



International Civil Aviation Organization

**The Third Meeting of the Air Traffic Flow Management Task Force
(ATFM/TF/3)**

Bangkok, Thailand, 6 to 9 September 2005

Agenda Item 5: Safety Assessment

ICAO SAFETY MANAGEMENT SYSTEM PROVISIONS

(Presented by the Secretariat)

SUMMARY

This paper presents information in relation to ICAO ATS safety management provisions.

1. INTRODUCTION

1.1 Safety has always been an important consideration in all aviation activities. This is reflected in the aims and objectives of ICAO as stated in Article 44 of the *Convention on International Civil Aviation* (Doc 7300), commonly known as the Chicago Convention, which charges ICAO with ensuring the safe and orderly growth of international civil aviation throughout the world.

1.2 The standards and recommended practices relating to the implementation by States of safety management programmes for Air Traffic Services (ATS) were introduced in Section 2.26 of Amendment 40 to Annex 11 – *Air Traffic Services*, which became applicable on 1 November 2001. Further provisions relating to the implementation of these safety management programmes, applicable from the same date, are contained in Chapter 2 of *Procedures for Air Navigation Services – Air Traffic Management* (PANS-ATM, Doc 4444).

1.3 The implementation of these provisions has implications for both providers of air traffic services, and the regulatory bodies within the States. However, it is the State which is responsible for implementation of ICAO SARPS within the airspace and at aerodromes for which it has responsibility and, in this context, for maintaining an acceptable level of safety in their operations.

2. DISCUSSION

2.1 The ICAO draft Manual on Safety Management for Air Traffic Services provides guidance in respect of safety analysis. A safety analysis must consider more than just the likelihood of failures during normal operation of the system. In particular, it must consider the effects of continued unavailability of one element of the system on other aspects of the system, and the implications of any loss of functionality or loss of redundancy as the result of equipment being taken out of service for routing maintenance. It is therefore important that the scope of the analysis, and the definition of the boundaries of the system for purposes of the analysis, be sufficiently broad that all necessary supporting services and activities are included.

Safety Assessment

2.2 Annex 11, paragraph 2.26.5, requires States to undertake a safety assessment prior to the implementation of any new separation minimum or procedure, in order to demonstrate that it meets an acceptable level of safety. Annex 11 requires that any significant safety-related change to the ATC system shall only be implemented after a safety assessment has demonstrated that an acceptable level of safety will be maintained (**Attachment A** refers).

2.3 More specific information on the circumstances in which a safety assessment could be required can be found in the PANS-ATM, Chapter 2, Section 2.6 (**Attachment B** refers). These examples can be used as a guide to aid State ATS providers in assessing when a safety assessment should be conducted.

2.4 Safety assessment is a structured and systematic process for the identification of hazards and assessment of the risk associated with each hazard. A safety assessment based on these concepts is essentially a process for finding answers to three fundamental questions:

- What could go wrong?
- What would be the consequences? and
- How often is it likely to occur?

2.5 In respect of the equipment to be used, a safety assessment should consider the following sources of faults:

- Hardware faults;
- Software malfunctions;
- Environmental conditions;
- Dependencies on external services; and
- Operating and maintenance procedures.

2.6 If the result of an assessment is that the system under review does not satisfy the safety assessment criteria, it will be necessary to find some means of modifying the system in order to reduce the risk. This process is called risk mitigation. The development of mitigation measures becomes an integral part of the assessment process, since the adequacy of the proposed mitigation measures must be tested by re-evaluating what the risk would be with the mitigation measures in place.

2.7 The purpose of safety assessment documentation is to provide a permanent record of the final result of the safety assessment, and the arguments and evidence demonstrating that the risks associated with the implementation of the proposed system or change have been eliminated, or have been adequately controlled and reduced to a tolerable level.

3 ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) note the information in respect of ICAO SMS provisions; and
- b) consider safety assessment issues associated with the implementation of an ATFM automated tool for the Bay of Bengal.

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Extracted from Annex 11 – Air Traffic Services (pages dated 28/11/02)

2.26 ATS safety management

2.26.1 States shall implement systematic and appropriate ATS safety management programmes to ensure that safety is maintained in the provision of ATS within airspaces and at aerodromes.

2.26.2 As of 27 November 2003, the acceptable level of safety and safety objectives applicable to the provision of ATS within airspaces and at aerodromes shall be established by the State or States concerned. When applicable, safety levels and safety objectives shall be established on the basis of regional air navigation agreements.

Note.— The acceptable level of safety may be specified in qualitative or quantitative terms. The following are examples of measures which could be used to express the acceptable level of safety:

- a) a maximum probability of an undesirable event, such as collision, loss of separation or runway incursion;*
- b) a maximum number of accidents per flight hour;*
- c) a maximum number of incidents per aircraft movement;*
- d) a maximum number of valid short-term conflict alerts (STCA) per aircraft movement.*

2.26.3 **Recommendation.**— *The acceptable level of safety and safety objectives applicable to the provision of ATS within airspaces and at aerodromes should be established by the State or States concerned. When applicable, safety levels and safety objectives should be established on the basis of regional air navigation agreements.*

2.26.4 An ATS safety management programme shall, *inter alia*:

- a) identify actual and potential hazards and determine the need for remedial action;
- b) ensure that remedial action necessary to maintain an acceptable level of safety is implemented; and
- c) provide for continuous monitoring and regular assessment of the safety level achieved.

2.26.5 Any significant safety-related change to the ATC system, including the implementation of a reduced separation minimum or a new procedure, shall only be effected after a safety assessment has demonstrated that an acceptable level of safety will be met and users have been consulted. When appropriate, the responsible authority shall ensure that adequate provision is made for post-implementation monitoring to verify that the defined level of safety continues to be met.

Note 1.— When, due to the nature of the change, the acceptable level of safety cannot be expressed in quantitative terms, the safety assessment may rely on operational judgement.

Note 2.— Attention is drawn to guidance material contained in the Air Traffic Services Planning Manual (Doc 9426), the Manual on Airspace Planning Methodology for the Determination of Separation Minima (Doc 9689), the Manual on Implementation of a 300 m (1 000 ft) Vertical Separation Minimum between FL 290 and FL 410 Inclusive (Doc 9574) and the Manual on Required Navigation Performance (RNP) (Doc 9613).

Extracted from PANS ATM (Doc 4444, pages valid 1/11/01)

2.6 SAFETY ASSESSMENTS

2.6.1 Need for safety assessments

2.6.1.1 A safety assessment shall be carried out in respect of proposals for significant airspace reorganizations, for significant changes in the provision of ATS procedures applicable to an airspace or an aerodrome, and for the introduction of new equipment, systems or facilities, such as:

- a) a reduced separation minimum to be applied within an airspace or at an aerodrome;
- b) a new operating procedure, including departure and arrival procedures, to be applied within an airspace or at an aerodrome;
- c) a reorganization of the ATS route structure;
- d) a resectorization of an airspace;
- e) physical changes to the layout of runways and/or taxiways at an aerodrome; and
- f) implementation of new communications, surveillance or other safety-significant systems and equipment, including those providing new functionality and/or capabilities.

Note 1.— A reduced separation minimum may refer to the reduction of a horizontal separation minimum, including a minimum based on required navigation performance (RNP), a reduced vertical separation minimum of 300 m (1 000 ft) between FL 290 and FL 410 inclusive (RVSM), the reduction of a radar separation or a wake turbulence separation minimum or reduction of minima between landing and/or departing aircraft.

Note 2.— When, due to the nature of the change, the acceptable level of safety cannot be expressed in quantitative terms, the safety assessments may rely on operational judgement.

2.6.1.2 Proposals shall be implemented only when the assessment has shown that an acceptable level of safety will be met.

2.6.2 Safety-significant factors

The safety assessment shall consider relevant all factors determined to be safety-significant, including:

- a) types of aircraft and their performance characteristics, including aircraft navigation capabilities and navigation performance;
- b) traffic density and distribution;
- c) airspace complexity, ATS route structure and classification of the airspace;
- d) aerodrome layout, including runway configurations, runway lengths and taxiways configuration;
- e) type of air-ground communications and time parameters for communication dialogues, including controller intervention capability;
- f) type and capabilities of surveillance system, and the availability of systems providing controller support and alert functions; and
- g) any significant local or regional weather phenomena.

Note 1.— See also Chapter 5, Section 5.11 concerning reductions in separation minima.

Note 2.— Guidance material on methods of expressing and assessing a safety level and on safety monitoring programmes is contained in Annex 11, Attachment B, the Air Traffic Services Planning Manual (Doc 9426), the Manual on Implementation of a 300 m (1 000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive (Doc 9574), the Manual on Required Navigation Performance (RNP) (Doc 9613) and the Manual on Airspace Planning Methodology for the Determination of Separation Minima (Doc 9689).