

ELEVENTH AIR NAVIGATION CONFERENCE

Montreal, 22 September to 3 October 2003

**REPORT OF COMMITTEE A TO THE CONFERENCE
ON AGENDA ITEM 3**

The attached report has been approved by Committee A for submission to the Plenary.

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Chairman
Committee A

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Agenda Item 3 Air traffic management (ATM) performance targets for safety, efficiency and : regularity and the role of required total system performance (RTSP) in this respect

3.1 INTRODUCTION

3.1.1 Under this agenda item, the meeting considered the establishment of performance targets for ATM as well as the concept of required total system performance (RTSP).

3.2 PERFORMANCE TARGETS FOR ATM

Required communication performance (RCP)

3.2.1 ICAO activities to develop a concept of RCP in the provision of air traffic services (ATS) were reviewed. It was noted that in 1996 the Aeronautical Mobile Communications Panel during its consideration of general aspects in the future evolution of the very high frequency digital link (VDL), had seen RCP as a set of performance parameters, the values of which would determine the operational requirements for communication systems in the various phases of flight. The meeting was informed that the panel had agreed upon the urgent need to assess the various technical options of communication systems against such a set of parameters. In follow-up, the Air Navigation Commission had tasked the Automatic Dependent Surveillance Panel (subsequently renamed as the Operational Data Link Panel(OPLINKP)) to develop the concept of RCP.

3.2.2 It was noted that before the advent of data communication systems for ATS, voice communications were assessed on the basis of actual performance, as it usually was readily evident when performance became degraded or was unavailable. With data link, however, these indications were not provided in the same way. The acceptance of data communications as a technology for communications, navigation, and surveillance/air traffic management (CNS/ATM) systems, in addition to voice communications, meant that a formal method of determining and specifying communication performance suitable for a variety of ATS functions was desired. Such a concept should be seen as a complement to collision risk modelling.

3.2.3 The meeting noted a number of key characteristics of RCP, the most significant of which were that the concept was performance based, human-centred, operationally significant and independent of specific technologies.

3.2.4 It was noted that in 2001, States and international organizations had been consulted on the RCP operational concept developed by OPLINKP, with a majority of responses indicating broad support for the operational concept of RCP. The meeting was informed that the OPLINKP was continuing work on the task and was expected to report on substantial progress by 2005.

3.2.5 On the basis of its discussions, the meeting agreed that further work was needed to develop means to specify performance requirements appropriate for the assumptions made by separation studies, particularly with regard to controller intervention and pilot-initiated weather deviations, within the framework provided by the RCP concept. It was also agreed that there was a need for further work on the relationship

of the RCP concept to interoperability, as well as efforts in the areas of standardization of RCP types and allocations, assessment of the adequacy of international air traffic services procedures for new CNS/ATM environments and safety performance monitoring.

3.2.6 Recognizing the important position States and PIRGs would have in ensuring an orderly and coordinated implementation of RCP, the meeting noted that on-going work by OPLINKP would continue to concentrate on how RCP would provide regional planning and implementation groups with a basis for the development of documents, procedures, and programmes to introduce the use of RCP in the airspace planning methodology. In this regard, State and regional support for performance-based planning was seen as an essential first step in advancing to the implementation stage.

3.2.7 In light of the urgent need for global harmonization of communication performance measures, the meeting recommended that ICAO give high priority to progress the work of enabling RCP implementation, while ensuring full consistency with the broader concept of RTSP being developed in parallel:

Recommendation 3/1 — Required communication performance (RCP)

That ICAO:

- a) continue the development of Standards and Recommended Practices (SARPs), procedures and guidance material on RCP; and
- b) investigate areas for further work to determine the relationship of the RCP concept to separation studies and interoperability, the standardization of RCP types and allocations, the adequacy of ATS functions and procedures for new CNS/ATM environments, as well as requirements for safety performance monitoring.

Performance metrics and ATM

3.2.8 During further discussions on performance targets for ATM, several presentations were made on work undertaken with regard to the analysis of economic performance, including quality, efficiency of service and establishment of benchmarks.

3.2.9 The meeting was made aware of on-going work within ICAO seeking to define the future involvement of the Organization with regard to the development and use of performance metrics in the provision of ATM and related services. It was noted that the *Manual on Air Navigation Services Economics* (Doc 9161), containing guidance material on organizational, managerial and financial aspects of the operation and provision of air navigation services (ANS), was under revision and being expanded. On the basis of work undertaken in several States, the manual would eventually provide a general description of best practices in benchmarking and performance measurement, however, without going into detail or trying to define any parameters. The guidance would be non-prescriptive, encouraging States to publish their particular performance measures in order to facilitate user consultation.

3.2.10 It was stressed that substantial benefits stood to be gained from the introduction of a strong, transparent and independent performance review system; for example, a 10 per cent improvement in cost-effectiveness equalled, in Europe alone, a potential saving of some 1 600 Million a year. It was also

emphasized that in the analysis of economic performance of ATM, transparency was seen as an essential component of a performance review system to ensure the cost-effectiveness of air navigation services and to support target setting and performance processes.

3.2.11 The meeting noted that expectations of the airlines sometimes went further than among other members of the ATM community. In this context, the meeting recognized that although safety was paramount, efficiency and regularity were still crucial to the development of a sustainable, efficient and cost-effective air transport system. The efficiency of an ATM service provider in delivering a service, including equipment and staffing, had a profound effect on the cost of that service to the airspace user. Although many elements relating to ATM efficiency and regularity could not yet be established mathematically, they were nevertheless measurable, and should be evaluated through observation and benchmarking. In this context it was essential that the highest degree of openness and transparency be maintained.

3.2.12 The point was also raised, however, that economic indicators alone were not sufficient, but that other factors like the number of trained staff and safety recommendations addressed also were important measurements related to performance.

3.2.13 The meeting recognized that some caution would be appropriate in relation to benchmarking, keeping in mind the need for diversity, that all locations and States were not immediately comparable and that not only quantitative but also qualitative aspects should be considered. On the other hand, what was not measured would stand little chance of being improved.

3.2.14 It was pointed out that a system of quality management could easily be added to the safety management systems currently being implemented. This would encourage an atmosphere of continuous improvement among air traffic services providers.

3.2.15 The meeting noted progress as regards the analysis of economic performance of ATM and benchmarking, and recommended that ICAO continue its work in this field, including an assessment of the need for worldwide standardization of minimum reporting requirements.

Recommendation 3/2 — Standardization of minimum reporting requirements

That ICAO continue its work in the field of economic performance of ATM and benchmarking, and assess the need for world-wide standardization of minimum reporting requirements in relation to information disclosure.

3.3 THE CONCEPT OF RTSP

Introduction

3.3.1 The meeting reviewed the results of the work of the Air Traffic Management Operational Concept Panel (ATMCP) to date on the subject of performance and required total system performance (RTSP). The panel had identified air traffic management performance, including the notion of RTSP, as a key aspect of the ATM operational concept and had therefore decided to introduce RTSP in the operational

concept. The purpose of the discussion was to clarify and develop the next steps of RTSP development on the basis of the initial arguments related to the feasibility of RTSP as a method to measure performance of the ATM system.

3.3.2 It was pointed out that the performance work undertaken by the ATMCP was only of an initial nature, and that further substantial work remained, in order to have the subject of ATM performance covered at the desired level of clarity.

Need for performance orientation

3.3.3 The meeting agreed that safety was the overriding aspect of performance in aviation.

3.3.4 It was noted that ATM was increasingly being discussed in terms of performance. Corporatization and a more structured regulatory environment, were placing increasing pressure on accountability. In this respect, it was agreed that at all levels, communicating performance objectives and achievements would facilitate positive dialogue between the parties involved.

3.3.5 It was further agreed that it was essential that systems be developed in terms of objectives to be achieved. The absence of performance objectives at the appropriate level of abstraction on the one hand and a lack of understanding of the effect of changing the objectives on the other, would likely significantly hamper the decision-making process.

ATM performance concepts

3.3.6 The meeting recognized that an essential prerequisite for the development of a complex system was an understanding of the nature of its performance. A hierarchy of five levels of concepts relating to ATM performance was recognized, as follows:

Hierarchical ATM Performance Concepts

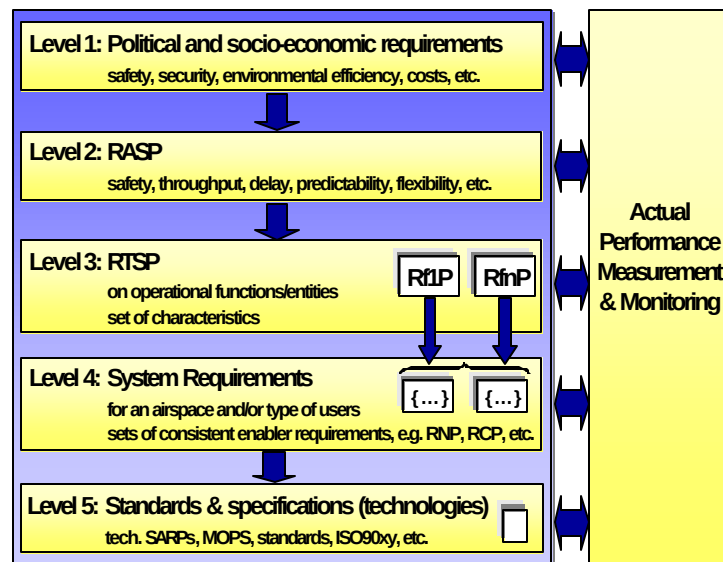


Figure 1. Concepts of performance

3.3.7 It was agreed that performance should be seen from many perspectives, such as safety and cost, as well as from the points of view of requirements, system design and specifications, and should include actual assessment and monitoring. The meeting therefore endorsed the hierarchy of performance concepts as depicted in the diagram as a sound basis for all future work in this field.

3.3.8 Level 1 of the figure above represented the high-level political and socio-economic expectations of society and/or the air transport sector, of a future ATM system. The measures necessary to meet these expectations should then govern the design of the system. More specifically, these general expectations addressed the technical, economic, environmental and other concerns relative to the effective operation of the ATM system and included, in particular, the areas of safety, security, environmental efficiency, cost-effectiveness, capacity, access and equity, general efficiency, flexibility, predictability, global interoperability and participation by the entire ATM community.

3.3.9 It was noted that expectations could be difficult to meet. Therefore, compromises would have to be negotiated throughout the development process of the ATM system, with a view to maximizing the relative advantages of that system for each of the stakeholders involved.

3.3.10 The ATM performance specification level, entitled the required ATM system performance (RASP) level, defined a second set of indicators of users' expectations which concerned the overall ATM system's operational services provided at the users' interface level. These could be considered as indicators of sub-objectives of the Level 1 expectations from a specific ATM system operational performance perspective.

3.3.11 The meeting agreed that in more general terms, RASP metrics should provide a set of high-level operational objectives for changing the global ATM system at its highest level of specification (e.g. operational objectives to mitigate effects on the environment, in balance with safety and regularity). Hence, RASP could be considered as a set of mission requirements for the ATM system aimed at achieving a top-level system operational objective.

3.3.12 It was noted that the RASP requirements might in some cases be very high and perhaps not technically and financially feasible, in which case the RASP requirements would need preliminary validation. The purpose of this validation would be to establish those requirements for the system that would be realistically achievable in the event that sufficient resources were not available to ensure the best indicators in accordance with cost/effectiveness criteria. The possibility could not be ruled out that the acceptable range for the RASP requirements would not correspond to available technical and financial resources. In such cases, having taken air traffic safety as the priority, it would be necessary to adjust the value of the remaining RASP requirements.

3.3.13 The meeting noted that Level 3, which covered the overall performance metrics for the ATM core system functions specified at the highest level, was entitled the required total system performance (RTSP) level. The ATM core system functions or concept components (airspace organization and management, aerodrome operations, demand/capacity balancing, traffic synchronization, airspace user operations, conflict management and ATM service delivery management) were parts of the entire ATM system divided into functions, the combination and integration of which represented the global ATM system. The meeting emphasized the importance of considerations related to environment. The need to fulfil safety requirements within environmental constraints might have an impact on efficiency, capacity or regularity.

3.3.14 RTSP was related to the performance of services provided by the ATM concept components. In this context, the term “service” referred to the implementation of a functionality of the ATM system in a given environment. It was agreed that requirements should be kept abstract enough to allow for flexibility in implementing choices, while preventing the proliferation of particular solutions. It was not, however, possible to address requirements independently from the different implementation options. RTSP was thus linked to system requirements (Level 4). To build this link, RTSP should provide indicators that would allow an assessment of the appropriate technical means for implementing operational scenarios, i.e. ways to realize implementation of concept components or other parts of the ATM system.

3.3.15 The meeting noted that performance metrics could eventually be applied to many parts of the ATM system. In this context, it was noted that Level 4 defined performance metrics for information management, data processing services and CNS operational services. It was entitled System Requirements and allowed, in particular, the introduction, within an appropriate architecture/hierarchy of system elements, of performance concepts such as RCP and RNP. Other required performance measures could be identified, such as required monitoring performance (RMP) to specify the capability to monitor the traffic situation in a given environment, or required planning performance (RPP) to specify the capability of predicting the future position of aircraft.

3.3.16 Subject to further validation, Levels 3 and 4 could be modelled using an identical template of characteristics, to permit the combination or separation of functional elements as needed, thus allowing for the determination of the key requirements for RTSP, for a given environment and traffic level.

3.3.17 Level 5 dealt with specific technologies and methodologies to implement Level 4.

3.3.18 It was suggested that the above hierarchy and the overall performance model provided a suitable structure for discussing performance. At the same time, it should assist the organization of the work and individual contributions from various bodies and partners, such as States, regional bodies and the Secretariat with respect to establishing a harmonized and generally acceptable basis for the development of performance requirements.

3.3.19 The meeting agreed that performance metrics should be developed within the ICAO framework and future agreement reached on the definition of metrics for the different objectives to be reached for Levels 1 and 2, as well as on guidance material for setting targets at the global, regional and State levels. Furthermore, the overall framework and guidance material on RTSP should be further developed and maintained by an appropriate body within ICAO.

3.3.20 It was further agreed that the definition of requirements for specific aspects of CNS/ATM, i.e. the individual elements of RTSP (Level 3) and lower layers, should be assigned to the relevant technical bodies, working in close coordination with each other as well as the body referred to above.

3.3.21 The meeting recognized that a further important phase, that of planning the implementation activities related to RTSP, was mainly within the purview of the planning and implementation regional groups (PIRGs) and States, with an overall coordination role for ICAO within the framework of the *Global Air Navigation Plan for CNS/ATM Systems* (Doc 9750). These activities would include the definition of performance targets at the appropriate level depending on the general policy adopted. Performance metrics for RTSP implementation would be selected either from a list defined at the global level or from locally-available options, as warranted by local traffic density. In this respect, the meeting emphasized the importance of different regions following identical definitions of the performance model; however, it was also recognized that the comprehensive definition of a common global framework would require some time. PIRGs and States should therefore be encouraged to begin moving to a performance driven planning process which would, however, have to be harmonized with globally-applicable definitions of the performance model as a common global framework, as they become available.

3.3.22 The meeting agreed that monitoring was an important aspect of the overall performance framework and that it therefore should be addressed at the appropriate level. Because effective monitoring provided an essential feedback which, on the basis of lessons learned, could significantly improve performance via benchmarking and dissemination of good practices, the meeting agreed that guidance for measurements and standards for information disclosure and guidelines for monitoring should be established by ICAO and consistently applied by States.

3.3.23 The meeting recognized that a performance orientation in ATM was fundamental, and agreed that it would be feasible to establish a performance framework which included the concept of RTSP. However, these were new notions, and they addressed complex systems. It would be necessary to develop the different layers of the model as well as the different related functions and services in much greater detail in order to ascertain the validity of this model. It was particularly stressed that for RASP and RTSP, while safety was the paramount aspect, it was one of several expectations that also included the environment, efficiency, and regularity, and that all these aspects would require careful balancing.

3.3.24 The meeting agreed that more work was also needed to identify, among other things, the main functions within the individual concept components of the ATM operational concept, and analyse which requirements would be imposed on them and how, collectively, they would meet expectations. It had to be established further how each operational function would be supported by technical functions, thus complementing the model with descriptions of interdependencies between the different functions. Moreover, the origins of expectations and functions must be clarified; what exactly would meet their requirements; what might counteract their original intent and what were the dependencies and interactions between these issues. The development of a causation model dealing with these and other related issues might provide a deeper system engineering understanding of ATM than was possible on the basis of currently available information.

3.3.25 The future work concerned all layers, from an understanding of future expectations suggested for Level 1 and how they could be met collectively, to the preparation of the standardization material for the next generation of technical systems, governed by Level 5. Progress must be made simultaneously on all levels to some extent. However, priority should be given to the clarification of the issues of the upper layers of the hierarchy, the understanding of how the ATM system behaved and generated performance. Also, the definition of indicators and targets were priority issues, as these aspects were currently not developed to sufficient maturity and because it was precisely this knowledge that would allow further decisions to be made for all other levels with greater confidence than in the past. This, in turn, would significantly accelerate the pace of modernization of ATM.

3.3.26 The meeting re-affirmed that the definition of the future global ATM system should be based on specific performance objectives to be met and monitored, as well as on the related operational and technical requirements, which would aim at achieving the agreed performance. The following recommendation was agreed:

Recommendation 3/3 — Performance framework

That ICAO, in consultation with the other members of the ATM community:

- a) formulate the performance objectives and targets for a future global ATM system;
- b) continue the definition of related performance metrics and elementary characteristics in the context of the overall behaviour of the ATM system; and
- c) coordinate and harmonize all related contributions within the overall performance framework initiated by the Air Traffic Management Operational Concept Panel, including definitions, standards for reporting requirements and guidance for monitoring.
