same general area should be combined so that they can be met by the least number of individual facilities.

2.1.2 Number 2 — Differences between international and national requirements for the same facility: Where a specific VORTAC or VOR/DME is serving both international and national (civil and/or military) requirements which are not identical as far as designated operational range and/or height are concerned, the higher of each of the respective values constitutes the combined requirement.

2.2 Over-all system use accuracy of VOR and DME

2.2.1 Number 3 — Over-all system use accuracy:

a) for VORs an over-all system use accuracy of ±5° should normally be used for planning purposes (see also the relevant paragraph in Annex 10, Volume I, Attachment C);

Note.— In specific cases improved accuracies are being obtained and are used for the alignment of the specific ATS routes.

b) for DMEs, co-located with an associated VOR in accordance with the applicable provisions of ICAO Annex 10, Volume I, Part I, the system use accuracy to be used for planning purposes regarding the configuration of ATS routes and related questions of separation should be that given in the relevant paragraph in Volume I, Part I of Annex 10.

2.3 Deployment of VORs

2.3.1 Number 4 — Track guidance: VORs should be deployed along ATS routes forming part of the agreed ATS route network and should be used to define the centre lines of such routes so as to ensure smooth transition of navigational guidance at the change-over point from one VOR to the next.

2.3.2 Number 5 — Spacing between VORs: Successive VORs providing track guidance along a given ATS route should be spaced at the maximum distance consistent with:

a) the required track keeping accuracy;

b) the lowest level at which navigational guidance along the route in question is required. In those cases where the VORs concerned serve ATS routes both in the upper as well as in the lower airspace, the requirements of the latter will dictate the spacing between the aids concerned.

Note 1.— With respect to 2.3.2 a), criterion number 9 is particularly relevant.
Note 2.— The requirement in 2.3.2 b) results from the quasi-optical propagation characteristics of VOR signals.

Note 3.— With regard to 2.3.2 b), VORs provided for use in the lower airspace only should not be frequency protected for utilization in the upper airspace.

2.4 Determination of designated operational range and height for VORs and DMEs

2.4.1 Number 6 — Designated operational range requirements: The designated operational range for individual VORs along specific route segments should, for planning purposes, extend up to half the segment length in question plus 10 per cent of that distance or 10 NM, whichever is greater. However, when successive facilities along a given en-route segment are spaced by a distance of 60 NM or less, each VOR should have a designated operational range covering the entire segment in question.

Note.— In those cases where special requirements for minimum operational range of adjacent VORs may be necessary, significant savings of frequency utilization may be achieved if the change-over from one VOR to the next is at the mid-point between the two VORs. This arrangement should be permissible provided total coverage of the route segment concerned is maintained (see criterion number 10).

2.4.2 Number 7 — Designated operational height requirement: In planning navigation coverage of VORs, the designated operational height should be determined by the highest level at which the aid concerned is planned to be used.

Note.— See also Note 3 to criterion number 5 (2.3.2 b) above).

2.4.3 Number 8 — Specifications of designated operational range for individual aids for frequency planning purposes: For frequency planning purposes the designated operational range of a specific VOR and/or DME should normally be expressed in one omnidirectional value, corresponding to the highest value of any segment length established for the aid in question. “Keyholing” may be applied whenever there are significant differences in designated operational range for different sectors of the circular area of coverage of an individual facility.

Note.— The designated operational range and height should be expressed, for practical reasons, in the following units:

Range (in NM): 25, 40, 60, 80, 100, 150, 200.

Height (in terms of flight levels): 100, 250, 500.

2.5 Provision of navigational guidance

2.5.1 Number 9 — Changes of direction on routes: If other methods of determining the position of points where changes in the direction of ATS routes occur are not practicable, VORs should be deployed at these points.

2.5.2 Number 10 — Change-over points: Change-over points from one VOR to another on ATS routes should normally be established at the mid-point between the two aids. Where the change-over point is not at the mid point between two aids or at the intersection of two VOR radials, its position should be specifically indicated on radio navigation charts. In such cases, the distance to the two VORs concerned should be indicated.

2.6 Deployment of DMEs co-located with VORs

2.6.1 Number 11 — Coverage requirements for DMEs: A DME, co-located with a VOR should operate to the limits of the designated operational coverage of its associated VOR.

2.6.2 Number 12 — Marking of “landfall” points: VORs situated at the end of long ATS route segments, along which navigation guidance provided by short-range station-referenced aids is limited (e.g. landfall points), should be provided with a co-located DME when a requirement for an increase in accuracy of navigation makes this essential.

2.6.3 Number 13 — Updating of airborne navigation systems: Where it is required to update airborne navigation equipment, appropriate VOR/DMEs provided for other reasons should be designated for this purpose.
Appendix C

Promulgation of Nominal Centre Lines of VOR-Defined Routes

1. DEFINITIONS

The nominal centre line of a VOR-defined route is an intended geographic track. It is composed of segments, each of which approximates a great circle track. The identification of each segment will contain the following elements:

a) a specific VOR;
b) the radial of that VOR which coincides, or nearly coincides, with the geographic track;
c) the distance(s) from the VOR included in the segment.

2. PROMULGATION OF THE CENTRE LINE

2.1 The VOR radial published by the appropriate authority should normally be the value corresponding to the magnetic direction of the minor arc of the great circle containing the route segment from the VOR. A different radial should be published where it can be established that a better average alignment or better coincidence at the change-over point is obtained (see Figures 1 to 3).

2.2 Application of this procedure will facilitate navigation close to the nominal centre line between VORs defining a route segment:

a) even where systematic errors persist despite technical adjustments to the VOR;
b) at high latitudes where convergence of meridians becomes significant in navigation;
c) at or near the magnetic poles where isogonals are affected by magnetic anomalies.

2.3 The precise alignment of VOR radials may not always be known, due to the lack of flight testing capability, and may vary with time, due, for example, to periodical technical adjustments to VORs, switch-over to standby transmitters and meteorological effects. The published radial should, however, be the best approximation to the average direction of the radial over a period of time which is consistent with routine amendment of charts and aeronautical information publications.

Figure 1. Standard charting of VOR route segment
Figure 2. Charting of VOR route segment with off-centre change-over point

Figure 3. Charting of VOR route segment with dog-leg
Chapter 6
Area Navigation

6.1 INTRODUCTION

6.1.1 The increase in sophistication of airborne navigation equipment, both as regards that using information derived from ground-based aids as well as that operating in a self-contained mode inertial navigation systems (INS), was believed to make it feasible that older forms of navigation, i.e. operating from navigation aid to navigation aid along routes which were more or less permanently established, could advantageously be replaced or complemented by one whereby aircraft could plan and operate along the most direct route between their point of departure and their destination. This concept is known as area navigation (RNAV).

6.1.2 Apart from the economic advantages to operators, RNAV was also expected to permit providers considerable economy in the provision of radio aids to navigation because under the concept of area navigation it would no longer be necessary to provide such aids at each significant point and/or aerodrome if that point was located within the area of coverage of another existing aid. The economic aspect to operators was made even more desirable after 1973, when general developments in the energy field and their consequences on the economy made fuel conservation a much more important topic in the conduct of flight operations.

6.1.3 It was for this reason that RNAV received growing attention especially on the part of operators engaged in commercial air transport operations. Studies conducted by a number of States and practical experience acquired in cases where the area navigation concept is being applied have shown, however, that the widespread application of flights along random routes will require very careful consideration and that much preparatory work, both by providers and users, is required before area navigation can be expected to become a general substitute for the present method of operation along established air traffic services (ATS) routes (see Chapter 5).

6.1.4 In reviewing the application of area navigation in a given environment, it was found that two aspects assumed the dominant role. One concerned the question of the horizontal separation minimum which needed to be applied between the flight paths of aircraft operating along random routes; the second aspect concerned the control methods which had to be applied to such aircraft.

6.1.5 Horizontal separation minima are primarily dependent on the accuracy of navigation which can be expected from aircraft operating in this mode, i.e. it must be assumed that each aircraft will meet agreed values of accuracy when air traffic control (ATC) determines the separation minima to be applied to each pair of aircraft. To achieve uniform navigation accuracies it is practically impossible to avoid establishing some type of minimum navigation performance specification expressed in terms of equipment fit (generally VHF omnidirectional radio range (VOR)/distance measuring equipment (DME) combined with a navigation computer on board the aircraft, or INS). Experience has shown that, in an environment where an appreciable portion of the air traffic is composed of international flights, achieving uniform navigation accuracies is difficult because operators views vary as to the manner in which the accuracy required can be met, both as regards the type of equipment and methods to be used as well as the need for back-up reliability.

6.1.6 When area navigation along random routes is applied, the most outstanding problem facing ATC is the presentation of the different routes planned by individual flights in such a manner that it becomes immediately apparent when and where individual aircraft will become essential traffic in relation to each other. This problem applies especially in view of the fact that this presentation may change frequently with the insertion of new flights into a given traffic situation. A further problem associated with area navigation along random routes is that co-ordination between adjacent ATC units becomes difficult because, in such cases, transfer of control points will change continuously, unless application of area navigation is restricted to within one control area at a time; a situation which, in most cases, would negate the advantages operators expect to derive from its use. The assumption that these problems can be resolved by the availability of radar
and/or automation may be correct; however, so far practical results have not been confirmed on a sufficiently large scale.

6.1.7 It would therefore appear, at least for the time being, that the use of the area navigation concept will be confined to selected portions of the airspace and/or specific groups of users which are prepared to meet a mutually agreed upon degree of accuracy in navigation while operating in the portions of airspace defined for that purpose. A further expansion appears possible by using area navigation in areas of high traffic density in order to establish parallel ATS routes without the need for the provision of additional navigation aids to relieve airspace congestion in areas where airspace is at a premium. Establishment of parallel ATS routes presupposes, however, that the increased accuracy in navigation can be met continuously and in a reliable manner by all aircraft engaged in routine operations in such an environment.

6.2 USE OF AREA NAVIGATION

6.2.1 As previously indicated, the use of RNAV in a given area, and the user’s ability to comply with the necessary conditions, must be based on:

a) firm agreements between the provider authority and all potential users that they will meet, on a continuous basis, the requirements for navigation accuracy upon which the application of RNAV is based;

b) provisions which specify, in detail, the procedures to be used for aircraft in transition between an established ATS route network and an RNAV area. These provisions must also cover cases of temporary loss of the RNAV capability by aircraft operating in an RNAV area;

c) provisions which ensure a continued monitoring of the navigation performance in the RNAV area in order to ensure that the conditions upon which RNAV is based are met;

d) provisions which envisage a suspension of RNAV and a reversal to other forms of operation in case a general deterioration of the situation is noted. These provisions should also cover the case of the restoration of RNAV whenever the causes, having led to its suspension, have been eliminated;

e) provisions regarding the full or partial immediate suspension of the use of RNAV whenever essential facilities upon which RNAV is based are temporarily out of service. These provisions should include the establishment of a list of such facilities and of the effects their withdrawal from service (either individually or in any combination) is likely to have on the use of RNAV.

6.2.2 It will also be necessary to publish full details on the use of RNAV, especially with regard to the role of responsibility pilots and operators will have in assuming its application, in order to stress the fact that RNAV is a collective effort by both the ground services and flight crews concerned.
Chapter 7
Requirements for Terminal Facilities

7.1 INTRODUCTION

7.1.1 As air traffic tends to concentrate in the area around aerodromes, especially those serving major population centres where the demand for air transportation is highest, it is essential that such areas be provided with adequate facilities in order to be able to accommodate this traffic. If adequate facilities are not provided, the repercussions of traffic accumulating in such areas will be felt not only by those aircraft constituting such traffic, but will also spread to the flow of air traffic bound for other locations. At some very busy aerodromes experience has already shown that such repercussions can spread over very large areas and affect traffic for a considerable distance away.

7.1.2 In discussing the various aspects involved in establishing requirements for terminal facilities it is not intended to describe in detail the various aids and their use in forming part of the terminal facilities. However, it is intended to mention only those points which concern ATS directly and the need for these points to be taken into account in ATS planning.

7.2 TERMINAL VORs AND OTHER AIDS

7.2.1 Whenever traffic density and/or complexity requires that a terminal control area (TMA) be established around one or more aerodromes with the associated routing patterns for departing and arriving traffic (e.g. standard instrument departure procedures (SIDs) and standard terminal arrival routes (STARS)), it is generally necessary to establish a number of exit/entry points at the edges of the TMA — at least with respect to those ATS routes which carry the bulk of the air traffic in that TMA. Exit/entry points can be achieved in a number of ways, i.e. by reference to a VHF omni-directional radio range (VOR) radial and a distance along the radial measured by the collocated distance measuring equipment (DME); provision of a locator or an NDB, depending on the coverage required. The operational need for additional, special navigation aids to establishment of exit/entry points should be reviewed critically so that a proliferation of aids serving a limited use only can be avoided where possible.

7.2.2 The need for the establishment of SIDs and STARS should also be very critically examined because experience has shown that, once established, controllers tend to use these procedures as convenient substitutes for the application of diligent control techniques. Such practices may require aircraft to fly unnecessary and unjustified complex patterns with the resultant undesirable economic consequences. However, where SIDs and STARS establishment is justified, it should be ensured that they can be flown with reference to navigational guidance alone because if their use requires extensive and prolonged radar vectoring from the ground it will have adverse consequences on the workload of controllers and on their capacity to handle air traffic in general.

7.3 CRITICAL WEATHER OPERATIONS

7.3.1 Initially, instrument approach procedures were developed only for those occasions when, because of meteorological conditions, it was not possible to conduct a complete approach and landing in accordance with visual flight rules (VFR). Depending on the type of air traffic operating at a specific aerodrome, this fact still holds true.

7.3.2 Where instrument approach procedures are established, the appropriate State authorities (not the air traffic services (ATS)) establish, for each instrument approach procedure, specific minimum values of height of cloud base and visibility which must be respected when using the related approach procedure. In some cases, however, States leave it to operators to ensure compliance with published minima (or higher values as determined by the operator) on the understanding that pilots are entitled to conduct an approach on a "look-see" basis and discontinue the approach when it cannot be completed. In other cases, States refuse pilots this privilege and take it upon
themselves to enforce compliance with the minima by refusing clearance for approach and landing when the minimum values of height of cloud base and/or visibility do not prevail.

7.3.3 In any case, the question of specific minimum approach values has to be determined between the operator and services other than the ATS. ATS should not be required to assume enforcement responsibilities in this respect. Nevertheless, ATS plays an important role in this matter because of timely information provided to pilots in critical situations enabling them to arrive at the operationally correct decision (see Part I, Section 2, Chapter 2, 2.2.9 on OFIS, and 2.2.10 on ATIS and Part I, Section 2, Chapter 10, 10.3 on ATS).

7.3.4 With the advent of faster and heavier turbo-jet aircraft to air transport, it was found that these aircraft required guidance along their approach regardless of prevailing weather conditions. As a consequence, at aerodromes used by such aircraft, an ILS was required to provide for at least the main landing direction used in critical weather conditions, even if the prevailing meteorological conditions alone would not have justified the provision of such equipment.

7.3.5 In recent years, much international effort has been invested in the development of an improved instrument landing system which is intended to overcome certain shortcomings of today's ILS as regards navigational guidance provided to aircraft on approach, i.e. more flexible flight path, continuous distance information from touchdown, better technical performance in critical terrain locations, etc. The new system is known as the micro-wave landing system (MLS). The progressive replacement of ILS with MLS can be expected to have significant beneficial effect on the handling of air traffic by ATS. This fact is due mainly to the greater flexibility which MLS permits in the sequencing of arriving air traffic. With MLS, for instance, it will no longer be necessary for ATS to require all aircraft to go to a common point to start their approach to land; thus permitting a more expeditious flow of arriving traffic.

7.3.6 With the increased importance of air transport as a routine means of travel, its regularity also gained in importance. It was for this reason that efforts have been made to develop equipment and associated procedures which would ensure that, even under adverse meteorological conditions, a flight could be conducted as planned, i.e. even the minima prescribed for take-off and landing could be lowered to a point where weather was no longer a determining factor in whether or not a flight could be started or would arrive in time at its destination as planned. Work in this field has been conducted under the heading of "All Weather Operations" and has now resulted in a programme which envisages a step-by-step method of lowering the prescribed landing minima in phase with the provision of suitable ground equipment at selected aerodromes and related measures by operators regarding airborne equipment and flight crew proficiency.

7.3.7 The various steps envisaged in the all-weather operations programme are referred to as categories of operation (CAT). Categories have been numbered from I to III. It should be noted, however, that while each of these categories prescribes specific technical performance characteristics of the ground equipment used for their conduct, these characteristics taken in isolation do not constitute a basis for the application of the related category of operation, e.g. an ILS may meet the technical performance required for CAT II operations without it ever being used for such operations. The decision to conduct a specific category of operation at a specific aerodrome depends exclusively on the operators in consultation with the authorities concerned. Apart from relevant operational technical considerations, cost-effectiveness considerations play a very large part in the decision-making process. More detailed information on the technical and operational aspects of this subject is contained in Part II, Section 5, Chapter 2 of this manual as well as in ICAO Doc 9365 — Manual of All-Weather Operations.

7.3.8 There are a number of other aspects of categories of operations which are of direct concern to ATS and which need to be taken into consideration in work in this field. These are:

a) contributions expected from ATS during the conduct of all-weather operations;
b) arrangements required during the extended transition period of application of one category of operations to the next, i.e. transition from CAT I to CAT II operations;
c) arrangements required to maintain pilots' proficiency in the conduct of such operations.

7.3.9 With respect to contributions expected from ATS, one essential point is that ATC ensures that the area on the aerodrome required to be protected from intrusion in order to ensure the proper functioning of the ground equipment, i.e. the "critical area", is kept clear during the period when approaches are in progress. In addition, air traffic control (ATC) should ensure that any information, essential for the pilot's decision to continue an approach, is brought to his attention in a clear and concise manner without delay, i.e. latest meteorological information, including runway visual range (RVR), wind shear, etc., changes in the operating status of essential components of the ground
equipment, etc. In meeting requirements for essential information, due account should also be taken of the fact that passing an excess amount of irrelevant information, as well as transmitting information at a moment when the pilot's attention is concentrated on critical manoeuvres, can have serious detrimental effects on the safe conduct of the approach by appreciably increasing the stress on pilots. It is therefore essential that ATS procedures for all-weather operations be clearly understood between operators and the ATC unit concerned and that ATC personnel be thoroughly trained in this respect, taking into account relevant local factors which may have a bearing on this matter.

7.3.10 For the reasons explained in 7.3.7 above, it can be expected that the introduction of specific categories of operation at specific aerodromes will be done progressively and that it may take a considerable time before such categories are fully used by the majority of aircraft operating into that aerodrome (see 7.3.8 b)). Situations will therefore arise where, under a given set of circumstances, some of the arriving aircraft may be able to conduct an approach to land while others cannot, but where their arrival sequence is independent of their respective capabilities. It will therefore be necessary to make arrangements which will permit suitably equipped and qualified aircraft to conduct their approach in a sequence different from the “first come — first served” sequence normally applied by ATC. In making such arrangements it should be clearly understood that they do not contravene the principle of providing service on a non-discriminatory basis, but that the opportunity to land offered to those aircraft which are able to do so safely will also benefit the others because it assists in easing the general traffic load normally experienced under such conditions (see also Part II, Section 5, Chapter 2, 2.5.3).

7.3.11 As mentioned in 7.3.8 c) above, the conduct of CAT II and III operations, in particular, requires that pilots retain their proficiency in conducting such operations. This requirement presupposes that the pilots have the opportunity to practice such approaches at frequent intervals. It will therefore be necessary for operators to arrange for practice approaches at those aerodromes where the conduct of the appropriate category of operation is possible. If such practice approaches are conducted during a period where traffic is frequently heavier than usual, i.e. the holiday season, it could have undesirable effects on the flow of other air traffic. It therefore appears advisable that ATC units at the aerodromes concerned develop, in coordination with operators concerned, programmes for the conduct of such practice approaches, and specify not only the times when such approaches can best be fitted in with other traffic using the aerodrome, but also ensure that equal opportunity is afforded to all operators confronted with this problem (see also Part II, Section 5, Chapter 2, 2.5.4).

7.4 SURVEILLANCE OF GROUND MOVEMENTS

Note.—See also Part II, Section 5, Chapter 4.

7.4.1 The need for adequate surveillance of ground movements is particularly important at aerodromes where low ground visibility occurs rather frequently and where the layout of the movement area is complex. Complex movement areas are mainly found at large busy aerodromes, which are in most cases geographically situated so that winds do not occur in a prevailing direction (e.g. near seashores or large bodies of water or in flat regions). The result of this condition is that runways are provided in different directions, thus creating a complex network of taxiways and resulting taxi routes to get aircraft to and from the runway in use. A further complicating factor is the traffic density at such aerodromes. The more aircraft and associated ground vehicles that are simultaneously moving on the aerodrome, the greater the likelihood of conflicts between them.

7.4.2 From the above, it is evident that there are three main factors which govern the need for surveillance of ground movements:

a) the frequency of occurrence of critical ground visibility conditions;

b) the traffic density, including that of ground vehicles;

c) the complexity of the aerodrome lay-out.

7.4.2.1 A further point which needs to be taken into account is the necessary arrangements between ATS and other agencies regarding the division of responsibility for the provision of services to aircraft and other traffic on the movement area (see also Part I, Section 2, Chapter 2, 2.4).

7.4.3 The means to effect surveillance of ground movements can range from very simple arrangements at smaller aerodromes with comparatively light traffic density and non-critical visibility conditions to very complex systems at large and busy aerodromes where critical visibility conditions frequently occur. Because of the many choices which are available and because local conditions at specific aerodromes play a major role in the determination of the most adequate solution, it is not possible to offer a standardized solution to this question, except that procedural arrangements and publications should not deviate...
from agreed basic principles as far as phraseology and/or use of standardized symbols in publications (especially on maps and/or diagrams) are concerned.

7.4.4 Amongst the many technical and operational considerations involved in planning surveillance of ground movements are three aspects especially needed to be kept in mind. These are:

a) the need to keep arrangements for pilots as simple and straightforward as possible and free of any possible ambiguities as to action expected of aircraft moving on the ground. Simplicity of procedures is preferable to utmost efficiency if the latter can only be achieved by complex and complicated procedures;

b) the need to keep cost-effectiveness in mind, especially when considering the provision of complex electronic aids;

c) the need to ensure that, from the start, planning is done with the active participation of airport authorities, operators of aircraft and those constituting other traffic on the movement area (operators of bus services for passengers, freight vehicles, the fire fighting services, catering services, etc.) so that their legitimate requirements will receive due consideration.
Chapter 8
Requirements for Communications

8.1 INTRODUCTION

8.1.1 Communications are a vital part of the provision of air traffic services (ATS) and their timely and dependable availability have a most significant bearing on the quality of the service provided by ATS. It is therefore essential that communication requirements form an integral part of any ATS planning, especially in view of the fact that their provision is frequently dependent on co-ordinated efforts by other than the air navigation services (i.e. the general telecommunication services). This co-ordinated effort not only applies to the availability of required communication links but also with respect to their quality of performance reliability and the time required for their restoration to full service in case of breakdowns. Appropriate arrangements covering these aspects should therefore be concluded between the air navigation planners and other parties concerned. These arrangements should also cover the long-range aspects of planning communications where new or greater demands are expected or required at a future date in order to meet the technical needs of more sophisticated ATS equipment, i.e. data links, high-speed transmission circuits, etc.

8.1.2 In formulating communication requirements care should be taken to clearly state the operational requirements without indicating the manner in which that requirement is to be technically satisfied. However, it is also important that technical limitations are not used as an excuse to degrade the stated operational requirements. Experience has shown that any ambiguities regarding respective responsibilities between those charged with the formulation of operational requirements and those charged with technical realization can have very detrimental consequences on the facilities concerned, resulting in even more detrimental effects on the operation of ATS.

8.2 FIXED SERVICE COMMUNICATIONS

8.2.1 The basic provisions regarding requirements for fixed service communications by different ATS units are contained in Annex 11. They are therefore not repeated in this manual. However, there are a number of additional aspects which merit consideration. These are:

a) the consolidation of different communications requirements into one technical means;
b) the frequency of breakdowns and the time required for repair or replacement of individual circuits;
c) the quality of the communications;
d) the arrangements for terminal fixed communication links.

8.2.2 With respect to consolidated communications requirements (8.2.1 a) above), modern communications technology makes it now feasible to use one technical carrier, on a time-sharing basis, to satisfy a number of aeronautical communication requirements. A typical example of this approach is the common ICAO data interchange network (CIDIN) which is designed to accommodate not only ATS requirements for data interchange but also the exchange of meteorological and aeronautical information service data between interested services as well as other data transmission now carried by the aeronautical fixed telecommunication network (AFTN). In this case, it is of the utmost importance that the operational requirements for the exchange of ATS data by normal or high-speed teletype transmission and/or by direct data exchange between air traffic control (ATC) computers be specified as precisely as possible. This applies to both the amount of data to be exchanged and the acceptable time limits, as well as the reliability and integrity of such exchanges. In addition, it is necessary to decide whether direct voice communications between ATS units are to be incorporated into such a common carrier system (which is technically feasible) or whether voice communications should be met by a different carrier. In the latter case, present trends are directed more towards keeping voice communications separate from the common carrier system (AFTN) because of their vital importance to the immediate resolution of critical situations, should these occur, and as a back up in case the common carrier is temporarily out of service.

8.2.3 Since ATS fixed communication links are normally not under the full control of the air navigation services
(from terminal to terminal), it is important to keep a continuous check on the frequency of their breakdowns and the time required to restore these communications to full service (8.2.1 b refers). In many cases it has been found that the authorities responsible for general telecommunications, providing fixed ATS communications circuits, are not, a priori, prepared to accord these circuits the special status required for communications involved with the safeguarding of human lives, especially provisions regarding priority maintenance and repair. In addition, alternative physical routings of potential back-up circuits are also not, in all cases, envisaged. It is therefore essential that communications breakdowns and time required for restoration be kept under close review and that, where necessary, appropriate arrangements for corrective action are made.

8.2.4 With regard to the quality of communications (8.2.1 c) above), much of what has been said in the previous paragraph also applies to voice communication circuits. Arrangements have been concluded whereby in some cases, switching through an intermediary terminal has been agreed upon as a means to satisfy a requirement for a connexion between two ATC units, both of which are connected to the intermediate third unit. This arrangement is done whenever operational and economic conditions permit. Experience has also shown that, if such an arrangement is not co-ordinated with the technical providers of the circuits concerned, it can lead to difficulties because the technical performance of the circuits in question (especially voice amplification) may not be sufficient to accommodate the additional use. Consequently, when through-switching is used, the speech quality may be insufficient to allow for reasonably acceptable communications. It has also been found that the cost charges for through-circuits are calculated differently than if they were only used between two ATS units. It is therefore important that such arrangements are clearly indicated in the technical specifications for fixed communication circuits and the agreements concluded between users and the providing agency are adequate.

8.2.5 In certain cases, it could also be advantageous if, for traffic flow planning purposes, a number of ATC units (primarily area control centres (ACCs)) in a given area were provided with the possibility of using interconnecting voice circuits in a conference-type arrangement to deal with critical ATC situations. Early identification of the technical pre-requisites for such arrangements is very important and should be done in good time so that necessary preparatory measures can be taken by all technical providers concerned.

8.2.6 ATC units frequently find the terminals for different communications circuits, and especially voice circuits, are installed independent of each other with the result that controllers are required to use four or five different telephones during any one given period of time. This arrangement is operationally unsatisfactory and should be avoided. All such terminals should be incorporated into one single communications keyboard or selector panel, permitting the operation of each of the circuits from one terminal. Co-ordination with the technical providers is required because, in some cases, the differing technical specifications involved do not always permit such a grouping of different circuits into one panel.

8.3 AIR-GROUND COMMUNICATIONS

8.3.1 ATS air-ground communications should be designed so that they require the least number of frequency changes for aircraft-in-flight, compatible with the provision of the required service. They should also provide for the minimum amount of co-ordination between ATS units. Basic elements for the determination of the need for air-ground communication channels are given in Appendix A.

8.3.2 Uniform values of designated operational range and height of very high frequency (VHF) air-ground communication channels used for specific ATS functions should be in accordance with the table shown in Appendix B. Deviations from these values at specific locations or for specific functions should be made only in those cases where adequate operational justification for such a deviation is provided by the ATS unit concerned.

8.3.3 In order to achieve optimum economy in the common use of international and national ATS air-ground radio communications frequency spectrum (VHF), the criteria outlined in Appendix B should be applied uniformly to all facilities using VHF air-ground communications regardless of who is operating them.

8.3.4 Since the use of frequencies for national VHF air-ground communication requirements has a bearing on international frequency assignment planning, States should:

a) normally base their national requirements on the values shown in Appendix B regarding designated operational range and height;
b) provide ICAO with as much information as possible in advance of planned national requirements;
c) submit those national requirements which are expected to cause operational and/or technical difficulties by their implementation to any appropriate ICAO body so that the available frequency spectrum can be shared on a commonly agreed basis and in accordance with uniform criteria.

8.3.5 In addition, VHF installations serving national purposes and sharing the frequency band for international requirements should fully meet the appropriate specifications for their technical performance contained in Annex 10, Volume I, Part I, both as regards ground and airborne equipment.

8.3.6 The progressive reduction of air-ground communications can also have an effect on the number of channels needed by ATC units (especially ACCs). It is for this reason that considerations regarding this subject have been included in Appendix C to this chapter. These considerations are based on experience gained by States in the European (EUR) region.

8.3.7 It is now accepted practice that ATS requirements for air-ground communication channels serving international purposes are included in the air navigation plan for a specific region. In those ICAO regions where the use of frequencies for national air-ground communication requirements has a bearing on international frequency assignment planning, the Regional Office concerned also issues a table containing all requirements for both international and national assignments. This table provides a means for conducting a reasonable planning exercise regarding both the operational need for channels and their technical provision in terms of specific frequencies. Therefore at regional meetings, or on any other occasion where this subject is dealt with, it will be sufficient if States present only those international requirements which are new or which need to be changed in comparison with what is already in the plan. In those cases of frequency assignment planning where national requirements need to be taken into account such presentations should also cover national requirements. The presentation of detailed statements by States of new or changed requirements for air-ground communications for air traffic services and explanation of a sample form used for this purpose are shown in Appendix D to this chapter.

8.4 RECORDING AND RETENTION OF ATS DATA

8.4.1 ATS data is a significant source of information in the reconstitution of incidents and/or accidents concerning aircraft. It is essential that information on the traffic situation at any given moment, as well as records indicating who was performing which function within an ATC unit, be kept in their original state as long as there is a reasonable possibility that such information may be required.

8.4.2 Written records (flight progress strips, ATS messages, duty logs, etc.) should be retained for a minimum of 90 days and should only be destroyed thereafter if no specific need for further retention has come to light. When the need for such data has become apparent destruction of the material should only be done after specific authorization has been granted by the appropriate authority.

8.4.3 In addition, written records should always be made in an indelible manner. Erasures should not be permitted. Recorded data should be corrected by striking out the information in such a manner that it remains legible and recording the correct data in a convenient place near the information that has been struck out (see also Part II, Section 3, Chapter 4).

8.4.4 Voice recordings of air-ground or telephone communications should be retained for a minimum of 30 days, again with the proviso that those for which a need for further retention has been made known shall be destroyed only after special authorization to do so has been received.

8.4.5 Both written records and voice recordings that require retention should also have appropriate arrangements made regarding their storage so as to prevent such data from being tampered with. The storage of voice recordings requires particular attention because, without such safeguards, unintentional or intentional exposure to electromagnetic radiations may occur.

8.4.6 Whenever voice recordings are used as evidence in the investigation or legal proceedings regarding incidents or accidents, it should be kept in mind that such recordings, while factually correct, will not always convey the entire environment in which the information was received at the time of its recording. Voice recordings may therefore give an erroneous impression of the situation; a fact which must be taken into account when interpreting voice recordings.

8.4.7 Based on a recommendation of the Accident Prevention and Investigation Divisional Meeting in September 1979 (Doc 9280), it is now a Recommended Practice that, where radar is being used by ATC, the information so obtained should be recorded in order to assist in the investigation of accidents and/or incidents and in search and rescue cases. In addition, it was felt that such recordings could also be of use in the evaluation of the ATC and/or radar system and serve as a training aid.
8.4.8 When using such recordings in investigations, it should, however, be kept in mind that what has been said in 8.4.6 above with respect to the relative value of voice recordings applies even more so to radar recordings. Recordings based on data as provided by the radar antenna may have little resemblance to what the controller concerned saw on his display at the time of the incident in question because the controller may have used the off-centring device or limited the range on his display to suit his particular needs. To be conclusive, it would be necessary to record the presentation on each display used for control purposes. Furthermore, experience seems to show that, in order to be able to make a reasonable reconstruction of a given situation from recorded radar data, it is necessary to provide for synchronous integration of the related voice recordings and, where automatic data processing equipment is used, of records kept by such equipment. Such a requirement could result in an elaborate installation whose initial and current costs need to be considered in relation to the likely benefits which may be derived from its use. These costs would also have to be assessed in relation to pressing requirements of ATC for other facilities or equipment in order to ensure that proper priorities are given to the acquisition of such a facility.

8.4.9 One point which plays a significant part in the assessment of recorded radar data is the role that the recorded data are expected to have in the investigation of incidents and/or accidents. Such an assessment depends on local factors such as coverage of radar equipment, types and density of traffic observed by the radar in question, likely frequency of occurrence of situations where recorded radar data may be of use, etc.

8.4.10 Recorded radar data may be of use in the evaluation of the ATC system or the performance of the radar equipment, or they may be used for training purposes. However, these possibilities, taken in isolation, will not justify the need for radar data recording.
Part I.— Planning factors
Section 2, Chapter 8.— Requirements for communications

Appendix A

Basic Elements for the Determination of the Need for ATS Air-Ground Communication Channels and their Economic Use

1. DETERMINATION OF THE NEED FOR ATS AIR-GROUND COMMUNICATION CHANNELS

1.1 Description of terms used

In describing the basic elements involved in the determination of the need for ATS air-ground communication channels, the following terms are used:

a) ATS radio control position. That part of an ATS unit performing a specific ATS function requiring the direct and unrestricted access to a VHF air-ground communication channel.

Note.— At present, this requirement is met by assigning a discrete channel for each ATS radio control position.

b) Sector. A defined portion of the airspace within which ATS are provided by one or more ATS radio control positions.

Note.— Normally a sector is part of a control area and/or an FIR/UIR. It can also be a defined area around major aerodromes wherein specific approach control functions are performed.

1.2 Factors to be taken into account

1.2.1 When determining the need for ATS radio control positions, the following factors are taken into account:

a) the amount of air traffic;

b) the configuration of the airspace;

c) the method of control used;

d) effects on the over-all communications workload resulting from the systematic reduction of air-ground communications and/or the use of “silent control”;  

Note.— “Silent control” is a method whereby ATC individually advises aircraft when to make the next report, based on their route of flight and the existing traffic situation.

e) special national requirements;

f) the average capability of the control personnel.

1.2.2 The amount of traffic should be expressed in the following manner:

a) the number of movements of air traffic handled by an ATS unit or part thereof during a given period of time (traffic load);

b) the traffic load handled during a specified seven-day period (weekly traffic load);

c) the traffic load handled during that clock hour in the period chosen in accordance with 1.2.2 b) above during which the highest number of movements occurs (peak traffic load);

d) the traffic load at the busiest instant within the peak hour as defined in 1.2.2 c) above (maximum instantaneous traffic load).

Note.— The values referred to in 1.2.2 b), c) and d) above should also include traffic handled by the relevant ATS radio control position on UHF, if a channel in this frequency band is provided.

1.2.3 Expressing the amount of traffic in the above-described manner and terms will make it possible to compare data obtained (for assessment purposes) with those provided by traffic forecasting groups in those areas where such groups function. If comparisons are required for other areas, the methods of data collection on air traffic movements used by States should be taken into account.

1.2.4 The configuration of the airspace should be broken down into and should take account of:

a) number of ATS routes served;

b) number of intersections of ATS routes;

c) number of major terminal areas and total number of aerodromes (including military) in the area;

d) proportions of aircraft in level flight and in climb or descent;

e) airspeeds and levels used by groups of aircraft constituting a significant portion of the total traffic.

1.2.5 When assessing the method of control used, it is necessary to differentiate between the following methods:
a) procedural control;
b) procedural control supplemented by the use of varying
degrees of primary radar control;
c) radar control based on the use of primary radar;
d) radar control based on the use of secondary surveillance
radar (SSR) with Mode C;
e) use of automatic equipment by the ATS radio control
position;
f) use of automatic data exchange between ATS units.

2. ECONOMY IN THE USE OF ATS AIR-GROUND
COMMUNICATION CHANNELS

2.1 Arrangements for ATS VHF air-ground communica-
tions should be reviewed periodically and, where neces-
sary, corrective measures taken, especially with regard to:
a) the combination of more than one ATS function into
one ATS radio control position;
b) the elimination of discrete channel requirements for the
provision of direction-finding services;
c) the elimination of multiple discrete channel require-
ments for precision approach radar (PAR) purposes;
d) the misuse of emergency frequency 121.5 MHz.

2.2 Stated requirements for VHF air-ground communi-
cation channels serving aerodrome control and approach
functions should be reviewed as a matter of routine in the
light of traffic developments with a view to reducing them
to the minimum, commensurate with the safe and efficient
performance of the services in question. Channel require-
ments thus eliminated should be notified to ICAO so that
if necessary the regional plan concerned can be amended
and frequencies concerned re-assigned for other, justified
purposes.

2.3 When a requirement for two air-ground communi-
cation channels covering the same area has been estab-
lished, i.e. one for the provision of procedural control, the
other for radar control, such a requirement should be
reviewed with a view to the earliest possible combination of
the two ATS functions. Any such combination of functions
and release of a communication channel should be notified
immediately to ICAO.

2.4 Taking account of the increase in general aviation and
non-scheduled commercial operations, it will be permis-
sible to assign more than one air-ground communication
channel for flight information service (FIS) functions
within a flight information region (FIR) in the lower
airspace. However, this should be justified by appropriate
traffic data provided by the State requesting such an
assignment.

2.5 The provision of supplementary services such as
limited FIS on channels reserved for aerodrome control
tower functions or their use for general purpose communica-
tions should only be permissible to the extent that the
performance of such supplementary services does not result
in the need for additional channels.
Appendix B

Table of Uniform Values of Designated Operational Range and Height of VHF Air-Ground Communication Channels for Specific ATS Functions

<table>
<thead>
<tr>
<th>AIR-GROUND COMMUNICATIONS FOR</th>
<th>SYMBOL</th>
<th>RANGE NM (Note 2)</th>
<th>HEIGHT FL</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Aerodrome control, including D/F service</td>
<td>T</td>
<td>25</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Precision approach radar</td>
<td>PR</td>
<td>25</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Automatic terminal information service (ATIS)</td>
<td>AT</td>
<td>60*</td>
<td>200*</td>
<td>*Unless difference values determined by requirements of arriving aircraft</td>
</tr>
<tr>
<td>Approach control (low) including radar control and/or D/F service</td>
<td>(APP) L</td>
<td>25</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Approach control (intermediate) including radar control and/or D/F service</td>
<td>(APP) I</td>
<td>40</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Approach control (high) including radar control and/or D/F service</td>
<td>(APP) H</td>
<td>50</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Area control service (lower airspace) including radar control</td>
<td>(ACC) L</td>
<td>Within specified area</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Flight information service (lower airspace)</td>
<td>F</td>
<td>Within FIR</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Area control service (upper airspace) including radar control</td>
<td>(ACC) U</td>
<td>Within specified area</td>
<td>450</td>
<td>One OFIS channel per UIR may be assigned if no ATC channel is provided. (Note 3)</td>
</tr>
</tbody>
</table>

Note 1.— The figures for service range and height in columns 3 and 4 may be altered in accordance with regional air navigation agreement. However, experience in complex areas has shown that the values indicated here are satisfactory to meet the most demanding situations.

Note 2.— Cases where a significant deviation from circular coverage is possible shall be specified.

Note 3.— The requirements for coverage of VHF channels used for the broadcast of OFIS messages are determined by regional air navigation agreement.
Appendix C

The Reduction of Air-Ground Communications

1. INTRODUCTION

Considerations regarding the reduction of air-ground communications reflects results of trials conducted by EUROCONTROL 1977, in co-operation with the International Air Transport Association (IATA), aimed at a reduction in radiotelephony in specified areas and along selected ATS routes.

2. CONSIDERATIONS

The following considerations should be taken into account in the reduction of air-ground radiotelephony communications between pilots and ATS units:

a) the development of procedures for the reduction of air-ground radiotelephony communications in a specified area requires close co-operation between ground services and the users and should, in any case, include practising controllers. Such co-operation should not only be maintained during the planning stage, but should also continue throughout the initial period of introduction of such procedures to ensure the rapid detection and correction of initial difficulties;

b) reduction of air-ground radiotelephony communications can comprise all or any of the following measures:

1) the systematic elimination of as many compulsory position reports as possible or their transformation into on-request position reports only;

2) the reduction of the content of position reports still required;

3) the reduction of the content of the initial call made by an aircraft when establishing contact with a new ATS unit or sector;

c) in any case, the need for an initial call when entering the area of an ATS unit and a ground-initiated call to an aircraft prior to its leaving that area are considered to be a minimum requirement for air-ground communications;

d) procedures used in order to obtain a reduction of air-ground communications in specific areas should be as uniform as possible throughout the region;

e) measures taken in order to reduce air-ground communications should be published with an advance notice of at least two AIRAC cycles.
Appendix D

Presentation of Detailed Statements by States of New or Changed ATS Requirements for Air-Ground Communication Channels

SAMPLE FORM:

<table>
<thead>
<tr>
<th>FUNCTION TO BE SERVED</th>
<th>SERVICE</th>
<th>STATUS OF FREQUENCY</th>
<th>Remarks by frequency assignment planners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit in charge (for symbols see Appendix B)</td>
<td>Number of channels</td>
<td>Range</td>
<td>Height</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Column 1 — Self-explanatory.
Column 2 — Use symbols as appropriate and as shown in column 2 of Appendix B.
Column 3 — Self-explanatory.
Column 4 — For TWR and APP only insert information if by regional agreement the requirement is in excess of or less than that specified in Appendix B. For ACC and FIC the area of use of each frequency (i.e. a sector) is best referred to by a number and the area itself should be shown on a chart depicting the area in question in sufficient detail for frequency planning purposes.
Column 5 — Insert information only if a specific requirement is different from that established by regional agreement.
Column 6 — Insert the existing assignments, if they have already been made work of frequency assignment planners so that existing assignments of frequencies are respected to the maximum extent possible.
Column 7 — Indicate whether the assignment is required to satisfy international (INT) or national (NAT) requirements.
Column 8 — Indicate whether the frequency shown in Column 7 is already in operation (x) or when it is expected that existing or new assignments will be put into operation by year (1985).
Column 9 — Insert any information which may assist in assessing the planners.
Column 10 — Reserved for remarks by the frequency assignment planners to indicate that specific requirements cannot be met in technical terms as requested and to propose appropriate alternative.
Chapter 9
Advanced ATS Systems

9.1 INTRODUCTION

9.1.1 Apart from adequate and reliable ground-ground and air-ground communications, an air traffic control (ATC) unit applying conventional control methods has comparatively few requirements for additional means and equipment. Experience has shown that if controllers received adequate training and the social and working conditions are reasonably satisfactory, an ATC unit will be able to handle appreciable amounts of air traffic before it will be necessary to introduce advanced air traffic services (ATS) systems.

9.1.2 While sophisticated equipment will, as a general rule, assist in resolving a particularly pressing problem (primarily capacity limitations), it is also likely that its use will create a number of new problems which, while probably of a less urgent nature, will nevertheless require resolution before the full benefit of the new equipment can be obtained. It has also been found that the introduction of such new equipment does not immediately reduce manpower requirements. In many cases, cost savings on the manpower side, when compared with the increase in air traffic, can only be made once the equipment is used close to its full inherent capacity.

9.1.3 The actual introduction and use of advanced ATS equipment generally requires considerable lead times because of budgetary requirements, administrative arrangements or delays in equipment delivery and/or installation by the supplier. These factors must be weighed against the fact that general progress in the technical field moves quickly and, as a result, advanced ATS equipment is likely to be outdated much earlier than is the case with simpler types of equipment. It must therefore be ensured that new equipment has growth potential to accommodate new steps in technology or the addition of new functions to existing tasks.

9.1.4 The decision to acquire advanced ATS equipment requires careful consideration of all aspects involved, including, where appropriate, detailed review at locations and operating conditions comparable to those where it is intended to be used. Such appraisals will help ensure that the anticipated benefits will be achieved with a high degree of probability. It may, at times, be advisable to visit locations where such comparable equipment is in operation.

9.1.5 Some of the equipment discussed in this chapter also requires a number of associated actions which, while not directly related to its operation, are nevertheless indispensable if the equipment is to be brought into use in a timely manner (see Part III, Section 1, Chapter 1). The procurement and use of advanced equipment cannot be decided lightly; it requires the development of a complicated and well-programmed multi-disciplinary approach if delays are to be avoided.

9.2 PRIMARY SURVEILLANCE RADAR

9.2.1 The major reason for the provision of primary surveillance radar (PSR) at a specific location is that traffic density and/or complexity has reached a point where, with the application of conventional non-radar control methods only, it is inevitable that aircraft will encounter unacceptable ATC delays. However, since the installation of radar generally presents one of the larger investments and because its recurrent costs are also far from negligible, it is necessary to ascertain that traffic situations which exceed the capacity achievable with conventional control methods are likely to occur reasonably frequently in order to obtain a positive cost-effectiveness equation, once the radar has been installed.

9.2.2 Experience has shown that, with comparatively few exceptions, the decision to provide radar at a given location is based on much more complex considerations than traffic density and/or complexity versus ATC capacity alone. Topography, prevailing weather conditions, civil-military co-ordination arrangements, national security considerations, as well as considerations of an international nature (e.g. gaps in radar coverage in adjacent countries adversely affecting the flow of air traffic over a wide area) can be significant factors in deciding that radar is justified at a
specific location. In the latter case, to obtain full benefits it is especially important that the location of such a radar should not be decided in isolation by the State concerned, but be made the subject of close co-ordination with neighbouring States. Particular points in question are:

a) the overlap in coverage provided by adjacent radar stations to ensure continuity of radar control between adjacent ATC units;

b) requirements for uniform performance so that compatible methods of radar control, including agreed separation minima, can be applied between such units.

9.2.3 Due to the inevitable interrelationship between operational desirability and technical limitations (e.g. range versus resolution between targets operating in close proximity to each other and renewal rate of radar data), each radar will most likely be a compromise between what ATC would like to have and what the equipment is capable of furnishing. Therefore, early in the planning process, it will be necessary to establish clear-cut priorities as regards the expected operational performance of the radar so that, once the final choice of the equipment has to be made, it is possible to choose between the essential and the desirable elements of its performance.

9.2.4 The standardization of civil radars, desirable as it may be, must be seen against the fact that, in those States where an electronics industry of sizeable proportions exist, the procurement of such equipment constitutes a very important economic factor. As a consequence, the choice of radar equipment may be dictated by other than technical and operational considerations.

9.2.5 The planning for the provision of radar should always start with the determination of the operational requirements, followed by transformation of these requirements into technical specifications. The ultimate choice of the equipment may, however, also have to take account of other, non-technical, aspects. No hard and fast general rules can be formulated regarding the acquisition of radar equipment. Each case must be considered on its own merits and on the understanding that each party concerned (ATC, the technical services and those responsible for financing and procurement) is given full opportunity to express its views and that the views receive equal and adequate consideration.

9.2.6 The provision of radar in a State is (see Part II, Section 3, Chapter 2) generally done on a progressive basis. It is therefore important that the first installation of such equipment should be seen within an over-all plan which will grow as more radars are provided. Such a plan should form a coherent system of radar coverage throughout the airspace where such coverage may eventually be required. If this is not done, costly redundancies and/or duplications of equipment might result. In border areas planning will require close co-ordination with neighbouring States so as to avoid costly and unnecessary overlaps of coverage. In some cases, where digitized transmission of radar data from the radar site is used, it may be possible to arrange for sharing of the radar by ATC units located in adjacent States. Such co-ordination may also result in re-delegation of control responsibility, once full radar coverage in the border area is provided (see Annex 11, 2.7).

9.3 SECONDARY SURVEILLANCE RADAR

9.3.1 All of what has been said above with respect to PSR, also applies to secondary surveillance radar (SSR). When fully developed, SSR is a sophisticated and complex co-operative system requiring aircraft to be capable of playing their technical and operational role in the SSR environment (see also Part II, Section 3, Chapter 2).

9.3.2 The decision to use SSR for the provision of ATS requires close co-operation between States and operators concerned if full benefits are to be derived. As to the co-operation with operators, it is evident that, as long as the majority of aircraft operating in the area where SSR is to be applied are not equipped with transponders capable of responding in the manner in which SSR is intended to be used (e.g. 4096 code capability in Mode A/3 plus Mode C), the operational advantage to ATC is substantially reduced. The decision to make the carriage of suitable transponders a mandatory condition for operation in the airspace concerned can have significant and far reaching technical and operational consequences on at least some of the operators concerned.

9.3.3 It will therefore be essential that, when planning for the use of SSR, all aspects of the operation should be taken into account. Operators concerned should be integrated into the planning process from its start, especially as regards:

a) the manner in which SSR is to be used and the consequent requirements for airborne transponders;

b) the establishment of realistic target dates for starting the use of SSR in the area concerned;

c) the related target dates for the mandatory carriage of suitable transponders by all aircraft intending to operate in its area of use, taking due account of lead times required by operators to procure and install such equipment aboard their aircraft;
d) the development of temporary exemption procedures for those aircraft for which the target date under c) cannot be met and for which a retro-fit is uneconomical because the aircraft useful service life will expire shortly after such a date;

e) the development of special contingency procedures covering the action to be taken in case of temporary failure of transponders aboard aircraft. Such procedures should not only cover the immediate action to be taken but also the conditions under which aircraft return to their home base in reasonably satisfactory conditions (including flight through airspace where SSR is mandatory, if required) before necessary repairs are made;

f) the development of procedures regarding the use of SSR alone without the associated PSR.

9.3.4 Co-operation with neighbouring States should not only cover the question of siting and coverage overlap, as already discussed in 9.2.6 above, but also needs to cover mode and frequency co-ordination and the method of code assignment to be used to ensure that the workload on pilots and ATC is kept within reasonable limits.

9.3.5 A further point which needs careful consideration in the planning of SSR is its growth potential both as regards coverage as well as technical sophistication. As described in Part II, Section 3, Chapter 2, SSR equipment can range from comparatively simple ground facilities to very complex arrangements, especially when it is integrated into an automatic ATC system to provide composite synthetic displays with alphanumeric data presentation for individual flights. To avoid expensive replacements of equipment each time a step towards increased sophistication is made, it is necessary to envisage such steps when the basic SSR equipment is procured so that it will be suitable for future expansion.

9.3.6 In those ATC units where SSR has already reached a high degree of development, it has been found that changes to the airspace configuration (ATS routes, routings in terminal control areas (TMAs), reporting points) and/or its designation are more difficult to effect when these configurations are part of the built-in programme of ground equipment. Experience in the European (EUR) region has shown that a change of the system of designation of significant points (i.e. the introduction of name-codes) required postponement for an appreciable period of time because the re-programming of electronically generated video displays and also of the associated flight data processors of the automated equipment required much more time than originally assumed. It would therefore appear that, when considering the use of SSR, airspace configuration changes are scheduled so that appropriate lead times are provided in order to effect the necessary changes to the software.

9.3.7 Not all aircraft are provided with SSR capability. As a result, it has been considered that the use of SSR without an associated primary radar should be confined to those exceptional cases where it can be ensured that it will not result in unacceptable risks.

9.3.8 As the use of SSR expands and takes account of developments in other fields aimed at the segregation of air traffic according to types of operation (see Part II, Section 4, Chapter 2), it may be possible to arrive at situations where all the traffic, operating within a defined portion of the airspace, i.e. at higher altitudes, will be SSR equipped. If such conditions are created and transponder reliability has reached a point where failures are rare, it may be feasible to rely on SSR without primary radar. Such an arrangement would present a very appreciable economy in the investments required.

9.3.9 It would appear advisable, therefore, to consider the use of SSR alone whenever radar is to be provided in additional portions of the airspace, or in those portions where it is already provided and where primary radar equipment will need replacement. This arrangement would, however, require that information on severe weather phenomena be provided from other sources and superimposed on controllers' displays or shown on a separate display near the controller so that required weather avoidance advice can to be given to aircraft.

9.4 AUTOMATION IN ATC

Because of the particularly close interrelationship between the operational requirements and the technical performance resulting from automated equipment, both aspects have been treated together in Part II, Section 3, Chapter 3. However, a number of basic considerations regarding the use of such automated equipment by ATC remain to be discussed.

9.5 FUTURE DEVELOPMENTS

9.5.1 Much has been written about future development in ATC, making the point that ATC cannot and should not be seen in isolation, neither within the field of air navigation, nor in the field of air transport in general. Events since the energy crisis of 1973 have shown that the
previous, nearly unrelated, side-by-side developments of air navigation and air transport are past history and that the economic and technical aspects of civil aviation will have to be treated as an inseparable entity (e.g. user charges versus technical developments in air navigation or fuel economy versus the organization of the traffic flow).

9.5.2 It can be expected therefore that, in the future, technical developments such as requirements for new or additional navigation aids, sophistication of the ATC system by the provision of complex radar and automation equipment, will be measured more severely against the likely economic benefits derived from them rather than what has been the case in the past. More emphasis is likely to be placed on improving available capacities through better procedural arrangements and voluntary cooperation between operators and administrations rather than on the provision of expensive equipment and related manpower which may, in some cases, be required for only comparatively short time periods of peak traffic.

9.5.3 Calculations made in one State (France) have shown that the improvements, required to increase the capacity of the ATC system to a point where it would be able to cope with 99 per cent of the projected demands imposed on its system, would nearly double its annual costs. However, because of the large seasonal and weekly variations in traffic density in the area in question, the increased capacity thus provided over the existing capacity would only be required 2 to 3 per cent of the total time the ATS system was in operation in the course of a year. The question of the level of capacity to which an ATC system should operate will require more detailed discussion in order that a common policy be established which may serve both States and operators.

9.5.4 In the air navigation field it appears that, within the foreseeable future, a similar process to that already experienced in aircraft development will take place, i.e. that not everything which is technically possible is operationally feasible. However, taking into account the immense variations between States and/or regions in stages of development of the air navigation system in general, the above should not serve as an excuse for not providing those services and facilities which will satisfy those operational requirements which are normally established and agreed upon at regional air navigation meetings of ICAO.

9.5.5 Equipment referred to in this chapter cover the following:

a) primary surveillance radar;
b) secondary surveillance radar;
c) electronic data processing equipment (EDP).
Chapter 10
Information From Other Sources

10.1 INTRODUCTION

10.1.1 As air traffic services (ATS) is normally the ground service which is in most frequent contact with aircraft, it has been charged with the responsibility of providing pilots with information which, while essential for the safe and efficient conduct of a flight, is not always originated by ATS. ATS depends on certain information derived from other sources; information which is required to permit controllers to assess situations and adjust their actions accordingly. ATS may also serve as the intermediary to obtain information from pilots on actual operating conditions required to complete and/or correct information available to the ground services concerned.

10.1.2 Services most concerned with providing additional information are:

a) the meteorological service (MET);

b) the aeronautical information service (AIS);

c) the aerodrome operating agencies;

d) the communication services (COM) as regards both the aeronautical mobile service and that dealing with the operation of radio navigation aids.

10.1.3 It will be necessary to conclude arrangements for information with each of the services mentioned above. These arrangements should outline all aspects of cooperation between ATS and the services involved, including responsibility regarding the type of information required, its periodic updating and renewal in case of sudden and significant changes and the format in which the information is to be provided. In the case of renewing information, it is also important that both ATS and the cooperating service concerned are reasonably familiar with each others' operation in order to have a clear understanding of the other duties each of the services is required to perform. This understanding applies particularly to ATS whose primary duties are to provide the required service to aircraft in flight and which, for this reason, must take priority over any other tasks.

10.1.4 Many local factors such as the location of the services in relation to each other, the type and amount of facilities involved, respective responsibilities and reporting lines, etc. are involved in the organization of this collaboration. It is therefore not possible to establish firm, uniform provisions in this field other than to ensure that the information exchange must work with least delay or administrative complications and without friction. It would appear that mutual respect for the other's task can best be fostered by frequent contacts between the personnel directly concerned and close familiarity with their work.

10.2 EXCHANGE OF INFORMATION WITH THE METEOROLOGICAL SERVICE (MET)

10.2.1 The provisions regarding meteorological information required by the different ATS (aerodrome control tower, approach control (APP), area control centre (ACC), flight information centre (FIC)) are contained in Annex 11, Chapter 7. ICAO Doc 9377 — Manual on Coordination between Air Traffic Services and Aeronautical Meteorological Services also provides pertinent information. However, there are a number of detailed aspects which need consideration in the development of appropriate co-operative arrangements. In the case of relations between a TWR and/or an APP with the local MET service, it is particularly important that provisions regarding assistance to aircraft encountering severe weather phenomena (thunderstorms, hail, etc.), be developed. Such provisions should cover:

a) the occasions when such data will be required;

b) the sources from which data on such phenomena will be derived (MET weather radar, ATC radar, pilots' reports);

c) the manner in which such data will be presented to AIS;

d) the conditions which will require update or cancellation of previously provided data.
10.2.1.1 Such data as described above should be used by ATS to provide aircraft with information on severe weather sufficiently in advance and should offer routings which will keep aircraft away from areas where the weather persists.

10.2.2 Where necessary because of local conditions, arrangements should also be made between TWRs and APPs and the local MET services which ensure that critical changes in the MET situation (e.g. icing conditions, etc.), which have occurred between the time of the MET briefing of a pilot and his actual departure, are brought to the pilot’s attention by the TWR or ACC before take-off so that these changes can be taken into account by the pilot concerned.

10.2.3 As regards the co-operation between ACCs or FICs and the appropriate MET service, the main problem appears to be ensuring that the MET information is provided in meaningful terms and adjusted to the traffic situation with which ACCs and FICs are confronted, i.e. that the information is of interest to both the ACC/FIC and to aircraft because the aircraft are likely to be exposed to the reported conditions. To achieve this, some States have placed MET personnel in ACCs/FICs so they are directly aware of the actual traffic situation and working conditions and can co-ordinate their contributions in the most effective manner. This co-ordination and appreciation also applies whenever the MET services require MET information from aircraft in flight. In other States, other arrangements have been found to also give satisfactory results (intercom lines between MET and ATS, closed circuits, television, etc.). In any case the type and amount of MET information provided should be determined by the needs of operators and pilots and by ATS as far as the information affects the provision of ATS and not by administrative considerations of the MET services only.

10.3 EXCHANGE OF INFORMATION WITH THE AERONAUTICAL INFORMATION SERVICE (AIS)

10.3.1 ATS units must be kept fully informed about the air navigation situation in their own area of responsibility and also in adjacent areas to the extent that such information may have an influence on the flow of air traffic of concern to them (e.g. status of radio navigation aids, military exercises, etc.). It is therefore essential that designated aeronautical information services (AIS) units provide the associated ATS units with the latest information available to them. In addition, as regards TWRs and APPs, arrangements should be made which cover those cases where new information has come to hand between the time of pilot briefing by AIS and his departure, which could affect the conduct of his flight in a significant manner and which, therefore, needs to be brought immediately to his attention.

10.3.2 A further point which needs co-operative efforts concerns the manner in which changes to the ATS system requiring NOTAM action should be notified to the AIS unit concerned for the issue of an appropriate NOTAM. Points in question in this respect are:

a) the contents of the NOTAM;
b) its expected period of validity;
c) its editorial arrangement, including the use of the NOTAM code to the maximum extent possible.

10.3.3 Arrangements should also cover the manner in which AIS will participate in the development of material which eventually results in changes to an aeronautical information publication of longer validity (e.g. changes to routings, re-sectorization of ACCs, etc.). To give AIS sufficient lead time in the editorial preparation of the material (e.g. new charts, revised texts) ATS material should be provided well ahead of its date of application (e.g. compliance with the agreed AIRAC cycle).

10.3.4 Appropriate agreements between ATS and AIS units should cover:

a) the area of interest for which AIS data are required by the ATS unit concerned;
b) the type of information which is required, especially as regards other areas for which the ATS unit is not directly responsible;
c) the manner in which such information is to be provided to AIS;
d) those cases where AIS should notify an aerodrome control tower or APP of a specific change which needs to be brought to the attention of pilots about to take off;
e) the manner in which ATS will notify AIS on matters which require the issue of a NOTAM or other aeronautical information publication;
f) the manner in which AIS is to participate in work of ATS which will eventually result in changes requiring the issue of an aeronautical information publication (NOTAM, amendment to the aeronautical information publication (AIP) or Aeronautical Information Circular (AIC)).
10.4 INFORMATION FROM AERODROME OPERATORS

10.4.1 Aerodrome control towers and APPs should be kept currently informed about the status of the aerodromes for which they are providing services. In cases where the ATS and the aerodrome services are provided by the same authority, only appropriate inter-service arrangements are required. However, when the airport authority is a semi-autonomous or completely independent authority, it will be necessary to reach very clear-cut arrangements regarding co-operation and respective responsibilities of ATS and the airport operator. These arrangements should not only cover the exchange of information regarding the status of services and facilities at the aerodrome in question but should also include information on planned or actual maintenance and/or construction work on the air side of the aerodrome, including details of temporary obstructions resulting from such work and affecting the provision of ATS. Such provisions should also cover the manner in which aerodrome services should comply with specific ATS requirements. More obvious cases in question are restoration of faulty visual aids to service, instructions to the fire fighting services when aircraft require their assistance, and other situations such as standby locations for landings under difficult conditions, provision of emergency aid for passengers in a critical situation, special security measures in case of unlawful interference, etc.

10.4.2 Where appropriate, such arrangements should also cover the prompt reporting of runway conditions when water, slush, snow or ice are present and their removal by the speediest means in a manner which interferes least with the actual and/or expected traffic flow.

10.4.3 ACCs and FICs require more general information on the operating status of aerodromes within their area of responsibility. This information should normally be provided to them by the local AIS unit, if one exists at the aerodrome concerned. However, in the case of uncontrolled aerodromes special arrangements will have to be concluded between the ACC/FIC and the aerodrome operators concerned, ensuring the provision and updating of such information in the most suitable manner.

10.4.4 It would also be normal to deal here with the question of visual aids for departure and approach because these aids are in many cases installed and maintained by the aerodrome operator. However, since they are complementary to the non-visual aids serving the same purpose, requirements for information are discussed in 10.5.4 below.

10.5 EXCHANGE OF INFORMATION WITH THE COMMUNICATIONS SERVICES (COM) FIXED AND MOBILE COMMUNICATIONS

10.5.1 ATS units should be kept currently informed about the status of ground-ground communication circuits used by them for ATS purposes. This applies particularly to voice circuits between adjacent ATS units. In case of failure of any of these circuits, the ATS unit should be kept informed by the COM service of the expected time of restoration to full service of the faulty circuit and of alternative means which may be used in the meantime to compensate for the temporary loss of the circuit in question.

10.5.2 Since air-ground communication channels normally come under the complete control of the civil aviation authority, it should be ensured that, apart from timely information on their status, their restoration to full service is given top priority to keep repercussions on the operation of the ATS system as small as possible. Restoration priority also applies to the full or partial failure of recording equipment, used to record telephone and/or radio voice communications.

10.5.3 ACCs and FICs must be provided with current information on the operating status of radio navigation aids used during the en-route phase of flight and in TMAs. Such information is essential to confirm that flights are able to conduct their flight as planned or cleared, except in those cases where individual aircraft encounter failure of their own equipment. It is therefore necessary to provide ACCs/FICs with appropriate control indicators to permit controllers to verify the operating status of the aids with which they are directly concerned. This can be done in a number of ways: one central indicator board showing the over-all situation; individual indicators related to sectors, etc. The arrangement chosen for a particular unit will depend very much on its layout and the working arrangements used. Whatever the arrangement, it must be ensured that such information is readily available, reflects the current situation and is presented so that it is easy to interpret.

10.5.4 As to radio navigation aids and visual aids used for approach and departure, the requirements for immediate and current information are particularly stringent. Detailed specifications regarding this matter have been developed and are contained in Appendix A. Indicators showing the status of these aids should be arranged so that controllers can see with one glance the current status of all the aids serving for approach or departure.
Appendix A

Provision of Information to ATS Units in Respect of Visual and Non-Visual Aids

1. Air traffic controllers and pilots have stringent requirements regarding up-to-date information on the operational status of those non-visual and visual aids which are essential to the departure, approach and landing phases of flight at a given location. The stringency assumes particular significance during weather conditions requiring the conduct of Category II and III approaches. Consequently, it is essential that air traffic controllers be provided with information on any failure of such aids or any degradation of their operational status on a timely basis. The timeliness required for the provision of this information will vary according to the service provided by the ATS unit involved and the use made of the aid(s) involved.

2. The ATS unit will need to be provided an indication of failure or malfunction in a readily intelligible form and without delay. Displays in ATS units should preferably be by remoted indicators rather than by actual monitors. Additionally, the indicators should be located at the ATS working position(s) where the information is needed. The alerting device should give a visual indication to the controller accompanied by an aural alarm of sufficient duration to attract his attention. It is important that the indications reflect the operational status of the aid rather than merely whether or not electrical power is reaching the particular installation.

3. The following principles provide general guidance regarding the provision of information to ATS units in respect to visual and non-visual aids:

a) An approach control service which employs standard instrument arrival procedures requires information on:

1) the non-visual aids which define those procedures;
2) the operational status of non-visual aids used for initial and intermediate phases of instrument approach procedures for the aerodrome(s) for which it has responsibility;
3) the operational status of visual and non-visual aids used for the final approach and landing phases of instrument approach procedures for the aerodrome(s) for which it has responsibility;
4) the operational status of visual and non-visual aids used for initial track guidance at and immediately following take-off, and those navigation aids used for turning points for instrument departure procedures.

b) An aerodrome control tower requires information on the operational status of visual and non-visual aids used for approach, landing and take-off at the aerodrome with which it is concerned.

c) An area control centre which provides clearances to aircraft executing instrument approach procedures and/or instrument departure procedures at aerodromes for which there is no other established ATC unit providing approach control service requires information on the operational status of visual and non-visual aids used for approach, landing, take-off and initial climb at such aerodromes.

d) A flight information centre requires information on the operational status of visual and non-visual aids used for approach, landing and take-off at aerodromes within its areas of responsibility for which there is no established ATC unit providing approach control service.

4. The application of the above principles is shown in the following table.
### Table 1. Application of the provision of information to ATS units in respect of visual and non-visual aids

<table>
<thead>
<tr>
<th>Principle</th>
<th>Specific phase of operation</th>
<th>Visual and non-visual aid(s) the status of which is important to the ATS unit</th>
<th>Required by which ATS unit</th>
<th>Optimum time requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At locations where approach control service is provided by an approach control office</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Inbound on a standard (instrument) arrival procedure</td>
<td>Those VORs and any other NAVAIDs on which the procedure is based</td>
<td>APP</td>
<td>Not more than 2 minutes</td>
</tr>
<tr>
<td>B</td>
<td>Initial and intermediate phases of approach</td>
<td>The NAVAID(s) and any secondary aids upon which these phases of the approach are based</td>
<td>APP</td>
<td>Not more than 2 minutes</td>
</tr>
<tr>
<td>C</td>
<td>Final approach and landing following an instrument approach</td>
<td>Those aids used for the final approach and landing phases of the approach procedures in use</td>
<td>APP, and TWR if appropriate</td>
<td>Without delay (see note)</td>
</tr>
<tr>
<td>D</td>
<td>Take-off and initial climb phases of instrument departure procedure</td>
<td>Those aids used for the runway and departure procedure in use</td>
<td>TWR and/or APP, as appropriate</td>
<td>Without delay (see note)</td>
</tr>
</tbody>
</table>

At locations where approach control service is provided by an area control centre

| E         | Approach, landing and take-off | The existing aids of those described in this column for Principles B, C and D | TWR | Same time requirement as listed above for the pertinent principles concerned |
| F         | Approach, landing, take-off and initial climb | The existing aids of those described in this column for Principles B, C and D | ACC (at those locations where there is no TWR) | Not more than 2 minutes |

At locations where approach control service is not provided

| G         | All phases | All such existing aids | FIC | Not more than 5 minutes |

**Note.**—Reporting requirements to ATS units are specified in Annex 10 for non-visual navigation aids and in Annex 14 for visual aids.