ICAO

Circular 347

Aircraft Tracking Implementation Guidelines

For Operators and Civil Aviation Authorities

Approved by and published under the authority of the Secretary General

INTERNATIONAL CIVIL AVIATION ORGANIZATION

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GLOSSARY

ACRONYMS AND ABBREVIATIONS

4D	Four-dimensional
ACARS	Aircraft communications addressing and reporting system
ADS	Automatic dependent surveillance
ADS-B	Automatic dependent surveillance – broadcast
ADS-C	Automatic dependent surveillance – contract
AIP	Aeronautical Information Publications
ANP	Air navigation plan
ANSP	Air navigation service provider
AOC	Air operator certificate
ASG	Area specific guidance
ATC	Air traffic control
ATM	Air traffic management
ATS	Air traffic services
ATSU	Air traffic services unit
EPIRB	Emergency position-indicating radiobeacon station
FIR	Flight information region
FOO	Flight operations officer/flight dispatcher
GADSS	Global Aeronautical Distress and Safety System
IFE	In-flight entertainment systems
LRCS	Long-range communication system
MEL	Minimum equipment list
NATII	Normal aircraft tracking implementation initiative
OFP	Operational flight plan
RCC	Rescue coordination centre
SAR	Search and rescue
SARPs	Standards and Recommended Practices
SATCOM	Satellite communications
SELCAL	Selective calling system
SMS	Safety management system
SOP	Standard operating procedures
TTX	Table top exercise
USOAP	Universal Safety Oversight Audit Programme
WPR	Waypoint position reporting

DEFINITIONS

Aircraft tracking. A process, established by the operator, that maintains and updates, at standardized intervals, a ground-based record of the four dimensional position of individual aircraft in flight. (Annex 6, Part I, Section 3.5, Aircraft tracking).

Air traffic service (ATS). 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). (Annex 11, Chapter 1, Definitions).

4D/15 service. In the provision of air traffic services an ATS unit receives four-dimensional (latitude, longitude, altitude, time) position information at 15-minute intervals or less from suitably equipped aircraft.

4D/15 tracking. The operator obtains four-dimensional (latitude, longitude, altitude, time) aircraft position information at 15-minute intervals or less.

Flight operations officer/flight dispatcher. A person designated by the operator to engage in the control and supervision of flight operations, whether licensed or not, suitably qualified in accordance with Annex 1 — *Personnel Licensing*, who supports, briefs and/or assists the pilot-in-command in the safe conduct of the flight. (Annex 6, Part I, Chapter 1, Definitions).

Flight plan. Specified information provided to air traffic services units, relative to an intended flight or portion of a flight of an aircraft. (Annex 6, Part I, Chapter 1, Definitions).

Oceanic area. Airspace which overlies waters outside the territory of a State.

Operational control. The exercise of authority over the initiation, continuation, diversion or termination of a flight in the interest of the safety of the aircraft and the regularity and efficiency of the flight (Annex 6, Part I, Chapter 1, Definitions).

Operational control personnel. Flight operations officers, flight dispatchers or other appropriately trained individuals designated by the operator to engage in the control and supervision of flights and/or be assigned operational control responsibilities, duties, or tasks.

Operational flight plan. The operator's plan for the safe conduct of the flight based on considerations of aeroplane performance, other operating limitations and relevant expected conditions on the route to be followed and at the aerodromes concerned. (Annex 6, Part I, Chapter 1, Definitions).

Note 1.— Information relevant to determining the extent that waters form part of the territorial sea may be found in the United Nations Convention on the Law of the Sea*.*

Note 2. — Definitions unique to this circular do not contain a source reference annotation.

REFERENCES

United Nations Convention on the Law of the Sea

ICAO documents

Annex 1 — *Personnel Licensing*

Annex 6 — Operation of Aircraft, Part I — *International Commercial Air Transport — Aeroplanes*

Annex 11 — *Air Traffic Services*

Annex 15 — *Aeronautical Information Services*

Annex 19 — *Safety Management*

Global Aeronautical Distress and Safety System (GADSS) – Concept of Operations – Version 5.12 Draft

Training Manual, Part D-3 — *Flight Operations Officers/Flight Dispatchers* (Doc 7192)

Manual of Procedures for Operations Inspection, Certification and Continued Surveillance (Doc 8335)

Safety Management Manual (SMM) (Doc 9859)

Chapter 1

INTRODUCTION

1.1 BACKGROUND

1.1.1 Following the loss of Malaysian Airlines flight MH370, a special multidisciplinary meeting on global flight tracking (MMGFT) was held at the Headquarters of the International Civil Aviation Organization (ICAO) on 12 and 13 May 2014. Participants included States represented on the ICAO Council and States having nominated members to the Air Navigation Commission, as well as representatives of industry and ICAO panels. The participants in the meeting were invited to explore, among other things:

a) the need and means available to track all airline flights;

b) the need for ICAO guidance on global aircraft tracking; and

c) the potential for strengthening ICAO provisions.

1.1.2 Upon completion of this special meeting, consensus was reached among Member States and representatives of the international air transport industry on a near-term strategy to track flights, regardless of their location or destination. The meeting also established a Global Aeronautical Distress and Safety System (GADSS) framework for future medium- and long-term efforts.

1.1.3 Subsequent to the special meeting, a “concept of operations” on aircraft tracking was drafted, which defined the roles and responsibilities of all the stakeholders and the objectives of aircraft tracking, in order to ensure the timely provision of information to the appropriate personnel to support search and rescue (SAR), and recovery and accident investigation activities. A final high-level concept of operations was delivered at the Second ICAO High-level Safety Conference (HLSC 2015), held from 2 to 5 February 2015 at ICAO Headquarters.

1.1.4 The HLSC 2015 produced several recommendations on finalizing aircraft tracking Standards and Recommended Practices (SARPs) and related guidance material. Recognizing the compelling need for a routine aircraft tracking solution in the short term, as determined by the MMGFT and supported by the HLSC 2015, proposed the expeditious implementation of routine aircraft tracking.

1.1.5 To achieve this, the Normal Aircraft Tracking Implementation Initiative (NATII) was formed on 19 February 2015. It was tasked with leading a multinational implementation initiative designed to demonstrate best use of present-day equipment and integrate the outcome into guidance material. The initiative would include, but not be limited to, operator flight monitoring, air traffic services (ATS), SAR and civil/military cooperation. Additionally, the HLSC 2015 agreed that planning of the activities should begin shortly after the conference and conclude by 31 August 2015 in order to enhance the guidance material used to advance aircraft tracking procedures.

1.2 PURPOSE

1.2.1 The SARPs in ICAO's Annex 6 — *Operation of Aircraft*, Part I — *International Commercial Air Transport — Aeroplanes*, Section 3.5 were adopted by the Council to expedite the implementation of a near-term and routine aircraft tracking solution. This circular was developed as part of the NATII and is intended to support the implementation of operator aircraft tracking policies, processes and procedures. Its purpose is to provide Information for regulators and operators on how to implement the SARPs, which will become applicable on 8 November 2018.

1.2.2 The information contained in this circular is based on current industry best practices and on the use of readily available or emerging technologies. It is intended to support the uniform implementation of the aircraft tracking SARPs and complies with the Recommendations of the Second ICAO High-level Safety Conference (HLSC 2015).

Chapter 2

AIRCRAFT TRACKING REQUIREMENTS

2.1 INTRODUCTION

2.1.1 Routine aircraft tracking under normal conditions is a core component of GADSS. Aircraft tracking is a near-term objective of GADSS. It is the first step necessary to move from current systems towards the GADSS target concept, which addresses the growing consensus in the global aviation community that the location of an aircraft should always be known. Aircraft tracking is a near-term solution intended to leverage existing technologies to:

a) assist in the timely identification and location of aircraft;

b) reduce the reliance on the procedural methods used for determining aircraft position;

c) help to ensure the availability and sharing of accurate aircraft position data (with the relevant entities); and

d) help to improve the effectiveness of air traffic services unit (ATSU) alerting and support SAR.

2.1.2 One objective of the aircraft tracking SARPs is to set an automated four-dimensional position reporting interval of 15 minutes or less (recommended in all areas of operation and required in oceanic areas). This standardized reporting interval is intended to ultimately reduce the time necessary to resolve the status of an aircraft or, when necessary, help to locate an aircraft.

2.1.3 The SARPs also allow stakeholders to meet tracking requirements using available and planned technologies and procedures, as necessary. In general, the SARPs:

a) do not introduce any changes to current air traffic control (ATC) procedures;

b) establish operator responsibilities for tracking their aircraft based on areas of operation;

c) are not technology specific; and

d) establish communication protocols between the operator and ATC.

Note 1.— Except as provided in Annex 6, Part I, 4.6.1 (c), aircraft tracking in accordance with Annex 6, Part I, 3.5 is not required for the safe conduct of a flight.

Note 2.— This circular provides guidance to supplement broader State requirements related to the operation and operational control of a particular flight or series of flights. In all cases, however, operators remain responsible for ensuring that their personnel comply with the laws, regulations and procedures of those States in which operations are conducted in accordance with Annex 6, Part I, 3.1.1.

2.2 UNDERSTANDING THE AIRCRAFT TRACKING SARPS

2.2.1 The SARPs introduced in Annex 6, Part I, Amendments 39 and 42 define aircraft tracking provisions that encompass operator responsibilities related to establishing the following:

a) processes to maintain a ground-based record of the position of individual aircraft in flight and that underlie all aircraft tracking SARPs (Annex 6, Part I, 3.5.1);

b) automated aircraft position determination and tracking interval recommended in all areas of operation (Annex 6, Part I, 3.5.2);

c) automated aircraft position determination and tracking interval required in oceanic areas (Annex 6, Part I, 3.5.3);

d) tracking data retention requirements (Annex 6, Part I, 3.5.5);

e) risk assessment process required when a flight or series of flights will commence when a recommended or required automated reporting interval is unachievable (Annex 6, Part I, 3.5.4); and

f) ground-based flight monitoring and ATSU notification requirements (Annex 6, Part I, 4.6.1).

Note.— Refer to Definitions for the terms 4D/15 service and 4D/15 tracking. These terms are used extensively throughout this circular as a form of shorthand to identify the entity responsible for receiving or obtaining 4D aircraft position data.

2.2.2 The remainder of this chapter will explain the SARPs in general terms to help give operators a basic understanding of aircraft tracking under normal conditions. It will also assist in the practical application of the SARPs, a subject that is addressed in greater detail in subsequent chapters.

2.2.3 Annex 6, Part I, 3.5.1 states:

> 3.5.1 The operator shall establish an aircraft tracking capability to track aeroplanes throughout its area of operations.

2.2.3.1 The principal intent of this SARP is to ensure that operators develop and implement the operational control capability to track their aeroplanes throughout the area(s) of operations defined in the air operator certificate (AOC) and related operations specifications. This aircraft tracking capability is defined in Annex 6, Part I and is applicable to operators of aircraft engaged in commercial air transport operations. It refers to a capability that maintains and updates, at standardized intervals, a ground-based record of the position of individual aircraft commensurate with their intended operations.

2.2.3.2 This SARP and its interrelationships with the subsequent aircraft tracking SARPs needs to be understood so as to ensure the uniform implementation of any aircraft tracking capability. In addition to the principal intent described in the preceding paragraph, it is important to note that Annex 6, Part I, 3.5.1:

a) establishes an aircraft tracking capability for operators of all commercial air transport aircraft, although it is particularly applicable to those not already encompassed by the aircraft tracking specifications of Annex 6, Part I, 3.5.2 and 3.5.3. The complexity of this capability would be commensurate with the complexity, breadth and scope of the operations conducted by the operator;

b) is typically considered a baseline operational control capability that can facilitate the implementation of additional aircraft tracking capabilities defined in Annex 6, Part I, 3.5.2 and 3.5.3. An assessment of

this baseline capability, by the operator, is usually the starting point for the aircraft tracking implementation activities detailed in Chapter 3;

c) does not impose additional aircraft tracking requirements on operators already in conformity with Annex 6, Part 1, 3.5.2 and 3.5.3;

d) requires that a ground-based record of aircraft position data be maintained by the operator at "standardized" intervals. A specific interval, however, is not defined and is at the discretion of the operator and/or their civil aviation authority (CAA);

e) does not require that aircraft tracking data be obtained through automated reporting; and

f) ensures aircraft tracking data are obtained for retention by the operator and to assist SAR in accordance with Annex 6, Part I, 3.5.5.

Note 1.— Annex 6, Part I, 3.5.1 does not specifically refer to a "ground-based record" or "4-dimensional position data". These elements are derived from the definition of aircraft tracking in Annex 6, Part I, Chapter 1.

Note 2.— Refer to Definitions for the Annex 6, Part I definition of aircraft tracking and operational control.

2.2.4 Annex 6, Part I, 3.5.2 states:

> 3.5.2 **Recommendation.—** *The operator should track the position of an aeroplane through automated reporting at least every 15 minutes for the portion(s) of the in-flight operation(s) under the following conditions:*
>
> *a) the aeroplane has a maximum certificated take-off mass of over 27 000 kg and a seating capacity greater than 19; and*
>
> *b) where an ATS unit obtains aeroplane position information at greater than 15-minute intervals.*
>
> *Note.— See Annex 11, Chapter 2, for coordination between the operator and air traffic service providers regarding position report messages.*

2.2.4.1 This recommends that aeroplane 4-dimensional (4D) position information be obtained using automated reporting means at 15-minute intervals or less. It is important to note that this is a recommended practice applicable in all areas of operations defined in the air operator certificate (AOC) and related operations specifications. Given the low take-off mass threshold, it is applicable to a wide range of aircraft.

2.2.4.2 This SARP is intended to expand the aircraft tracking capability defined by 3.5.1, as it specifies a standardized automated reporting interval. It also encompasses areas that are not addressed by the specifications of 3.5.3. Like 3.5.3, however, it relies on aircraft position data being obtained (by the operator) through automated reporting. This is intended specifically to preclude a negative impact (from a human-factor perspective) on the workload of the flight crew members.

2.2.4.3 The term "4D/15 service" is used when an aircraft is in an area where position information is received by an ATSU. The term "4D/15 tracking" is used when such information is obtained by the operator. The premise is that automatically capturing aircraft position data, either by an ATSU or the operator, can be used to fulfil aircraft tracking recommendations or requirements. In other words, an operator may suspend its own 4D/15 tracking in areas where 4D/15 service is available, although aircraft tracking in accordance with Annex 6, Part I, 3.5.1 remains applicable.

Note.— Although 3.5.2 is a recommended practice, to avoid duplication, much of the guidance with respect to an operator's responsibility to obtain aircraft position information is identical to the guidance provided for 3.5.3.

2.2.5 Annex 6, Part I, 3.5.3 states:

> 3.5.3 The operator shall track the position of an aeroplane through automated reporting at least every 15 minutes for the portion(s) of the in-flight operation(s) that is planned in an oceanic area(s) under the following conditions:
>
> a) the aeroplane has a maximum certificated take-off mass of over 45 500 kg and a seating capacity greater than 19; and
>
> b) where an ATS unit obtains aeroplane position information at greater than 15-minute intervals.
>
> *Note 1.— Oceanic area, for the purpose of aircraft tracking, is the airspace which overlies waters outside the territory of a State.*
>
> *Note 2.— See Annex 11, Chapter 2, for coordination between the operator and air traffic services providers regarding position report messages.*

2.2.5.1 In contrast to the Recommendation in 3.5.2, 3.5.3 establishes a required automated reporting interval applicable to aeroplanes that is to be maintained in oceanic areas either by the operator or by the relevant ATSU. In other words, 4D/15 tracking in accordance with 3.5.3 is applicable only in oceanic areas where a 4D/15 service is unavailable (e.g. when aircraft is not suitably equipped to allow an ATSU to receive its position data).

2.2.5.2 Conformance with this SARP requires the operator to determine, prior to flight commencement, whether an aircraft can participate in an available 4D/15 service or whether 4D/15 tracking will be required (note the use of the word “planned” in 3.5.3 above). This means the operator would have a reasonable certainty of being able to meet aircraft tracking requirements by the time the planning stage for the flight was complete. It does not imply a requirement on the part of the ATSU to provide a 4D/15 service.

2.2.5.3 If a 4D/15 service or 4D/15 tracking becomes unavailable after flight commencement, there is no implied requirement for the operator to have a backup means for 4D/15 tracking. And, once airborne, if the aircraft operates outside of the planned route or area (e.g. unplanned diversion) and is unable to maintain a 4D/15 service or undertake 4D/15 tracking, the operation may continue.

> *Note.— Refer to Chapters 4 and 5 for additional pre-and post-flight commencement considerations.*

2.2.6 Annex 6, Part I, 3.5.4 states:

> 3.5.4 Notwithstanding the provisions in 3.5.2 and 3.5.3, the State of the operator may, based on the results of an approved risk assessment process implemented by the operator, allow for variations to automated reporting intervals. The process shall demonstrate how risks to the operation resulting from such variations can be managed and shall include at least the following:
>
> a) capability of the operator’s operational control systems and processes, including those for contacting ATS units;
>
> b) overall capability of the aeroplane and its systems;
>
> c) available means to determine the position of, and communicate with, the aeroplane;
>
> d) frequency and duration of gaps in automated reporting;
>
> e) human factors consequences resulting from changes to flight crew procedures; and

f) specific mitigation measures and contingency procedures.

Note.—. Guidance on development, implementation and approval of the risk assessment process which allows for variations to the need for automatic reporting and the required interval, including variation examples, is contained in the Aircraft Tracking Implementation Guidelines *(Cir 347).*

2.2.6.1 The intent of this SARP is to define the criteria that would allow operators, based on the results of a specific risk assessment process, to vary from the automated reporting requirement and associated interval(s) specified in Annex 6, Part I, 3.5.2 and/or 3.5.3. The SARP should only be used as a means to cover specific situations where the technical challenges/limitations or the level of exposure may not support or warrant 4D/15 tracking.

2.2.6.2 The SARP is neither an alternative to compliance with aircraft tracking provisions nor does it relieve operators of the responsibility to track their aircraft. It simply defines a risk-based methodology that allows for the commencement of a flight or series of flights when the recommended or required automated reporting interval is not achievable in accordance with either 3.5.2 or 3.5.3.

2.2.6.3 Some of the circumstances when this SARP is envisaged to be applied include the following singular (e.g. one-off) or long-term (e.g. continual) scenarios:

a) aircraft equipment failure prior to dispatch (commencement) rendering 4D/15 tracking unserviceable;

b) systemic (non-aircraft dependent) failure rendering 4D/15 tracking unachievable;

c) regular short exposure to lack of 4D/15 coverage (e.g. short A to B flights);

d) temporary airspace closures that may force unequipped aircraft onto routes that would typically require 4D/15 tracking;

e) technologically challenging areas (e.g. polar routes); and

f) other scenarios where, subject to risk assessment results, the technical challenges or the level of exposure may not warrant or justify 4D/15 tracking.

2.2.6.4 The risk assessment process described by the SARP is intended to be strategic in nature and scope. It is not intended, for example, that a specific risk assessment be conducted on a flight-by-flight basis by operational control personnel or the flight crew. Rather, the risk assessment process would be used by the operator to develop mitigations that would be embedded in policy and procedure. This would, in turn, allow for flight commencement (dispatch) in accordance with the outcome of the process and resultant policy and procedure.

Note 1.— It is not intended that the State would have to review and approve each individual occasion when the risk assessment process was applied or a risk assessment conducted. The risk assessment process and related considerations are dealt with in detail in Chapter 4.

Note 2.— For the purpose of achieving conformity with this SARP, the specified risk management activities are applicable any time an operator accepts the 4D/15 tracking responsibility in accordance with either Annex 6, Part I, 3.5.2 or 3.5.3.

2.2.7 Annex 6, Part I, 3.5.5 states:

3.5.5 The operator shall establish procedures, approved by the State of the Operator, for the retention of aircraft tracking data to assist SAR in determining the last known position of the aircraft.

Note.— Refer to 4.2.1.3.1 for operator responsibilities when using third parties for the conduct of aircraft tracking under 3.5.

2.2.7.1 This SARP establishes an operator's aircraft tracking data retention responsibility. The principal intent of the SARP is to ensure the availability of tracking data that would assist SAR in locating an aircraft.

Note.— The obligation to retain data only applies to the operator's aircraft 4D/15 tracking data that would aid in the determination of an aircraft's position in the event of an accident.

2.2.8 Annex 6, Part I, 4.6.1 states:

> 4.6.1 A flight operations officer/flight dispatcher in conjunction with a method of control and supervision of flight operations in accordance with 4.2.1.3 shall:
>
> . . .
>
> d) notify the appropriate ATS unit when the position of the aeroplane cannot be determined by an aircraft tracking capability and attempts to establish communication are unsuccessful.

2.2.8.1 This SARP is applicable to operators that use a flight operations officer/flight dispatcher (FOO) in conjunction with a method of control and supervision of flight operations. It establishes the requirement for an FOO to notify the relevant ATSU in the event of a missed position report from an aircraft that cannot be resolved due to the FOO's inability to communicate with that aircraft.

Note.— Responsibilities for all operators, including those that do not use FOOs, are addressed in Chapters 4 through 7 of this circular.

2.3 AREAS OF OPERATIONS

2.3.1 Annex 6, Part I, 3.5.1 specifies that an operator must establish an aircraft tracking capability to track aeroplanes throughout its area of operations as defined in the AOC and related operations specifications. To achieve this, the operator must first define the scope of its operations to be encompassed by its aircraft tracking processes.

2.3.2 In the development and application of operator policy, process and procedures, many operators already subdivide or classify their operations according to geographic areas. This facilitates the development of area specific guidance (ASG), which could also be adapted to address aircraft tracking. In defining such areas, each operator decides on the level of detail, which is typically driven by differences in operational procedures required for each area of operation. In developing the guidance, it is also typical to identify procedural elements common to all areas of operation.

2.3.3 Figure 2-1 is a representation of how an operator might choose to identify its area(s) of operations for the purpose of establishing the scope of its aircraft tracking capabilities and developing guidance material both for operational control personnel and for flight crew. Such a representation could also be helpful in identifying those areas where an ATSU obtains aeroplane position information in accordance with the criteria in Annex 6, Part I, 3.5.2 and/or 3.5.3. Once all such areas are defined, the specific details of aircraft tracking in each area can be identified, collated and addressed.

Note.— The concept of area specific guidance (ASG) related to aircraft tracking is explored further in Chapter 4.

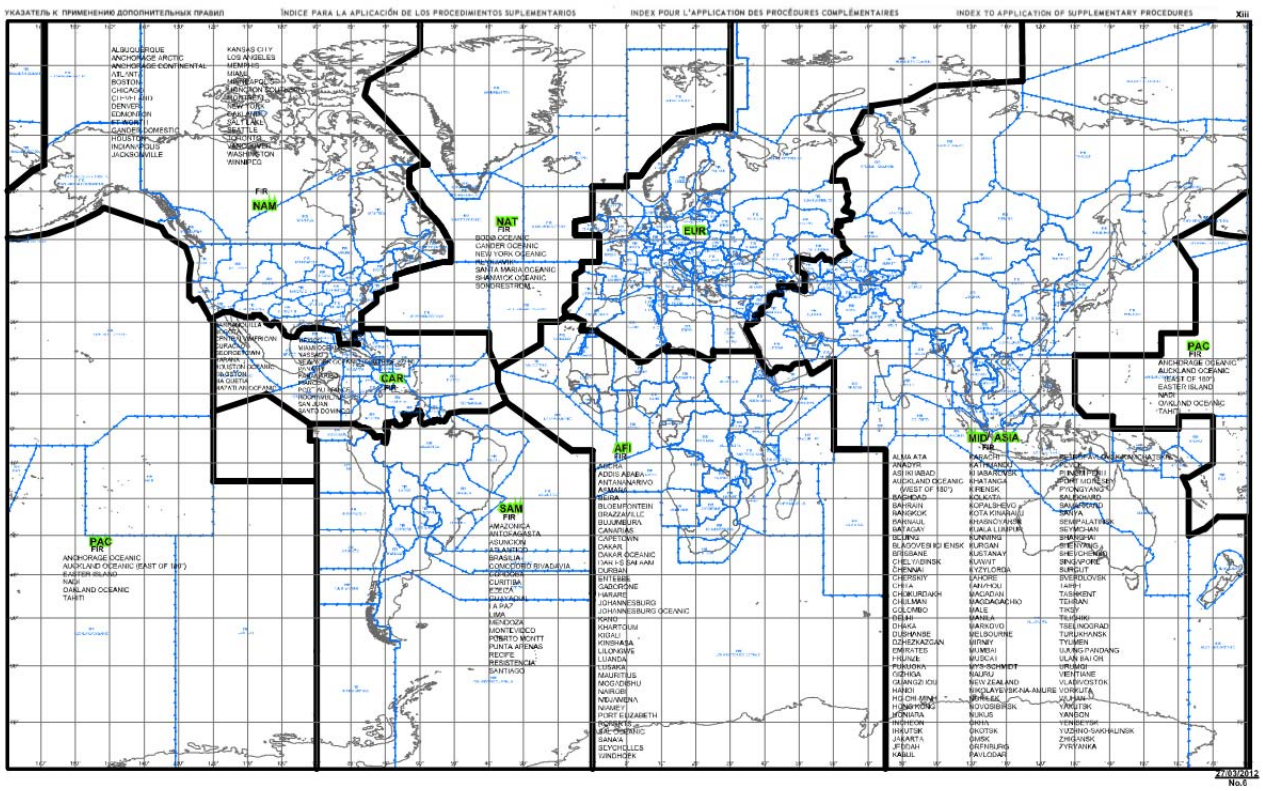


Figure 2-1. Extract from the *Regional Supplementary Procedures* (Doc 7030), Page XIII

2.4 AIRCRAFT TRACKING SARPS IMPLEMENTATION TIMELINE

2.4.1 ICAO uses three dates to outline the implementation process of SARPs: adoption date, effective date and applicability date:

a) **Adoption date**: The date that the ICAO Council adopts, on behalf of Member States, the proposed SARP.

b) **Effective date**: After the ICAO Council adopts the SARP, a letter with an interim edition of the amendment, referred to as the "Green Cover", is dispatched to States. If the majority of Member States do not issue a "disapproval" to the proposed SARP in the four months following the adoption date, the SARP becomes effective. The effective date gives States assurance that the content of the SARP is final and that they should begin working on implementation.

c) **Applicability date:** This is the date, normally four months after the effective date, that ICAO expects the SARP to be implemented by Member States. From this date on, the SARP may form part of the protocol questions of the ICAO Universal Safety Oversight Audit Programme (USOAP). States have one month prior to the applicability date to file a difference to a Standard in accordance with Article 38 of the Convention on International Civil Aviation (Chicago Convention). Although there is no requirement to file a difference to a Recommended Practice, States are strongly encouraged to do so.

2.4.2 Some SARPs are published with an embedded applicability date. This is common when a transition period is envisaged. It gives States certainty of what the requirements will be and the time for implementation of the Standard.

2.4.3 Table 2-1 illustrates the adoption, effective and applicability dates for the provisions regarding aircraft tracking requirements, as well as for the complementary SARP developed to allow risk-based variations to the automated reporting interval.

Table 2-1. Timeline for the implementation of aircraft tracking and complementary SARPs

	Adoption date	Effective date	Applicability date
Aircraft tracking SARPS of Annex 6, Part I, 3.5.1, 3.5.2, 3.5.3, 3.5.5 and 4.6.1 c)	10 November 2015	20 March 2016	8 November 2018
Complementary risk-based SARP of Annex 6, Part I, 3.5.4	27 February 2017	10 July 2017	8 November 2018

Chapter 3

IMPLEMENTATION PLANNING

3.1 OPERATOR CAPABILITY ASSESSMENT, GAP ANALYSIS AND RISK ASSESSMENT

3.1.1 In developing an implementation plan for tracking flights under normal conditions, operators should first perform a self-assessment to determine whether or not they possess or have access to the requisite knowledge, skills and expertise to support the implementation of aircraft tracking as defined in Annex 6, Part I. Such an assessment would also take into account the ground-based and airborne systems and technologies necessary and available to support tracking activities. The practical outcome of this initial assessment is the definition of the operator's current level of performance with respect to aircraft tracking as defined by the SARPs.

3.1.2 After determining the present state of performance with respect to the desired or required level of aircraft tracking performance, the operator should conduct a formal gap analysis. Such an analysis would identify the components already in place and any additional components necessary to achieve the desired or required level of performance. In many cases, existing systems, technologies, policies, processes and procedures can simply be modified to meet future needs. In other cases, there will be a requirement to close the gap between current and required aircraft tracking performance.

3.1.3 The operator's aircraft tracking implementation plan, including the desired end-state for its tracking capability, should be subjected to pre/post-implementation risk assessments. This is necessary to identify any existing and potential risks to the operation as well as preclude the introduction of new operational risks as an unintended consequence of implementation. This could be accomplished using a stand-alone risk management component or by addressing intended tracking capabilities (ground-based and airborne) within the operator's safety management system (SMS).

3.1.4 Consideration should also be given in the implementation plan to developing the risk management component that would ultimately interface with the aircraft tracking component(s) as well as with the SMS (as applicable) and quality systems. This integration would, in turn, ensure that future aircraft tracking systems, processes and activities are subjected to the organization's overarching safety and quality assurance processes.

3.1.5 Operator processes for the tactical assessment and management of potential risks to the operation should also have sufficient maturity, precision and sophistication to assess the types of risks inherent in the use (or the lack) of particular ground-based and/or airborne aircraft tracking processes or capabilities. In all cases, the aim of the operator's internal processes and controls should be to ensure that there is no reduction in operational performance and/or safety resulting from the implementation of any aircraft tracking capability that meets the criteria of Annex 6, Part I, 3.5.2 and 3.5.3 or the mitigation measures resulting from the application of 3.5.4.

Note.— Refer to Chapter 4 for specific risk management considerations when 4D/15 service and/or 4D/15 tracking is unavailable/unachievable.

3.2 EVALUATION OF EXISTING AIRCRAFT TRACKING TECHNOLOGIES AND SERVICES

3.2.1 To determine the best combination of technology, process and procedure to satisfy existing and future aircraft tracking needs, operators need to take a well-considered, methodical and risk-based approach. Any decisions made by an operator should be based on existing/emerging equipage options, area(s) of operation and services provided, regional versus global mandates and any other factors that could influence tracking decisions and/or minimize the introduction of new or unintended risks to the operation or impact to ATS.

3.2.2 As described in the previous section, it is necessary for operators to have a basic understanding of whether or not the current tools and technologies at their disposal could be used to support automated aircraft tracking activities. Where automated solutions are not currently in place, and depending on the complexity of the operation, operators may have to evaluate new technologies or services.

3.2.3 As a starting point, an operator would review its existing flight planning/flight tracking systems and aircraft equipage to determine if they are sufficient to meet future or “end-state” requirements. To satisfy ground-based and airborne aircraft tracking needs, for example, an existing flight planning system and/or flight tracking system could be used to identify areas where tracking is required or recommended in accordance with the aircraft tracking SARPs.

3.2.4 Subsequently, the operator would typically review the means by which aircraft position data can be obtained, particularly in areas where a 4D/15 service is unavailable. In many cases, required reports can be automatically sent to the operator from those aircraft which are suitably equipped. Aircraft tracking requirements can be satisfied in many ways and 4D/15 position data obtained when required. Such methods typically fall under one or more of the broad categories depicted in Table 3-1, as applicable to the operator:

3.2.5 After reviewing flight planning system and aircraft position data sources, ground-based monitoring processes should be reviewed. One common example of how information from flight planning and airborne systems or sources can be used is a ground-based graphical flight following display. Such displays can potentially be tailored to provide alerting for:

a) non-compliance with the operational flight plan (OFP);

b) no position report received;

c) flight level discrepancy;

d) time over fix discrepancy; and

e) other user defined discrepancies necessary to meet monitoring and notification requirements as defined in Annex 6, Part I.

3.2.6 As part of this pre-implementation evaluation, operators may discover that they already possess some or all of the requisite technologies and have access to the required services necessary to meet aircraft tracking requirements. In other cases, operators will need to methodically identify and evaluate the new (to the operator) technologies and services necessary to meet those requirements.

Table 3-1. Airborne aircraft tracking capability

Methods	Suitable to meet tracking requirements		
	4D/15 tracking	**4D/15 service**	**NO**
1. Electronically and automatically exploiting existing and emerging surveillance technologies relying on ADS-C and/or ADS-B equipage and infrastructure.			
a) ADS-C *Note.— Periodic contracts of 15 minutes or less.*	X	X	
b) ADS-B *Note.— Dependent on the deployment of terrestrial and/or spaced-based infrastructure.*	X	X	
2. Electronically, using ACARs that relies on existing HF/VHF/SATCOM datalink capabilities/equipage. *Note.— The use of ACARs datalink can be further subdivided into manual and automatic position reporting depending on the level of ACARs sophistication. This differentiation is important from a flight crew workload perspective and should be evaluated by an operator during pre-implementation SRM activities.*			
a) ACARs automatic	X	X	
b) ACARs manual			X*
3. Electronically, automatically and autonomously re-purposing existing on board systems modified to transmit 4D position data at the desired interval. *Note.— Any modification to existing equipment should meet appropriate airworthiness requirements.*			
a) Engine condition monitoring systems	X		
b) Satellite-based in-flight entertainment systems (IFE)	X		
4. Electronically, automatically, and in some cases autonomously, using new and emerging dedicated aircraft tracking technologies.			
Dedicated aircraft tracking solutions that meet appropriate airworthiness requirements.	X		
5. Procedurally, using long-established position reporting methods that rely on HF/VHF/SATCOM voice.			X*

** Manual ACARs and procedural voice position reporting, however, is unsuitable for use to meet automated 4D/15 Aircraft Tracking requirements as the additional flight crew workload required to maintain 4D/15 reporting intervals could have a negative impact on the overall safety of the operation. It is required that 4D/15 tracking be met with automated systems only. This does not preclude, however, subject to risk assessment, the limited use of manual position reporting (ACARs or Voice) to meet 4D/15 tracking in cases for example, where there are small gaps in 4D/15 service coverage, to reset 4D/15 after a missed report or as part of established contingency procedures.*

However, If used for aircraft tracking purposes, the practicality of manual ACARs and procedural voice position reporting must also be assessed from a crew workload and operational viability perspective. Factors to consider during risk management activities include, but are not limited to, transmission medium used, frequency of required reports, potential for bandwidth saturation and any other constraints that would limit the viability of manual position reporting.

3.3 TRAINING OF GROUND PERSONNEL AND FLIGHT CREW

3.3.1 Training must be given in the operator's aircraft tracking policy, process and procedure to ensure that personnel are current, competent and qualified. Training materials must also be developed to ensure operational control personnel are aware of and can use the various tools available to track flights.

3.3.2 Such training should be given to flight crew and flight operations officers/flight dispatchers (if used in conjunction with a method of control and supervision of flight operations) or other relevant operational control personnel, as applicable. Training should also emphasize the specific requirements associated with each aircraft tracking activity to include operational monitoring and the support of ATSU alerting services.

Note.— The details of the flight operations officer/flight dispatcher training programme when one is employed in conjunction with a method of flight supervision is in accordance with Annex 6, Part I, 10.3 a).

3.4 AIRCRAFT TRACKING EXERCISES AND TRIALS

3.4.1 Before implementing their aircraft tracking capability, operators may wish to conduct internal exercises and trials to validate its preparedness. Such activities would normally take place after the initial development of policy and procedure and could be used as a training tool for operational control personnel. Trials and exercises should be scripted, realistic and based on the operator's areas of operation and tracking technologies to be used. The objectives should be clearly defined and could include:

a) to validate 4D/15 tracking assumptions and procedures (e.g. routes/areas where 4D/15 tracking is required/recommended) to include:

   i) determining operator responsibility to track;

   ii) determining 4D/15 tracking capability at the preflight planning stage;

   iii) exercising the risk assessment process if 4D/15 tracking is required but cannot be achieved (at the planning stage and/or up to the point of dispatch);

b) to assess/validate the technologies to be implemented or more broadly applied (e.g. expanded use of ADS-C);

c) to assess and refine new monitoring procedures to be implemented, including:

   i) procedures for use in the event of missed 4D/15 tracking reports;

   ii) procedures for verification of system integrity;

   iii) procedures for re-establishing contact with an aircraft within prescribed timeframes;

   iv) communication protocol between operator and air navigation service provider (ANSP) including the delivery of missed report forms to the ATSU in the correct format (see Chapter 8 and Appendix C);

d) to assess the accuracy/accessibility of ATSU contact information;

e) to assess the reliability and efficacy of communication capabilities between and among aircraft, ATSUs and the operator; and

f) to exercise and validate aircraft tracking data collection and retention systems or processes.

3.4.2 Any information or experience obtained from the exercises and trials should be carefully analysed for the purpose of improving the operator's overall capability to track its aircraft, monitor their position and support ATSU alerting services.

3.5 DATA COLLECTION AND RETENTION

3.5.1 Another important element of an operator's aircraft tracking policy and ATSU notification procedures is the collection and retention of tracking data. Through data collection tools, an operator should be able to effectively acquire and retain tracking information. The responsibility for collecting and retaining operational data should also be clearly communicated to the relevant operational staff.

3.5.2 Annex 6, Part I, 3.5.5, stipulates that aircraft tracking data be retained as necessary to determine the known position of an aircraft. After an aircraft has landed safely, an operator does not need to retain tracking data.

3.6 CONTINUOUS IMPROVEMENT

3.6.1 Continuous improvement is a formal process to identify the causes of poor operational performance or outcomes that do not meet the specifications defined by the operator for aircraft tracking. Such a process can also determine what action needs to be taken to ensure that operational performance meets or exceeds expectations.

3.6.2 Continuous improvement is achieved in practice through an internal (to the operator) adjustment component or subsystem that responds to any underperformance or deviation identified through internal or external quality assurance and safety assurance processes. The foundation for continuous improvement is the collection and analysis of operational data relevant to the actual and expected performance of aircraft tracking activities.

3.7 OPERATOR IMPLEMENTATION TIMELINE AND MILESTONES

3.7.1 The completion of an analysis undertaken by an operator is necessary to establish the framework for the implementation of an aircraft tracking function and represents a milestone in the development of an aircraft tracking capability. This includes an assessment of an operator's capability to accomplish 4D/15 tracking where and when required.

3.7.2 As discussed in the previous chapter, this circular is structured in a manner to support the development of (operator) aircraft tracking capabilities, including the development of supporting policy, process and procedures. The milestones listed below are therefore arranged in a manner to support a logical progression from analysis to implementation. Operators can identify the relevant sections associated with the milestones in this progression by associating them with the chapter contents as shown in Table 3-2:

Table 3-2. Milestones

Milestone	Description	Chapter(s)
1	Achieve an understanding of the aircraft tracking SARPs	2
2	Complete pre-implementation activities	3
3	Determine dedicated aircraft tracking solution to be used	3
4	Develop policy, process and procedure for aircraft tracking under normal conditions	4
5	Address preflight planning, flight commencement and in-flight considerations	4 and 5
6	Develop operator monitoring policy, process and procedures	6
7	Implement aircraft tracking under normal conditions	4 to 6
8	As applicable, develop and implement monitoring of aircraft experiencing an abnormal operation or event	7
9	Conduct post-implementation activities	3
10	Measure, analyse and adjust as necessary	3

Note 1.— The milestones can be further expanded and/or subdivided as necessary to facilitate implementation.

Note 2.— Refer to Chapter 2, 2.4 for a description of ICAO aircraft tracking SARP implementation timelines.

Chapter 4

OPERATOR AIRCRAFT TRACKING POLICY, PROCESS AND PROCEDURES

4.1 POLICY, PROCESS AND PROCEDURES DEVELOPMENT

4.1.1 Before any aircraft tracking activities can begin, operators should be confident that they can exert sufficient organizational control over their operations and personnel to achieve their operational objectives. This ensures repeatable conformance with operational requirements and control over outcomes associated with any operational activity. Developing and documenting organizational and operational policies, processes and procedures is therefore a fundamental step in maintaining such organizational control. If done properly, it will also assist in the effective assessment of the type of risks associated with aircraft tracking and related activities.

4.1.1.1 To achieve the required organizational control and risk assessment of aircraft tracking and related activities, an operator should:

a) establish an overall aircraft tracking policy (intention to track, operations affected, precision required, exceptions, contingencies, etc.);

b) address both ground-based and airborne tracking requirements and capabilities;

c) determine if existing aircraft tracking capabilities are sufficient to conform to Annex 6, Part 1, 3.5 as described in this circular and address any gaps in conformance, as applicable;

d) establish and document all applicable policies, processes and procedures;

e) establish standard operating procedures (SOP) and provide the guidance, information and instructions necessary for operational control personnel to fulfil their duties and responsibilities;

f) train and supervise all the relevant personnel;

g) allocate appropriate resources;

h) establish appropriate tasking of operational control personnel; and

i) ensure that operational control personnel adhere to the SOP.

4.1.1.2 The following sections provide additional guidance material for use by operators to develop the framework for supporting the effective implementation and maintenance of an aircraft tracking capability.

Note.— Risk management activities are part of the process defined by Annex 6, 3.5.4 that would, under specified conditions, allow for the commencement of a flight or series of flights when a 4D/15 service or tracking deficiency is known (by the operator) prior to flight commencement.

4.1.2 Operator aircraft tracking policy

4.1.2.1 As described in Chapter 2 and the previous sections of this chapter, 4D/15 tracking is recommended in all areas of operation and required in oceanic areas unless ATC provides a 4D/15 service. It should therefore be reflected in operator policy that it is incumbent on the operator to make the determination which routes or route segments will be reliant on participation in a 4D/15 service and, if applicable, which will require 4D/15 tracking.

4.1.2.2 It should also be reflected in operator policy that if the operator determines (at the planning stage) that a flight or series of flights will not meet (oceanic area) 4D/15 requirements by either means, such flight(s) must have been subjected to a risk assessment process to determine if mitigation measures are necessary in accordance with Annex 6, Part I, 3.5.4.

4.1.3 Aircraft tracking (4D/15 tracking) in all areas of operation

There are several key points to emphasize for 4D/15 tracking in accordance with Annex 6, Part l, 3.5.2 to ensure they are appropriately reflected in operator policy, process and procedure. Points to consider include but are not limited to:

a) 4D/15 tracking policy for all areas of operations as specified in the AOC that are not already addressed by oceanic area 4D/15 tracking, as applicable (e.g. the area(s) of operations, the operator will meet the recommended tracking specifications of Annex 6, Part I, 3.5.2);

b) differences, if any, from oceanic area policy, process and procedure; and

c) the (additional) aircraft to be tracked, e.g. aircraft not already encompassed by oceanic area 4D/15 tracking and/or encompassed due to the lower take-off mass threshold, as applicable.

Note 1.— All operations are encompassed by the tracking capability specified in Annex 6, Part I, 3.5.1. The interval recommended or required for such capability is defined in Annex 6, Part I, 3.5.2 and 3.5.3, respectively.

Note 2.— The risk-based provisions of Annex 6, Part I, 3.5.4 also apply to the recommended 4D/15 tracking interval in situations where an operator chooses to implement the Recommendations of Annex 6, Part, 3.5.2 or a State requires the additional application of such recommendations.

4.1.4 Aircraft tracking (4D/15 tracking) in oceanic areas

There are several key points to emphasize with respect to operator 4D/15 tracking required in oceanic areas in accordance with Annex 6, Part I, 3.5.3, to ensure they are appropriately reflected in operator policy, process and procedure. Points to consider include but are not limited to:

a) the availability of 4D/15 service and/or the 4D/15 tracking capability would be considered prior to the conclusion of the planning stage. After flight commencement, an unanticipated loss of 4D/15 service or tracking capability does not prevent continuation of the flight, even for those portions of the route where 4D/15 tracking was previously determined to be required;

b) the point(s) at which the operator’s responsibility to track begins is the point(s), relevant to the nominated route or route segment in an oceanic area, where a 4D/15 service is no longer available; and

c) operators planning to commence a flight or series of flights when a required 4D/15 service or 4D/15 tracking is determined to be unachievable (at the planning stage) must ensure that such operations have been subjected to the risk assessment process defined in Annex 6, Part I, 3.5.4.

Note.— Refer to Definitions for the definition of oceanic areas.

4.1.5 Operator aircraft tracking responsibilities

To routinely fulfil its aircraft tracking responsibilities in practice, an operator should analyse its routes to determine the areas of operation wherein ATSUs do not provide a 4D/15 service (i.e. for the areas where the 4D/15 tracking responsibility would be undertaken by the operator). An operator should also periodically update aircraft tracking policy, process and procedures in order to fulfil its responsibility to obtain aircraft position data through automatic reporting. In view of these objectives, and in order to also ensure 4D/15 tracking is undertaken when necessary or desired, operators should have specific policies and procedures in addition to those in 4.1 of this chapter, which:

a) identify the duties, tasks and actions (and interactions) necessary to track a specific flight or series of flights;

b) ensure that the duties, tasks and actions related to the tracking of each flight are assigned to the appropriate personnel;

c) ensure that planned routes are reviewed, using whatever means available at the flight planning stage to determine whether or not a 4D/15 service is available along an intended route;

d) ensure that aircraft equipage matches the 4D/15 service in use;

e) identify the areas, routes or route segments where 4D/15 tracking would be undertaken by the operator; and

f) identify when 4D/15 tracking is no longer required (e.g. flight re-enters surveillance airspace or 4D/15 service is otherwise available).

Note 1.— Refer to Appendix A for a flowchart depicting the steps in a typical flight planning exercise to evaluate the availability of a 4D/15 service and when 4D/15 tracking is to be accomplished by an operator.

Note 2.— ICAO has encouraged air navigation service providers to publish, in the Aeronautical Information Publications *(AIP), current information on all system(s) used by ATSUs to receive aircraft position information (e.g. ADS-C, MLAT), their associated coverage area(s) and for non-surveillance systems, the periodic reporting intervals (time).*

4.1.6 Development of area specific guidance (ASG)

4.1.6.1 As described in the previous section, the preflight determination of the areas where the operator would assume the aircraft tracking responsibility is an essential operator activity. It is essential as the absence of a 4D/15 service along the planned route may be the triggering event for other tracking activities. The appropriate development of operator policy, process and procedure is therefore crucial in order to ensure all such “triggered” activities occur when required and are consistent and repeatable. This includes infrequent activities that must be carried out by relevant personnel (e.g. actions to be taken when 4D/15 tracking is unachievable, resolving missed reports, ATSU notifications, etc.).

4.1.6.2 To help achieve this, and for the benefit of all personnel involved in aircraft tracking activities, it may be useful for an operator to define the baseline in relation to the available 4D/15 services relevant to the operator’s routes. It would also be helpful to categorize guidance according to areas of operation. One way for operators to achieve this aim would be to develop ASG derived from the Aeronautical Information Publications (AIPs) published by States in accordance with Annex 15 — *Aeronautical Information Services*, Appendix 1.

4.1.6.3 Considering the areas of operation described in Chapter 2, an example of a basic table that illustrates the AIP material to address aircraft tracking requirements is presented in Table 4-1. Provided for illustrative purposes only, the table represents one method for organizing operational guidance according to regions where operations are conducted.

Table 4-1. Example AIP material for aircraft tracking requirements

Region and route specific guidance					
Subject					
i) Introduction ii) General regional guidance (common to all regions outside of home region)					
iv) Areas of operation:	4D/15 service normally available in FIRs listed	How 4D/15 service is met	4D/15 service unavailable-operator **should** track in FIRs listed**	4D/15 service unavailable-operator **shall** track in FIRs listed*	Routes or route segments affected
a. Pacific (PAC)	**XXX FIR**		**YYY FIR**	**ZZZ FIR**	
b. North America (NAM)	**XXX FIR**		**YYY FIR**	**ZZZ FIR**	
c. North Atlantic (NAT)	**XXX FIR**		**YYY FIR**	**ZZZ FIR**	
d. Caribbean (CAR)	**XXX FIR**		**YYY FIR**	**ZZZ FIR**	
e. South America (SAM)	**XXX FIR**		**YYY FIR**	**ZZZ FIR**	
f. Europe (EUR)	**XXX FIR**		**YYY FIR**	**ZZZ FIR**	
g. Middle East/Asia (MID/ASIA)	**XXX FIR**		**YYY FIR**	**ZZZ FIR**	
h. Africa (AFI)	**XXX FIR**		**YYY FIR**	**ZZZ FIR**	
i. Polar***	**XXX FIR**		**YYY FIR**	**ZZZ FIR**	

**Note 1.— This column refers to areas where the operator has accepted the 4D/15 tracking responsibility in accordance with Annex 6, Part I, 3.5.2.*

***Note 2.— This column refers to areas where the operator has accepted the 4D/15 tracking responsibility in accordance with Annex 6, Part I, 3.5.3.*

****Note 3.— A 4D/15 service may be unavailable and 4D/15 tracking unachievable on certain polar routes or route segments depending on aircraft equipage. Such (oceanic) operations are typically subjected to a specific risk assessment process prior to commencement in accordance with Annex 6, Part I, 3.5.4.*

4.1.6.4 The collation and dissemination of relevant and current regional information is important for developing and implementing aircraft tracking capabilities. Operational control personnel also require clear and concise guidance material on all applicable aircraft tracking duties, responsibilities or tasks. The scale and complexity of any such guidance material would be commensurate with the scale and complexity of an operator's route structure.

4.2 RISK-BASED AIRCRAFT TRACKING POLICY, PROCESS AND PROCEDURES

4.2.1 Annex 6, Part I, 3.5.4 provides the framework for establishing a risk assessment process that would allow for flight commencement when 4D/15 tracking would otherwise be required. The inability to achieve any automated reporting interval, however, may be outside the control of the operator. The vast majority of aircraft operating in oceanic areas, for example, are already equipped with the FANS 1/A avionics package, which includes the automatic dependent surveillance-contract (ADS-C) capability. Most operators, therefore, will likely exploit this capability in order to participate in a 4D/15 service or undertake 4D/15 tracking. A systemic ADS-C outage would, however, render automated 4D/15 tracking unachievable. Without the risk assessment process defined in 3.5.4, operators would not have the methodology to support continued operations.

4.2.2 The risk assessment process and associated risk mitigations provide the mechanism to allow for short- or long-term variations from the automated reporting intervals specified in Annex 6, Part I, 3.5.2 or 3.5.3. The criteria for the risk assessment process provide the controls to ensure that assessments are robust enough to consider the individual capabilities that make up an operator's overall aircraft tracking capability. In fact, the robustness of the operator's aircraft tracking capability would be a key consideration during the risk assessment process.

4.2.3 The risk assessment process defined in Annex 6, 3.5.4 should be strategic in nature, based on the scope and complexity of the operations of the operator. It should be embedded in policy, process and procedures rather than tactically applied at the planning stage when an aircraft tracking deficiency first becomes known to the operator. The preferred method is to use the risk assessment process to develop mitigations as necessary that are mostly transparent to flight crew and embedded in policy, process and procedures.

4.2.4 Considering these objectives, and also to ensure that risks to the operation are managed when necessary, operators would have specific policies and procedures in addition to those in 4.1 of this chapter, which:

a) establish and document the process to assess the risks of commencing planned operations with a known automated reporting interval deficiency;

b) establish appropriate tasking of personnel with the requisite knowledge, skills and subject matter expertise to participate in the risk assessment process;

c) clearly define the triggering event for the risk assessment process;

d) identify the factors that must be considered during the risk assessment process in accordance with Annex 6, Part I, 3.5.4;

e) identify how and when the risk assessment process will occur;

f) determine the means to implement mitigations and manage risks (systemic, minimum equipment list (MEL), area specific guidance (ASG), standard operating procedures (SOP), other); and

g) ensure that there is sufficient guidance in operator documents (MEL, ASG, SOP, other) to ensure that mitigation measures, if applicable, are applied prior to flight commencement in accordance with Annex 6, 3.5.4.

Note.— Although there are many examples (see Chapter 2), polar operations in particular, lend themselves to a risk-based approach that allows for variations to automated reporting intervals. This is due largely to the unique operational challenges faced in operations. Such challenges include but are not limited to space weather, limited navigation and communications infrastructure and/or operator investments in pre-existing aircraft tracking technologies.

4.2.5 Understanding risk in the context of aircraft tracking

4.2.5.1 The first step in the risk assessment process is to identify hazards. The corresponding risks to the operation are then assessed in relation to the potential consequences of a hazard. Where the risks to the operation are assessed to be unacceptable, additional risk controls and mitigations must be built into the system.

4.2.5.2 For effective hazard identification and risk management, operators must first understand the types of risks posed by the inability to receive automated reporting data at the required interval. For this, any known deficiencies in a required 4D/15 service or a 4D/15 tracking capability should be identified as a hazard as part of the operator risk management activities. This is important so that any risks to the operation (e.g. reputational) are identified and given appropriate consideration in the risk assessment process. More importantly, however, operational safety must not be compromised as a result of any mitigations related to known aircraft tracking deficiencies.

4.2.5.3 To further develop their risk management activities, it would also be helpful for operators and authorities to fully understand and appreciate the purpose of the aircraft tracking SARPs. They were developed in part to address a GADSS objective to reduce the time necessary to determine the operational status of and locate an aircraft (see Chapter 2, 2.1).

4.2.5.4 Over time, it should be easy for operators and authorities to conclude that if the position of the majority of oceanic flights can be determined with 4D/15 precision, then the likelihood (over time) that an individual flight will experience a harmful event and lack the capability to have its position accurately determined would be low. Additionally, operators should be able to determine the effect on this likelihood when a flight or series of flights lacks a recommended or required automated interval reporting capability.

4.2.5.5 Systemic (4D/15) outages could occur that affect the position determination accuracy of a larger number of aircraft and/or flights. There is also the potential for the unintended introduction of operational safety risks owing to mitigation strategies implemented by operators to address the risks associated with aircraft tracking. These possibilities must also be considered during risk assessment process.

4.2.5.6 Annex 6, Part I, 3.5.4, was specifically crafted with the aforementioned precepts in mind. The SARP assigns the responsibility to the operator, with the approval of the State, to assess and manage the risks to the operation associated with gaps or lapses in 4D/15 tracking. It also addresses the principle that mitigation strategies should not introduce operational safety risks. Finally, it provides the framework for operators to consider and critically assess all of the components that make up their aircraft tracking capability to determine the measure of risk mitigation that this capability provides (in the absence of automated 4D/15 tracking).

4.2.6 Risk assessment process and considerations

The specific operator process that allows for commencement of a flight or flights lacking a recommended or required automated 15-minute interval reporting capability would be documented and include a risk assessment component. Hazards should be identified and the associated risks assessed according to the probability and the severity of the consequences. Risk probability is defined as the likelihood or frequency that an undesirable consequence or outcome

might occur. The risk assessment process would, as a minimum, address the considerations specified in Annex 6, Part I, 3.5.4. As with all risk management activities, the level of detail and complexity of risk assessments related to aircraft tracking should be adapted to, and commensurate with, the particular needs of each operator and the complexities of each operation.

Note 1.— The risk assessment process, which allows for variations to automated reporting, may be stand-alone or a sub-component of an existing and systemic method for managing risk (e.g. SMS). In all cases, however, such a process would be tailored to manage the specific risks associated with using reporting means and/or intervals other than those specified in Annex 6, Part I, 3.5.2 or 3.5.3 to satisfy aircraft tracking requirements.

Note 2.— Refer to Annex 19 — Safety Management *and the* Safety Management Manual (SMM) *(Doc 9859), for information related to the conduct of risk assessments.*

4.2.6.1 ***Capability of the operator's operational control systems and processes***

When addressing the components of the specific risk assessment process in accordance with Annex 6, Part I, 3.5.4 a), it should be understood that the "capability of the operator's operational control systems and processes, including those for contacting ATSUs" refers to:

a) the demonstrable tracking capabilities of the operator's ground-based systems and processes that are used to determine the position of an aircraft based on any available data and/or telemetry from the aircraft or other sources;

b) the demonstrable flight monitoring capabilities of the operator's ground-based systems and processes that detect when a required position report is missed and resolve missed reports;

c) the demonstrable capabilities of ground-based tracking and monitoring capabilities to adapt to a lack of automated 4D/15 tracking;

d) the appropriate training of relevant personal to cope with lapses in 4D/15 tracking;

e) the demonstrable capability of an operator to share any available tracking data with relevant parties when necessary;

f) the quality and reliability of the communication capabilities available to contact relevant to ATSUs; and

g) any other ground-based system or process that increases the accuracy of aircraft position data or aids in the timely resolution of missed reports.

4.2.6.2 ***Overall capability of the aeroplane and its systems***

When addressing the components of the specific risk assessment process in accordance with Annex 6, Part I, 3.5.4 b), it should be understood that the "overall capability of the aeroplane and its systems" refers to:

a) the tracking capability afforded by available (remaining) aeroplane technologies that support automated aircraft position reporting (e.g. engine condition monitoring systems, satellite-based in-flight entertainment systems (IFE, ADS-B, ADS-C, other);

b) the tracking capability afforded by available (remaining) aeroplane technologies that support automated waypoint position reporting (WPR) and manual WPR (via ACARS or Voice via SATCOM/HF/VHF);

c) the capabilities afforded by serviceable aeroplane location technologies (e.g. ELTs, ULDs, systems for locating an aeroplane in distress, EPIRBs) on board the aircraft in the context of planned area(s) of operation;

d) the serviceable communication technologies (e.g. VHF, HF, SATCOM, SATVOICE, SAT-Phone) on board the aircraft and communication capability afforded by such equipment considered in the context of the planned area(s) of operation; and

e) communication system redundancies.

Note.— Unserviceable aircraft system(s) with aircraft tracking implications may not be immediately obvious (e.g. ELT inoperative) and should be identified as such in the MEL or other operational documentation.

4.2.6.3 ***Available means to determine the position of and communicate with the aeroplane***

When addressing the components of the specific risk assessment process in accordance with Annex 6, Part I, 3.5.4 c), it should be understood that the “available means to determine the position of and communicate with the aeroplane” refers to:

a) the demonstrable capability of an operator to rapidly and reliably communicate with an aircraft;

b) the quality and reliability of the surveillance and communication capabilities available to support aircraft/operator/ATS communications and surveillance, as necessary, to determine/refine aircraft position (e.g. to support/update ground-based tracking, resolve missed position reports, determine flight status);

c) ANSP access to surveillance information beyond the range of VHF communications which could be used to monitor flights; and

d) operator access to other sources of flight tracking data which could be used to locate the aircraft.

4.2.6.4 ***Frequency and duration of gaps in automated reporting***

4.2.6.4.1 When addressing the components of the specific risk assessment process in accordance with Annex 6, Part I, 3.5.4 d), note it should be understood that the “frequency and duration of gaps in automated reporting” refers to:

a) the exposure of a given operation or series of operations to gaps in 4D/15 service or 4D/15 tracking; and

b) the likelihood that an undesirable event or outcome might occur (probability) during such gaps in coverage considering the number of planned flights, the length of each flight and the duration of the gap(s) in coverage on each flight.

4.2.6.4.2 This consideration relates to the total probability of an undesirable consequence or outcome involving a flight while it is operating without a 4D/15 tracking capability. For example, from a risk management perspective it may be acceptable for longer flights to operate without 4D/15 tracking for the entire duration of the oceanic portion of a flight if

the number of such flights is limited. It might also be acceptable for other flights to depart more frequently without a required 4D/15 tracking capability if the length of the segment where 4D/15 tracking would be required is relatively short.

4.2.6.5 ***Human factors consequences resulting from changes to flight crew procedures***

When addressing the components of the specific risk assessment process in accordance with Annex 6, Part I, 3.5.4 e), it should be understood that the “human factors consequences resulting from changes to flight crew procedures” refers to:

> the impact on flight crew workload (from a human factors perspective) of any existing or proposed procedures implemented to mitigate the risk(s) associated with gaps in 4D/15 service or 4D/15 tracking.

Note.— The Normal Aircraft Tracking Implementation Initiative (NATII) discussed the challenges of making manual 4D/15 position reports (e.g. HF, VHF, ACARS). HF voice position reporting in particular was evaluated during the NATII table top exercise (TTX). The NATII concluded, based on the TTX and internal deliberations, that the additional workload required to meet 4D/15 tracking requirements would distract the flight crew from other operational duties and have a negative impact on the safety of the operation. Additionally, manual position reporting could introduce a level of uncertainty regarding accuracy (e.g. introduce the potential for error).

4.2.6.6 ***Specific mitigation measures and contingency procedures***

When addressing the components of the specific risk assessment process in accordance with Annex 6, Part I, 3.5.4 f), it should be understood that the “specific mitigation measures and contingency procedures” refer to:

a) the risk mitigation strategies used to reduce the probability or severity of the consequences of a hazard that may adversely affect a planned operation or series of operations; and

b) the contingency procedures for use by operational control personnel and flight crew that address gaps in 4D/15 service or 4D/15 tracking and that maximize (remaining) operator aircraft tracking capabilities;

Note 1.— Mitigation measures must be evaluated to ensure they do not introduce any unintended safety risks.

Note 2.— Refer to Appendix B for a risk management flow that incorporates the considerations of Annex 6, Part I, 3.5.4.

4.3 SUMMARY

4.3.1 An operator’s tracking responsibility and its capability to track its aircraft in accordance with the 4D/15 tracking criteria in Annex 6, Part I, 3.5.2 and/or 3.5.3 are evaluated by the operator at any point prior to the completion of the planning stage for each operation or series of operations. The operator must typically assess whether or not 4D/15 tracking is achievable when required or if its aircraft can participate in a 4D/15 service where available.

4.3.2 If tracking is unachievable or an operator cannot participate in a 4D/15 service, the operator would take steps to identify and manage any risks associated with the commencement of an operation without, as applicable, a recommended tracking capability in accordance with Annex 6, Part I, 3.5.2 or a required tracking capability in accordance with Annex 6, Part I, 3.5.3.

4.3.3 The management of risks to the operation should be satisfied systemically, process based and rooted in policy and procedure. How this is accomplished, however, is up to each operator as long as the outcome is in keeping with Annex 6, aircraft tracking SARPs.

4.3.4 The following examples illustrate two variations in implementation that may occur based on the scope and complexity of an operator's operations:

a) an operator with a complex and varied route network that entails the use of multiple aircraft types with differing capabilities crossing multiple FIR boundaries may choose to assess 4D/15 tracking requirements and capability for each flight in accordance with the guidance at the beginning of this section. This would be a day-to-day operational control activity performed by appropriately trained personnel;

Note.— Refer to Appendix A for a flowchart depicting the steps in a typical flight planning exercise to evaluate the availability of a 4D/15 service and when the 4D/15 tracking is to be accomplished by an operator. Refer to Appendix B for a risk assessment process flowchart that incorporates the considerations of Annex 6, Part I, 3.5.4.

b) an operator with one aircraft type and a limited oceanic route structure may choose to simplify matters and, as a matter of policy, always takes on the 4D/15 tracking responsibility (e.g. track every flight regardless of oceanic area of operation or 4D/15 service availability). In such cases, the operator would perform a risk assessment to address circumstances when 4D/15 tracking is unachievable. Refer to Appendix B for a risk management flowchart that incorporates the considerations of Annex 6, Part I, 3.5.4.

4.3.5 In either of the aforementioned cases, the operational outcome would be the same and aircraft would be tracked by the operator as required and mitigations applied when necessary.

Chapter 5

PREFLIGHT PLANNING, FLIGHT COMMENCEMENT AND IN-FLIGHT CONSIDERATIONS

5.1 PRACTICAL APPLICATION OF AIRCRAFT TRACKING SARPS

Chapter 4 described the development of aircraft tracking policy, process and procedure required to ensure that 4D/15 tracking responsibilities are taken on by the operator when necessary. This chapter looks at the day-to-day management of tracking activities from an operational perspective and is intended to better illustrate how operators can conform in practice to the aircraft tracking SARPs.

5.1.1 Preflight determination of 4D/15 service availability and 4D/15 tracking responsibilities

5.1.1.1 ***Aircraft tracking planning assumptions***

5.1.1.1.1 If 4D/15 tracking is required (as predetermined by the operator), the operator should be reasonably certain it can fulfil its responsibility for tracking its aircraft. In this case, it can also be assumed that an operator would take the steps necessary to ensure that airborne tracking systems and dependent subsystems/processes are forecast to be operable and available for the duration of each planned flight.

5.1.1.1.2 Concerning aircraft equipage, system malfunctions or inoperative components of an operator's aircraft tracking capability discovered prior to flight commencement would typically be processed in accordance with the minimum equipment list (MEL) or related documents (e.g. area specific guidance as described in Chapter 4). However, the nature of an operator's aircraft tracking capability may vary widely and/or be dependent on the operability of separate and distinct components (e.g. the components that comprise FANS–1/A capability). The interrelationship, therefore, between components, as well as the impact on the overall tracking capability, must be assessed by the operator, as reflected in policy and procedures.

5.1.1.1.3 As the SARPs do not require an operator to have a backup 4D/15 tracking capability when the primary capability is unusable or unavailable, it is necessary to manage any potential risks to the operation associated with the absence of a required tracking capability. This process allows the flight to commence under conditions predefined by the operator when operational control personnel or the flight crew discover a 4D/15 tracking capability to be unusable at the preflight planning stage.

Note.— An operator may choose to have redundant systems and processes to ensure the 4D/15 tracking can be accomplished under varying circumstances. While such redundancy is not required, it would represent one potential strategy that could simplify operator processes for dealing with system outages or equipment failures. It is important to note, however, that there is no one-size-fits-all approach to dealing with such outages or failures.

5.2 (4D/15) FLIGHT COMMENCEMENT/CONTINUATION CONSIDERATIONS (BASED ON AREAS OF OPERATION)

5.2.1 To carry out aircraft tracking responsibilities, it would be useful if operational control personnel could easily identify the operational elements that comprise a 4D/15 tracking capability, as well identify the specific mitigations to be applied when 4D/15 tracking is unachievable. Note, however, that the identification of such elements may be outside the scope of the MEL and could be contained in a related document (e.g. area specific guidance) to be considered by the flight crew after MEL processing.

5.2.2 Operator guidance related to commencing or continuing a flight cannot be less restrictive than the applicable MEL guidance with respect to the functionality of any aircraft system or related component. Additionally, the performance requirements or criteria for operating within the airspace(s) to be traversed should be reproduced in operator guidance as necessary. Finally, the development of such guidance material is specific to each operator, based on operator capabilities, available technologies and risk management activities.

5.2.3 The following is typically addressed by the operator in area specific guidance material which may be outside the scope of the MEL:

a) the areas and routes as defined in the AOC;

b) the performance criteria for areas of operation derived from the applicable air navigation plans (ANPs);

c) flight crew responsibilities related to MEL processing;

d) flight crew responsibilities related to commencing a flight with a known 4D/15 tracking deficiency;

e) ATSU coordination activities, if required;

f) contingency reporting procedures, methods, and means;

g) long-range communication system (LRCS) requirements, as applicable; and

h) functional checks of communication equipment, if required (e.g. high-frequency selective calling system (HF SELCAL)).

5.3 (4D/15) IN-FLIGHT CONSIDERATIONS – OPERATOR

5.3.1 In order to conform to the aircraft tracking SARPs, reasonable certainty should exist at the preflight planning stage that an operator can either:

a) take on the responsibility to track its aircraft as stipulated in the relevant SARPs; or

b) ensure that any risks associated with initiating an operation with a known tracking deficiency are appropriately managed.

5.3.2 An operator is required to track in accordance with the filed flight plan. After preflight planning is complete and an aircraft is airborne, an operator is not required to take on new 4D/15 tracking responsibilities if the plan changes. If a dependent 4D/15 service becomes unavailable (e.g. radar outage) in-flight, or an aircraft deviates from the planned flight track (e.g. into non-surveillance airspace), the operator is not required to (tactically) take on the 4D/15 tracking responsibility. The Annex does not stipulate an in-flight replanning requirement for 4D/15 tracking if it becomes unachievable for any reason after flight commencement.

Chapter 6

OPERATOR MONITORING — POLICY, PROCESS AND PROCEDURES

6.1 MONITORING OF FLIGHTS AND SUPPORT OF ATS UNIT ALERTING

6.1.1 Operational monitoring of flights is a fundamental part of an operator's responsibility to exercise operational control integral to the operator's capability to track aircraft under normal conditions and central to the implementation of Annex 6, Part I aircraft tracking provisions. Such tracking is undertaken (by the operator) in accordance with the Annex to help ensure the availability and sharing of accurate aircraft position data with the relevant ATSUs. This is important, as these ATSUs are responsible for providing alerting services to rescue coordination centres (RCCs).

6.1.2 ATSUs serve as the central point for collecting all information relevant to the emergency state of an aircraft operating within the flight information region or control area concerned and for forwarding such information to the appropriate RCC. ATSUs, however, do not always have direct access to the most recent 4D aircraft position data. By providing aircraft position data when necessary, operators can help to improve the effectiveness of ATSU alerting and support search and rescue (SAR).

6.1.3 Where 4D/15 tracking is undertaken by operators, the operator is responsible for obtaining 4D/15 position data. It is also responsible for notifying the relevant ATSU as necessary and when a missed 4D/15 tracking report from their aircraft cannot be resolved in accordance with 6.1.2 of this chapter. If, at that point, the ATSU (or operator) is unsuccessful in establishing contact with the aircraft, the appropriate emergency phase in accordance with Annex 11, 5.2 will be initiated by the ATSU.

Note.— For the purpose of determining which ATSU to contact in the event of a missed position report under normal conditions or an abnormal event detected in accordance with Chapter 7; the "relevant ATS units" are those responsible for the area in which the aircraft could be (based on latest known position, expected track and time since last position update). In case of cross-border situations, it is important that all relevant/adjacent ATSUs be notified.

6.1.4 Monitoring policy, processes and procedures for use under normal conditions should support all aircraft tracking activities defined by Annex 6, Part I, should support the ATSU alerting services defined by Annex 11, Chapter 5 and:

a) ensure that aircraft tracking requirements, including associated flight monitoring duties, responsibilities or tasks, are appropriately identified and defined;

b) ensure that appropriately qualified individuals are assigned flight monitoring duties responsibilities or tasks;

c) ensure that airborne data communication technologies and associated flight crew procedures, as applicable (e.g. when position reporting requires flight crew action such as logging on to ADS-C) are sufficiently robust, complement and support operator (ground-based) systems, processes and procedures;

d) ensure that a ground-based communications capability commensurate with the scope of operations and for the purposes of communicating with aircraft en-route and when necessary, the relevant ATSUs;

e) ensure the recording, in real time, of departure and arrival messages to ensure that a flight is operating and has arrived at the destination airport;

f) ensure the monitoring and recording of the 4D position of aircraft at standardized intervals as appropriate to the phase of flight;

g) identify those flights that are subject to 4D/15 tracking by the operator;

h) determine if the 4D/15 tracking reports contain the required data elements;

i) ensure, when required 4D/15 tracking is unachievable, that flight monitoring and ATS support activities are appropriately adjusted in accordance with the outcome of the risk assessment process required by Annex 6, Part I, 3.5.4 (see Chapter 4 of this circular);

j) ensure the timely identification of aircraft that have missed a required tracking report(s);

k) trigger the initiation of appropriate sub-processes and/or procedures (see 6.1.2 of this chapter) when a 4D/15 tracking report is missed and when necessary ensure passing of missed 4D/15 tracking information to the applicable ATSU in the appropriate format (see Appendix C); and

l) fully support the activities of the applicable ATSUs providing the alerting service(s) in conformance with Annex 1 — *Personnel Licensing*, Chapter 5.

Note.— Operators that use automated flight monitoring systems (e.g. graphical flight following displays) to provide flight progress data to operational control personnel should ensure such systems display actual aircraft position, are appropriately scaled and tailored for use in support of 4D/15 monitoring and alerting. The following sections identify the additional elements of operational monitoring and alerting to be addressed by operators when developing policy, process and procedures for use under normal conditions. The operator monitoring of flights experiencing an abnormal operation or event is addressed in Chapter 7.

6.2 RESPONSIBILITIES, DUTIES AND TASKS OF OPERATIONAL CONTROL PERSONNEL

6.2.1 Any operational activity in accordance with policy, processes and procedures will depend on the assignment of responsibilities, duties and tasks to appropriately qualified individuals. It is the responsibility of the operator to determine the qualifications necessary for an individual to carry out operational monitoring and support the alerting activities described in this section and in accordance with State requirements.

Note.— For the purposes of developing training materials and otherwise ensuring operational control personnel engaged in operational monitoring are competent; an operator can assume such personnel may be assigned responsibilities, duties or tasks related to any operational monitoring or alerting activity described in this section (that are attributable to an operator). This includes those associated with automated systems or technologies and is irrespective of the method of control and supervision of flight operations in use by the operator.

6.2.2 The provisions contained in Annex 6, Part I define the specific monitoring responsibilities that are to be assigned to a flight operations officer/flight dispatcher (FOO) if one is used in conjunction with a method of control and supervision of flight operations. For operators that use an FOO, the following SARP defines the responsibilities that are directly and indirectly related to aircraft tracking and operational monitoring under normal conditions:

6.2.3 Annex 6, Part 1, 4.6.1 states

> 4.6.1 A flight operations officer/flight dispatcher in conjunction with a method of control and supervision of flight operations in accordance with 4.2.1.3 shall:
>
> . . .
>
> c) furnish the pilot-in-command while in flight, by appropriate means, with information which may be necessary for the safe conduct of the flight; and
>
> d) notify the appropriate ATS unit when the position of the aeroplane cannot be determined by an aircraft tracking capability and attempts to establish communication are unsuccessful.
>
> . . .

Note.— Aircraft tracking in accordance with Annex 6, Part I, 3 may augment but is not required to comply with Annex 6, Part I, 4.6 c).

6.2.4 In addition to the aforementioned SARP in Annex 6, Part I, Annex 11 contains SARPs that address coordination between operators and ATSUs from an ATSU perspective. To support such coordination, operators would need appropriately qualified individuals in place (and assigned the responsibility) to respond to ATSU requests for information, as well obtain information from a relevant ATSU when needed (to fulfil monitoring requirements).

6.2.5 Such coordination could be accomplished by an FOO or another appropriately qualified individual, as applicable. In either case, appropriate coordination is fundamental to the support of ATSU alerting and RCC coordination activities.

6.2.6 Annex 11, 2.17.1 and 2.17.2 serve to further clarify the roles and responsibilities of operators in the context of the coordination with an applicable ATSU. These SARPs state:

> 2.17.1 Air traffic services units, in carrying out their objectives, shall have due regard for the requirements of the operators consequent on their obligations as specified in Annex 6, and, if so required by the operators, shall make available to them or their designated representatives such information as may be available to enable them or their designated representatives to carry out their responsibilities.
>
> 2.17.2 When so requested by an operator, messages (including position reports) received by air traffic services units and relating to the operation of the aircraft for which operational control service is provided by that operator shall, so far as practicable, be made available immediately to the operator or a designated representative in accordance with locally agreed procedures.

6.2.7 In summary, regardless of the method of control and supervision of flight operations or operational control personnel present, operators should ensure that key responsibilities related to operational monitoring and ATSU alerting/coordination are assigned to appropriately qualified personnel.

Note 1.— Refer to Definitions for the definition of flight operations officer/flight dispatcher.

Note 2.— Refer to Chapter 7 for additional operator responsibilities with respect to the operational monitoring of flights that may be experiencing an abnormal operation or event.

6.3 MISSED REPORT PROCEDURES

6.3.1 This section describes the activities that should be addressed in operator procedures in the event of missed 4D/15 tracking report. In all cases the overriding objective is to resolve the position and operational state of the aircraft as soon as practicable. To achieve this, the procedures described in the following sections may, depending on the available resources, be combined or occur in parallel (e.g. communication system verification can be combined with attempts to contact the aircraft).

6.3.2 To appropriately manage internal and external resources, operators should, to the extent foreseeable/practicable, ensure the timeliness and accuracy of required 4D/15 tracking reports. This is necessary to minimize missed report events due to failures of system, processes or procedures and that could have been avoided.

6.3.3 This is applicable even though some forms of position data communication may be automated and not require input from operational control personnel or the flight crew. In any case, it is essential that care is taken to minimize the occurrence of missed 4D/15 tracking reports regardless of the means of position data communication so as to ultimately preclude unnecessary ATSU and/or RCC coordination (e.g. prevent consuming operator and ATSU resources chasing missed reports).

6.3.4 *Verification of system integrity*

An operator should be able to determine whether or not a missed 4D/15 tracking report is the result of a system outage or equipment failure. Operator procedures should therefore ensure operational control personnel assess the nature of each missed report. To achieve this (after a missed report), the relevant communication links between the aircraft and the operator should first be verified and attempts made to contact the aircraft by any available means. If communication attempts are unsuccessful or a second 4D/15 missed report occurs, the airline operator needs to notify the relevant ATSU in accordance with 6.3.5.

Note.— All other procedures related to 4D/15 tracking and operational monitoring should continue until a determination is made that there is an outage. Confirmation of an outage would also require a position report be obtained from the aircraft as a minimum.

6.3.5 *Attempts to re-establish communication*

6.3.5.1 Attempts to communicate with the aircraft should begin immediately after a missed 4D/15 tracking report in order to remain within the ATSU alerting service (emergency phase) timescales of Annex 11, Chapter 5. The time it takes to communicate with the aircraft is also a key factor to be considered by operators when developing monitoring policy and procedure. This is important as it drives the determination of if and when an ATSU must be contacted in order to initiate appropriate emergency phases and related RCC notification procedures.

6.3.5.2 This capability of an operator to communicate with the aircraft therefore should be honestly assessed as part of implementation and risk management activities as it will play an important role in monitoring and the support of ATSU alerting activities.

6.3.5.3 In summary, operator procedures related to communicating with an aircraft that has missed a required 4D/15 tracking report should aim to:

a) determine in a timely manner and by any available means the position of the aircraft and the reason for the missed report. In some cases, this may require immediately contacting the relevant ATSU;

b) ensure that subsequent to an unresolved missed 4D/15 tracking report, the relevant ATSU is contacted in accordance with 6.4 as soon as possible, but no later than a second missed 4D/15 tracking report;

c) ensure that when re-establishing communications with an aircraft following a missed 4D/15 tracking report an updated 4D position is requested/obtained; and

d) ensure that if an ATSU has been contacted to resolve a missed report, operators notify the ATSU immediately should they regain contact or reinstate tracking information from their aircraft.

Note.— ATSU emergency phase declarations in accordance with Annex 11, 5.2 are based on the earliest missed 4D/15 tracking report time.

6.4 CONTACT ATS UNIT (EXAMPLE OF A MISSED POSITION REPORT FORM IN APPENDIX C)

One of the (sub-) processes triggered by the operator's overall operational monitoring process is the preparation and delivery of a missed 4D/15 tracking report to the relevant ATSU when required, in the appropriate format and using the appropriate means. To achieve this aim, and assuming that the conditions to generate a report are satisfied, the operator should:

a) ensure access to an up-to-date emergency contact list of ATSU telephone numbers to contact the relevant ATSU in the event of a missed 4D/15 tracking report;

Note.— Refer to the references section for a link to the ATSU contact information for use in the event of a missed 4D position report (e.g. telephone numbers and, where available, other means of communication such as email addresses and fax numbers).

b) ensure operational control personnel have access to the standard report format to use when providing missed report information to ATSUs. This form includes operator contact information and non-public data (e.g. last reported position) which is necessary to validate that the information actually comes from the operator. The form includes fields for relevant information such as missed but located reports and last known position that ATSUs need to initiate alerting services.

Note.— Refer to Appendix C for an example of a 4D/15 missed position report form.

6.4.1 ***Resetting 4D/15 after a missed position report***

6.4.1.1 When a missed position report is resolved by the operator and/or ATSU and contact is re-established with an aircraft, it is necessary for the operator to reset and resume 4D/15 tracking. This typically occurs after an updated 4D/15 position report is obtained in accordance with 6.3.5 of this chapter. The reset procedure should address exactly when the next 4D/15 position report is expected from the aircraft. This is essential to preclude the unnecessary initiation of missed report procedures as a result of the next reporting (reset) interval or point never being clearly established.

6.4.1.2 Several options exist for accomplishing this reset procedure. They may depend on the technologies used or the operational requirements of the operator or the performance requirements of an ATSU. For example, the reset could occur as early as the next regularly scheduled 4D/15 reporting interval. Alternatively, the reset could occur 15 minutes after the last 4D/15 position report was received. Realistically, any point in time that remains within 4D/15 tracking and ATSU alerting timescales could be appropriate. In all cases, the most important attributes of the reset procedure are to clearly identify the reset point so that a 4D/15 position is received when expected in order to avoid the unnecessary initiation of missed report procedures.

Chapter 7

OPERATOR MONITORING OF AIRCRAFT EXPERIENCING AN ABNORMAL OPERATION OR EVENT

7.1 BACKGROUND

7.1.1 The guidance in this chapter is provided to supplement and support broader State requirements related to the operational control of a particular flight. This includes State requirements related to the operator responsibilities as described in Annex 6, Part I regarding the identification of emergency situations that may endanger the safety of the aeroplane or persons on board:

7.1.2 Annex 6, Part I, 3.1.5 states:

> 3.1.5 If an emergency situation which endangers the safety of the aeroplane or persons becomes known first to the flight operations officer/flight dispatcher, action by that person in accordance with 4.6.2 shall include, where necessary, notification to the appropriate authorities of the nature of the situation without delay, and requests for assistance if required.

7.1.3 Annex 6, Part I, 4.6.2 states:

> 4.6.2 In the event of an emergency, a flight operations officer/flight dispatcher shall:
>
> a) initiate such procedures as outlined in the operations manual while avoiding taking any action that would conflict with ATC procedures; and
>
> b) convey safety-related information to the pilot-in-command that may be necessary for the safe conduct of the flight, including information related to any amendments to the flight plan that become necessary in the course of the flight.
>
> *Note.— It is equally important that the pilot-in-command also convey similar information to the flight operations officer/flight dispatcher during the course of the flight, particularly in the context of emergency situations.*

7.1.4 Existing State requirements related to the operational monitoring of flights may be more restrictive based on the operator's method of control and supervision of flight operations.

7.1.5 Aircraft tracking under normal conditions, as defined in Annex 6, Part I, can potentially enable an operator to collect data from an aircraft in addition to those which are needed to fulfil tracking requirements. The operator could use such ancillary data to identify certain abnormal events that might be precursors to accidents or serious incidents. The collection and analysis of these data, while not defined in Annex 6 as a required aircraft tracking activity, present an opportunity for operators to capitalize on existing tracking capabilities.

7.1.6 Data collected through aircraft tracking under normal conditions and its analysis is intended to be used solely for the purpose of maintaining or improving safety. Provisions on the protection of safety data, safety information and related sources are contained in Appendix 3 of Annex 19 — *Safety Management*.

7.1.7 Abnormal events are those occurrences, defined by the operator, with the potential to develop into a condition of distress. By defining such events in the context of aircraft tracking, an operator with the requisite capabilities can routinely identify and, when practicable, more closely monitor an aircraft that may potentially be in distress. When such an aircraft is identified, an operator would use all available means to determine its operational state and monitor its position. This may include coordinating with the appropriate ATSU to the extent necessary and when attempts to communicate with the aircraft are unsuccessful.

Note.— Additional guidance related to the definition and categorization of abnormal events for incorporation into operator policy, processes and procedures is provided in 7.3 of this chapter.

7.1.8 The aircraft tracking and related monitoring activities described in the previous chapters rely solely on a missed 4D/15 tracking report as the triggering event for communicating with an aircraft in order to determine its operational state. Under normal conditions, therefore, required operator activities related to the determination of an aircraft's operational state may not begin until a scheduled automated position report is missed.

7.1.9 In contrast, the identification and monitoring activities described in this chapter are triggered by the detection of an aircraft experiencing an abnormal event. They are based on the operator's determination that an abnormal event may have occurred. Such a determination may be based on technologies purposed for aircraft tracking under normal conditions and/or on actionable operational data or information received from other sources.

7.1.10 The abnormal events within the scope of the activities described in this chapter are those that become known to the operator and can be broadly categorized as follows:

a) events discovered as a consequence of activities related to aircraft tracking under normal conditions (e.g. 4D/15 tracking data received from an aircraft does not coincide with an aircraft's planned, projected or expected 4D position); and

b) any other abnormal event or occurrence, as defined by the operator, that becomes known to the operator and that would, as practicable, need to be communicated to or reconciled with, the flight crew.

7.1.11 In summary, the monitoring of aircraft as described in the previous chapters, is an integral part of an operator's aircraft tracking capability. One by-product of such routine operational monitoring is the potential for an operator to take the pre-emptive steps necessary to identify, query and monitor a flight that may be experiencing an abnormal operation or event. In many cases, this can be readily accomplished using the existing operator systems, aircraft technologies and related resources already dedicated to aircraft tracking under normal conditions.

7.1.12 The implementation guidance for "abnormal" event monitoring provided here is intended to assist those operators that wish to further exploit and/or expand their flight monitoring capabilities. Such exploitation and/or expansion can assist in the early identification of an aircraft that may be experiencing an abnormal event. Identifying such aircraft, communicating with the flight crew and closely monitoring the aircraft's position are key parts of an overall operator strategy to address the sequence of events that may potentially lead to a condition of distress.

7.2 THE INTERRELATIONSHIP BETWEEN THE OCCURRENCE OF AN ABNORMAL EVENT AND THE DECLARATION/ESCALATION OF AN EMERGENCY PHASE

7.2.1 A review of the typical sequence of events before and after the ATSU declaration/escalation of an emergency phase is useful to highlight the importance of early ATSU and/or operator identification of aircraft experiencing abnormal events. The sequence typically begins with the detection of the event, progresses through the various emergency phases (uncertainty phase, alert phase, distress phase) and culminates in the initiation of SAR activities.

7.2.2 How an abnormal event is initially detected, however, varies and is largely dependent on the existing real-time surveillance and communication capabilities of ATSUs and operators. Whether an abnormal event is detected by an ATSU or an operator, successful detection also depends on the real-time analysis of information received from available ground-based and airborne systems, processes and technologies.

7.2.3 The guidance provided here, however, presumes the operator has undertaken the aircraft tracking responsibility (as defined by the Annex) and has access to information that may not be available to an ATSU (e.g. an ATSU may not have the capability to detect when an aircraft deviates from its assigned flight path). Any operator activities related to the identification of an aircraft that is potentially in distress, however, cannot conflict with ATC procedures. They are undertaken by the operator in addition to and to supplement the actions taken by an ATSU or a flight crew in accordance with Annexes 2, 6 and 11, as applicable.

Note 1.— Refer to Annex 6, Part I, 4.6.2, for the actions to be taken by a flight operations officer/flight dispatcher in the event of an emergency.

Note 2.— The communication of the escalation of an emergency phase to the rescue coordination centre (RCC) is performed by the ATSU and not by the aircraft operator. Refer to Annex 11 for the definitions of the emergency phases (uncertainty phase, alert phase and distress phase) as well as a description of the progression from one phase to the next.

7.2.4 Initial identification of an aircraft that may be experiencing an abnormal event

7.2.4.1 ATSUs rely primarily on the existing surveillance and communications capabilities to initially identify an aircraft experiencing an abnormal event that may develop into a condition of distress. ATC services, for example, may identify such an aircraft when:

a) it deviates from its assigned flight path;

b) continuous surveillance is lost;

c) normal voice and data communication is lost; and

d) it fails to report at a specific waypoint/interval or fails to arrive as planned into a region where ATS surveillance services are provided.

7.2.4.2 Operators, using actionable data from numerous sources, can also develop the capability to identify an aircraft experiencing an abnormal event based on predefined triggering events. One such triggering event could be, for example, a flight's deviations from planning criteria or a flight crew's deviation from operator policy, process and procedure (e.g. a significant deviation from the planned or projected altitude and/or route that cannot be reconciled against or explained by operator, policy and procedure). This could become known to the operator when comparing the aircraft's reported position with its expected or planned position.

Note.— When an ATSU (through its own capabilities or as assisted by the operator) confirms that an aircraft is experiencing an abnormal event, it follows standards as contained in Annex 11 and procedures for air navigation services contained in the Procedures for Air Navigation Services — Air Traffic Management *(PANS-ATM, Doc 4444) and the* Procedures for Air Navigation Services — Aircraft Operations *(PANS-OPS, Doc 8168).*

7.2.5 Verification of aircraft experiencing abnormal events

7.2.5.1 The current operator systems and procedures that allow for ATSU or operator identification and verification of an aircraft experiencing an abnormal event that may develop into a condition of distress rely predominantly on

communicating with the flight crew through either voice or data communications. A number of aircraft systems may be available to determine the operational state of a flight including VHF, HF and SATCOM voice communication or data communication through VHF, HF or satellite link.

7.2.5.2 Other existing communication and data gathering technologies associated with an operator's aircraft tracking capability can also be further leveraged to provide actionable information or data. These capabilities would be adapted so as to supplement or support flight crew actions and, in some cases, may even provide the first indication that an aircraft may be experiencing an abnormal event (e.g. engine exceedance alerting).

7.2.5.3 *Leveraging existing operator ground-based capabilities to detect an aircraft experiencing an abnormal operation or event*

7.2.5.3.1 An abnormal event is potentially identified when a required position is not received and normal voice and data communication with the aircraft cannot be established. The basis for this determination is the expectation that a required 4D/15 tracking report would be received at the required interval. Existing operator systems and processes, however, may not be tailored to detect an abnormal event if position data is received on schedule. To address this gap, the operator's ground-based systems and/or processes could be further adapted to more fully assess position-reporting data received from the aircraft that does not coincide with its projected or planned track.

7.2.5.3.2 This enhancement in ground-based capability could allow for the (early) detection of abnormal events that would not be otherwise captured by an operator's aircraft tracking capability. It could also be used as the triggering event for more closely monitoring the position of an aircraft (e.g. increasing the automated position reporting rate if practicable with the existing tracking technology).

7.2.5.4 *Leveraging existing reporting capabilities of an aircraft and related systems*

To complement refinements in ground-based systems, existing airborne systems and technologies could also be further leveraged to allow for closer monitoring of the position of an aircraft. The protocols (e.g. ADS-C periodic contract request) for the aircraft systems to send data could be further refined by the aircraft operator to increase the reporting rate based on predefined triggering events. An increased aircraft position reporting rate would then continue until the operational state of the aircraft can be determined by any means available.

7.3 OPERATOR ABNORMAL EVENT MONITORING POLICY, PROCESS AND PROCEDURE

7.3.1 The key to effective abnormal event monitoring is in establishing operator confidence that a flight is proceeding according to plan and the aircraft is in a normal operational state. If such confidence cannot be established, is in question or is lost, then the steps that should be taken by the operator to communicate with the flight, determine its operational state and coordinate with the relevant ATSU as necessary, should be clearly documented.

7.3.2 It is also important for the operator to appropriately define the events within the scope of "abnormal" event monitoring. This is a necessary step as there are many occurrences that could affect the safety of a flight that are routinely resolved by the flight crew and only communicated to the operator and relevant ATSU if necessary. There are also many deviations from the flight plan that are within the scope of "normal" operations that could be misidentified as "abnormal" by the operator in the absence of clear and concise guidance for flight crew and operational control personnel.

7.3.3 Defining abnormal events

7.3.3.1 As described in 7.1, an operator must clearly define abnormal events in order to trigger subsequent and related monitoring activities. This would include clearly differentiating between the more typical occurrences (e.g. weather deviations) and those occurrences detected by the operator, which, if left unreconciled (and uncommunicated to the relevant ATSU), could escalate to an emergency. In a general sense, and for the purposes of developing operator policy, processes and procedures, the definition of an "abnormal event" can be further refined to address any event during flight which is outside the parameters defined (by the operator) for normal operations.

7.3.3.2 The classification and level of detail provided to operational control personnel with respect to such events is at the discretion of the operator. Operators should, however, take care to provide sufficient detail to preclude the mischaracterization of normal operational events or occurrences as abnormal. This is to preclude false alerts when no abnormal situation actually exists and a notification to an ATSU (and ultimately an RCC) should not have resulted.

7.3.4 Determination of an abnormal event and forewarning of a distress condition

As described in 7.1, for the purposes of providing sufficient guidance to operational control personnel, abnormal events that may provide forewarning of a distress situation can be classified in operator documentation as presented in Table 7-1 as follows:

Table 7-1. Examples of abnormal events

Abnormal events discovered as a consequence of aircraft tracking under normal conditions, including for example, (when ADS-C is used to meet tracking requirements):	Other abnormal events or occurrences, as defined by the operator for example:
• 4D/15 tracking data received from an aircraft does not coincide with an aircraft's planned, projected or expected 4D position (e.g. ADS-C lateral or level range deviation). • Ancillary information or data received as a consequence of normal tracking activities indicate an abnormal aircraft state (e.g. aircraft-initiated emergency reporting).	• Actionable information or data from any source that becomes known to the operator, indicates the potential for a distress condition to develop and that needs to be communicated to or reconciled with the flight crew. Examples include but are not limited to: a) safety and/or security threats received against or projected for the flight (e.g. sabotage threat, operations in conflict zones); b) engine exceedance alerting; c) information or data categorized as abnormal by the operator received from engine condition monitoring systems, in-flight entertainment systems and/or any other onboard system that routinely transmits information or data to the operator; and d) a loss of telemetry from one or more on board systems that routinely transmit data to the operator.

7.3.5 Increasing the automated reporting rate and recommended triggering parameters

7.3.5.1 Given the importance of accurately determining the position of an aircraft in distress, it would be desirable for the automated position-reporting rate associated with aircraft tracking under normal conditions to be increased in response to abnormal events detected by the operator. For operators that possess such capability, procedures and/or processes should be in place to increase the reporting rate based on predefined conditions. The purpose of the increased reporting rate is to provide the relevant ATSUs with the most accurate position data available should an escalation to an emergency phase occur.

7.3.5.2 Any increase in reporting rate commensurate with the capability of the technologies used for aircraft tracking would be helpful in localizing an aircraft that is potentially in distress. Existing technologies used for aircraft tracking (e.g. ADS-C) have the capability to transmit position data at intervals of approximately once every minute. Such triggered transmissions of aircraft can allow for locating an aircraft within a 6 NM radius.

Note.— Refer to Chapter 4 for information related to the development of area specific guidance that would assist operational control personnel in identifying the (relevant) ATSU(s) requiring access to aircraft position data.

7.3.6 Resolution of abnormal events

After an abnormal event is detected, the primary objective of the operator is to establish communication with the aircraft by any available means. Operators with access to rapid and reliable communications systems will be able to determine the operational state of aircraft much faster than those with less developed communication capabilities. The capability of an operator to communicate with its aircraft therefore should be addressed by procedure as it may determine when the assistance and support of a relevant ATSU will be required. Operator policy, process and procedures related to resolving detected abnormal events should aim to:

a) determine in a timely manner and by any available means, the operational state of the aircraft;

b) notify the relevant ATSU, under the conditions defined by the operator, including when attempts to contact the aircraft are unsuccessful;

c) ensure operators notify the relevant ATSU immediately should they regain contact with their aircraft;

d) if achievable, trigger an increased automated position reporting interval; and

e) when an abnormal event is resolved and contact re-established with an aircraft, trigger a return to the normal tracking interval.

Note.— Refer to 6.3.5 for additional guidance related to re-establishing communications with an aircraft in order to determine its operational state.

7.3.7 ATS unit (ATSU) notification and coordination

When an abnormal event is detected, and the operational state of the aircraft cannot be determined, the operator contacts the ATSU(s) corresponding with the last known position of the aircraft and expected track. The operator may use the contact directory service for obtaining the ATSU ID and point of contact. Once the ATSU establishes that there may be an emergency, the operator must make available on request, all information which may be of use to the ATSU and/or SAR, including aircraft tracking information.

Note.— Refer to Appendix C for the missed 4D/15 report form that should be used by the operator to relay aircraft information to the relevant ATSU.

Chapter 8

OPERATOR MISSED REPORTS NOTIFICATION TO ATS UNIT

8.1 MISSED REPORT PROCESSING

8.1.1 This chapter outlines the procedures to be followed when an operator notifies an ATSU of a missed aircraft 4D/15 tracking report. The procedures relating to the ATS alerting service are detailed in Annex 11. The new element comes from the fact that those procedures can now benefit from information provided, by the operator, to the ATSU(s).

8.1.2 ATSUs are responsible for providing alerting services that notify appropriate organizations when an aircraft is considered to be in state of emergency. This involves notifying the RCCs. The ATSU serves as the central point for collecting all information relevant to the emergency state of an aircraft operating within the flight information region or control area concerned, and for forwarding such information to the appropriate RCC. However, ATSUs may not always have direct access to the most recent 4D aircraft position data.

8.1.3 In areas outside ATS surveillance and direct controller-pilot communication, operators may undertake 4D/15 tracking, depending on airspace region, as described in Chapter 2. Consequently, and after following the procedures outlined in 5.1.1.1, the operator is required to notify the relevant ATSU when communication attempts with the aircraft are unsuccessful and/or 4D/15 missed reports occur. Figure 8.1 provides an overview of the process to follow following a missed 4D/15 position report.

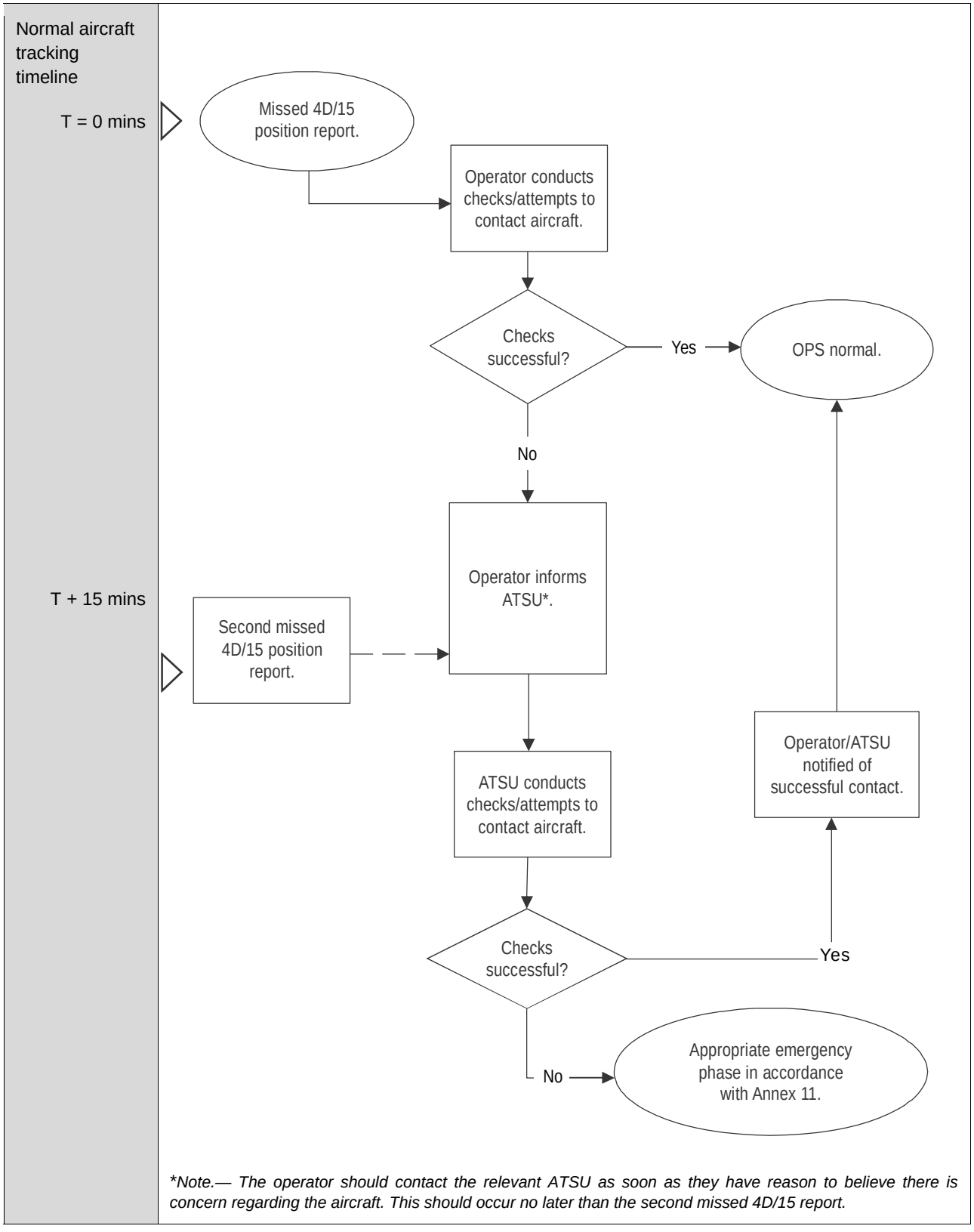


Figure 8-1. Example flowchart for missed 4D/15 position report

8.2 CONTENT OF THE OPERATOR NOTIFICATION REPORT

8.2.1 The notification report should include, at a minimum, the following information:

1. initial or subsequent notification indication
2. flight number and call-sign
3. aircraft type
4. last known 4D/15 position
5. time of last communication
6. last known altitude or flight level
7. next expected 4D/15 position (if known), and estimate
8. name of ATSU notified
9. name of operator
10. contact details of operator primary point of contact for this event.

8.2.2 The report may also contain the following supplementary information:

11. contact actions attempted
12. registration
13. colour and distinctive marking
14. fuel endurance or fuel endurance remaining at last known position
15. total persons on board
16. alternate or possible alternate aerodromes
17. any other relevant information (e.g. dangerous goods carried).

Note.— Every attempt should be made to include items 11 – 17 in subsequent reports.

8.2.3 An example of the 4D/15 missed report form containing the above information can be found in Appendix C.

8.3 FOLLOW-UP OF A NOTIFICATION REPORT

On receipt of such a report, the ATSU would conduct their own attempts to contact the aircraft, in line with their established procedures.

8.3.1 Action when communication is re-established

Should the ATSU establish contact with the aircraft, the ATSU needs to notify the operator so that the operator may verify if there are any system failures that caused the missed 4D/15 reports. The flight will continue without this capability in the event of a failure, subsequently the operator will re-establish 4D/15 tracking if possible.

8.3.2 Action when communication is not established: emergency phase declarations

8.3.2.1 If the ATSU is not able to establish contact with the aircraft, the ATSU will declare the appropriate emergency phase. When determining which emergency phase to initiate, the ATSU will build on the sequence of events that led to the present situation and will consider that, for the event to have progressed to this stage, the following had occurred:

a) one 4D/15 report was missed (possibly more) and the operator was unable to contact the aircraft; and

b) the ATSU was also unable to contact the aircraft.

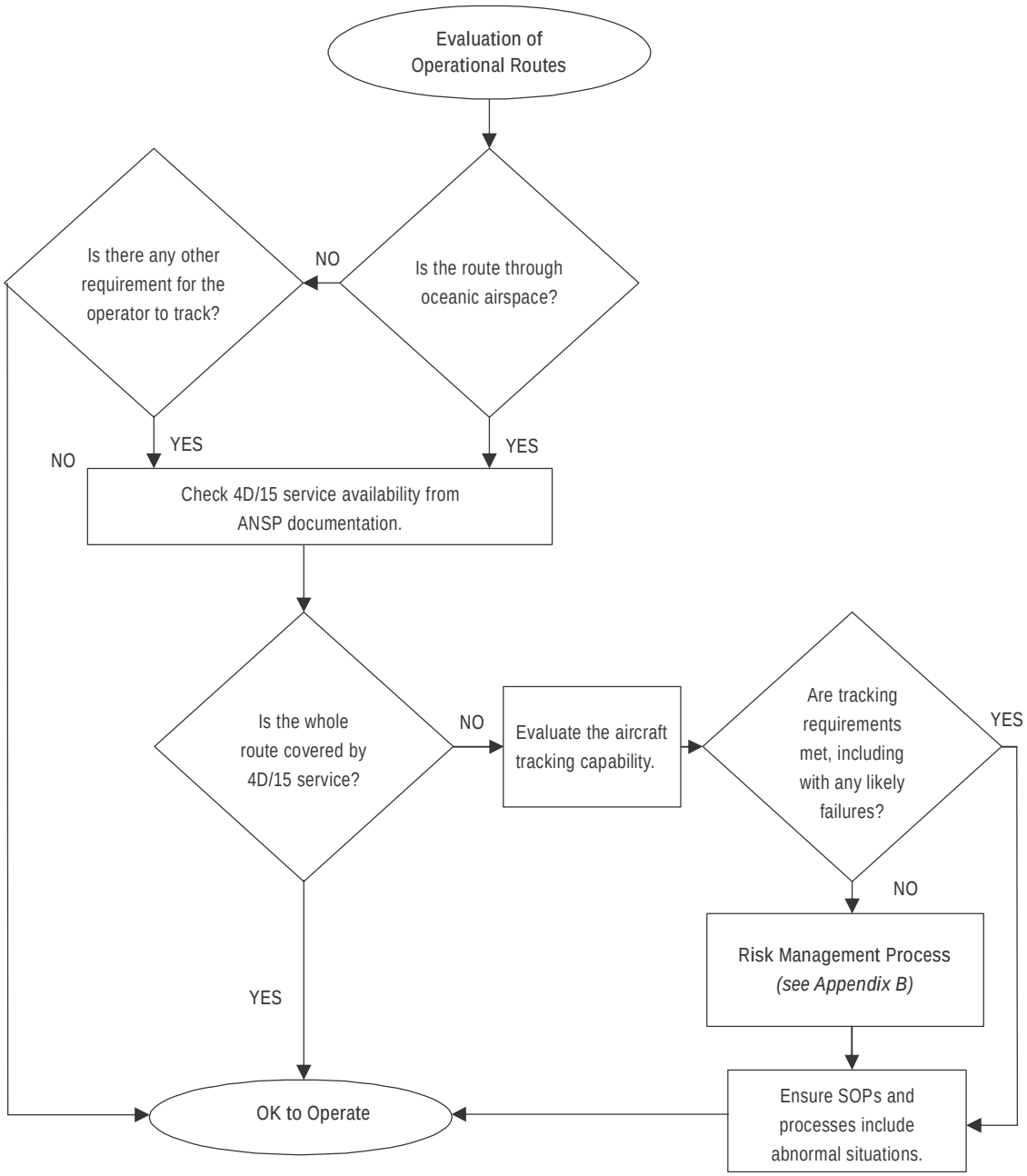
8.3.2.2 In the absence of any recent communication between the ATSU and the aircraft, the additional information provided to the ATSU as a result of operator aircraft tracking will therefore provide direct support to the provision of the appropriate alerting service. The time of the first missed 4D/15 position report, could, in particular, be used as the time at which a loss of communication with the aircraft is assumed to have begun. This may provide enough justification for the ATSU to begin an alert phase because attempts to establish communication with the aircraft or enquiries to other relevant sources have failed. Initiating the alert phase in a timely manner increases the likelihood of finding survivors after an accident.

8.4 OBLIGATIONS OF ATS UNITS

Should there be an upgrade of the emergency phase after the initial declaration, the ATSU, in accordance with Annex 11, Chapter 5, must inform the RCC immediately. When the ATSU is informed that an aircraft has resumed normal operations or has landed safely following the declaration of an emergency phase, the RCC is informed, without delay, that the emergency situation no longer exists. All information notified to the RCC by an area control or flight information centre should, whenever practicable, also be communicated without delay, to the operator.

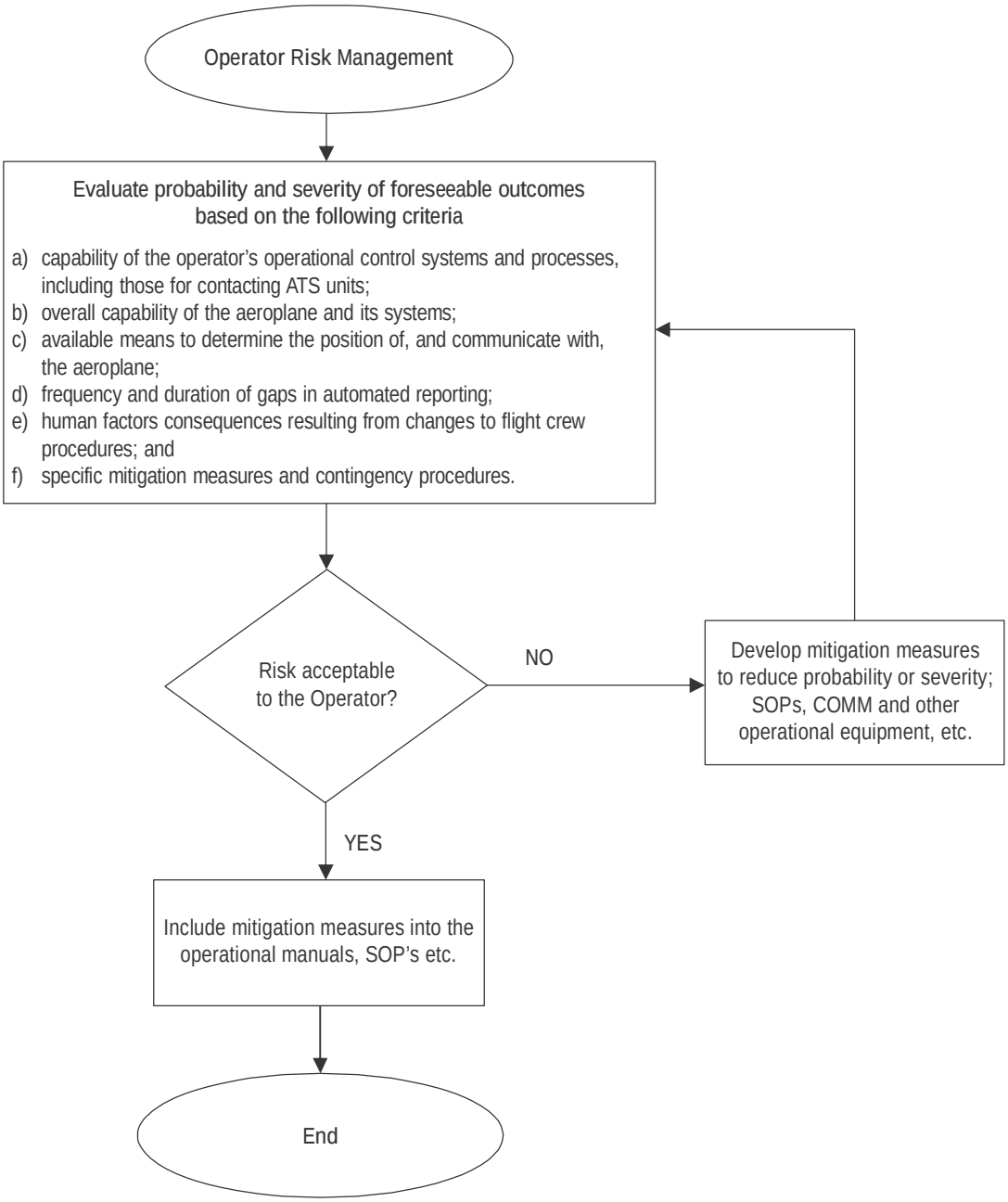
Appendix A

OPERATOR 4D/15 TRACKING PROCESS FLOWCHART



Appendix B

AIRCRAFT TRACKING RISK MANAGEMENT FLOWCHART



Appendix C

MISSED 4D/15 POSITION REPORT FORM FOR OPERATOR

	Required information	
1.	Initial or subsequent notification indication	
2.	Flight number and call-sign	
3.	Aircraft type	
4.	Last known position (place, time)	
5.	Time of last communication	
6.	Last known altitude or flight level	
7.	Next expected 4D/15 position (if known), and estimate	
8.	Name of ATSU notified	
9.	Name of operator	
10.	Contact details of operator primary point of contact for this event	
	Supplementary information, if available	
11.	Contact actions attempted	
12.	Registration	
13.	SAR info: colour and distinctive marking	
14.	Fuel endurance or fuel endurance remaining at last known position	
15.	Total persons on board	
16.	Alternate or possible alternates	
17.	Any other relevant information (e.g. dangerous goods on board, etc.)	

— END —

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