

ELEVENTH AIR NAVIGATION CONFERENCE

Montreal, 22 September to 3 October 2003

Agenda Item 2: Safety and security in air traffic management (ATM)
2.1: Safety management systems and programmes

A GLOBAL FRAMEWORK FOR SAFETY

(Presented by the Secretariat)

SUMMARY

This paper advocates the establishment of a safety framework that is based on the system safety approach that is globally standardized and logically unified while remaining closely and rationally linked to developments in the area of total system performance.

Action by the Conference is in paragraph 3.

1. INTRODUCTION

1.1 The air traffic management (ATM) operational concept presented under Agenda Item 1 of this Conference established a strong link between the key concepts of performance and safety. There are two aspects to this linkage:

- a) safety performance is one of the key performance indicators for the ATM system; and
- b) the planning and implementation of all measures designed to improve the performance of other aspects of the ATM system must include an assessment of their impact on the overall system safety.

1.2 Amendment 41 to Annex 11 — *Air Traffic Services*, which became applicable on 1 November 2001, introduced a requirement for ATS providers and regulators to establish formal safety management programmes. A similar requirement has been introduced for aerodromes, through the mechanism of the aerodrome certification provisions of Annex 14 — *Aerodromes*. Safety assessments have also always been a key element in the certification of aircraft and aircraft systems.

1.3 In current air traffic management systems, there is already a significant degree of interdependence between ground-based and airborne components of the overall system. It is expected that in future, more advanced systems, this interdependence will become even more significant. This must be reflected

in the approach to safety. It is for this reason that the system safety approach described in the ATM operational concept proposes an integrated, system-wide approach to safety.

2. DISCUSSION

2.1 The effective and safe functioning of the aviation system is dependent on a large number of individual elements, which include, *inter alia*: personnel, rules of the air, meteorological information, aeronautical information, aeronautical charts, units of measurements, aircraft systems, operational procedures, maintenance procedures, air traffic services procedures and facilities, search and rescue, aerodromes and associated ground facilities, environmental requirements, and dangerous goods handling procedures. The safety of the system as a whole is dependent not just on the individual elements, but also on the way in which the people, procedures, technologies and information interact in the operation of the system.

2.2 Within ICAO, a number of closely related initiatives have been or are being progressed in the related areas of safety and performance. These include:

- a) the ICAO Universal Safety Oversight Audit Programme (USOAP), and its expansion to cover Annex 11, Annex 13 — *Aircraft Accident and Incident Investigation* and Annex 14;
- b) the introduction of provisions in Annex 11 and the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444) requiring States to establish ATS safety management programmes;
- c) the introduction of provisions in Annex 14 relating to certification of aerodromes, which require that certified aerodromes have in operation a safety management system;
- d) introduction into Standards and Recommended Practices (SARPS) of provisions, such as carriage of ground proximity warning systems (GPWS) and terrain portrayal on approach charts, to help reduce the likelihood of controlled flight into terrain (CFIT) accidents;
- e) development of CFIT educational and training material;
- f) the development of guidance material on crew resource management;
- g) upgrading the provisions relating to the carriage of airborne collision avoidance system (ACAS) and secondary surveillance radar (SSR) transponders;
- h) the establishment of programmes to monitor gross navigation errors in minimum navigation performance specification (MNPS) and required navigation performance (RNP) airspace, and height-keeping errors in reduced vertical separation minimum (RVSM) airspace;
- i) the establishment of the ICAO Safety Indicators Study Group (SISG);
- j) the development of a runway incursion prevention tool kit, and the instigation of a runway incursion prevention education and awareness campaign;

2.3 In addition to the ICAO activities, work is underway in some States and international organizations to develop performance frameworks and their related metrics (e.g. key performance indicators).

2.4 ICAO has established the global aviation safety plan (GASP) as a means of coordinating the many safety initiatives underway worldwide. This is not a separate activity in its own right; rather, it is a mechanism which allows consolidated reporting on safety-related activities, and presents an overview of all safety-related activities in one document. Further information on GASP will be provided in AN-CONF/11-WP/10, under Agenda Item 2.4.

2.5 Aviation is a complex system, the safety of which depends on the performance of a large number of different elements. This is well illustrated by the range of current safety-related initiatives listed paragraph 2.2. The safety of such a system cannot be assured by consideration of the safety of individual elements in isolation.

2.6 While existing mechanisms within ICAO provide for consolidated reporting of safety-related activities, there is, as yet, no mechanism for establishing and requiring a unified approach to the management of safety and the setting of safety targets for individual system elements. It is for this reason that the ATM operational concept, presented under Agenda Item 1, calls for a *system safety approach*, and the establishment of a global framework for the assessment and management of safety. This would be in accordance with the objectives of Assembly Resolution A33-16, which is reproduced in Appendix B to AN-Conf/11-WP/10.

2.7 In the absence of such a globally-agreed framework, there would be a definite risk of duplication of effort in the analysis of common problems, or of excluding consideration of a critical issue believed to be adequately taken care of by other groups.

2.8 The system safety approach requires that each individual element of the system be the subject of a safety analysis as an individual element and as a component which interacts with others as part of a larger system. It is defined in the operational concept as:

System safety approach. A systematic and explicit approach defining all activities and resources (people, organizations, policies, procedures, time spans, milestones, etc.) devoted to the management of safety. This approach starts before the fact, is documented, planned and explicitly supported by documented organizational policies and procedures endorsed by the highest executive levels. The system safety approach uses systems theory, systems engineering and management tools to manage risk formally, in an integrated manner across all organizational levels, across all disciplines and all system life cycle phases.

2.9 The global framework for safety management would be expected to address issues such as:

- a) harmonization of safety indicators to be used across the aviation system, with particular emphasis on the development of predictive or “leading” indicators in addition to those which express the achieved level of safety;
- b) the setting of safety targets for the system as a whole;
- c) guidelines for determining the acceptable level of safety for particular system components and appropriate metrics for expressing this;
- d) guidelines concerning the way in which accountability for safety should be addressed within an organization and the need for documentation of safety-related decisions;

- e) suitable mechanisms for monitoring of safety indicators and ensuring that there are formal feedback learning/control loops (such as the USOAP), to ensure that mitigation measures are implemented in areas where safety concerns are identified; and
- f) the importance of all organizations developing a positive safety culture, recognizing that accidents result not just from the mere coincidental occurrence of multiple undefended failures, but also from the migration of organizations toward unsafe behaviour.

2.10 A holistic approach (i.e. an approach which considers the “whole made of interacting parts”) is considered by many safety authorities to provide the most effective and efficient approach to the management of safety. The characteristics of the current approach to safety are the result of historical development. The adoption by ICAO of a logically-unified safety framework, as proposed in the system safety approach, would significantly enhance the effectiveness of the safety management process.

3. ACTION BY THE CONFERENCE

3.1 The Conference is invited to:

- a) note the logical linkage between system safety and overall system performance; and
- b) agree on the following recommendation:

Recommendation 2/ — A framework for system safety

That ICAO investigate appropriate mechanisms for the development and implementation of a framework for a system-wide approach to safety and the harmonization of provisions relating to safety assessment and management in all Annexes.

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