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WORKING PAPER

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Agenda Item 4: Optimum Capacity and Efficiency – through global collaborative ATM
4.3: Enhance operational decision-making through integrated meteorological information

AVIATION SYSTEM BLOCK UPGRADE MODULES RELATING TO METEOROLOGICAL INFORMATION

(Presented by the Secretariat)

EXECUTIVE SUMMARY

The 37th Session of the ICAO Assembly directed ICAO to increase its efforts to meet global needs for airspace interoperability while maintaining its focus on safety. To this end, a planning framework for global harmonization and interoperability named the aviation system block upgrades (ASBU) is proposed to the Conference for incorporation into the Fourth Edition of the *Global Air Navigation Plan.*

The ASBU framework includes modules over a series of blocks, supported by technology roadmaps, which serve to progressively enhance many aspects of civil aviation operations. This paper presents the modules relating to meteorological information supporting enhanced operational efficiency and safety, which comprise:

B0-105, B1-105 & B3-105 – Meteorology in support of air traffic management improvements.

Action: The Conference is invited to agree to the recommendation in paragraph 3.

Strategic Objectives:	This working paper relates to the Safety and Environmental Protection and Sustainable Development of Air Transport Strategic Objectives.
Financial implications:	The cost impact for these modules is expected to be minimal, and is anticipated to be borne predominantly by the States. However, based on preliminary indications, the benefits of implementing these modules could be substantial for global system performance and, when implemented, the benefits are expected to far outweigh the costs.
References:	Annex 3 – *Meteorological Service for International Air Navigation* Doc 9958, *Assembly Resolutions in Force (as of 8 October 2010)* Doc 9854, *Global Air Traffic Management Operational Concept* Doc 9750, *Global Air Navigation Plan*

1. INTRODUCTION

1.1 The next edition of the *Global Air Navigation Plan* (Doc 9750, GANP), will be presented to the ICAO Assembly in 2013 for approval. The draft GANP, and the aviation system block upgrade (ASBU) strategy it establishes, proposes that future air navigation technology and procedure improvements are organized and based on a consultative strategic approach that coordinates specific global performance capabilities and the flexible upgrade timelines associated with each component.

1.2 The ASBU modules are organized into flexible and scalable building blocks that can be implemented depending on the operational need, while recognizing that implementation of a particular module is not mandatory in all areas or circumstances. The approach adopted is not limiting and recognizes that deployments in addition to the material described in the ASBUs may also take place or be necessary. The broad timescales associated with the ASBU framework (Block 0 = 2013, Block 1 = 2018, Block 2 = 2023, Block 3 = 2028) are intended only to depict the initial readiness of all components, including ICAO Standards and Recommended Practices (SARPS), needed for deployment and do not imply a mandated State or regional implementation timeframe. The ASBU framework with supporting technology roadmaps ensures that State and regional implementation planning and deployment activities can be undertaken with the confidence that all components necessary for a particular deployment will be available within the ASBU dates mentioned.

1.3 Meteorological information is an integral component of the tomorrow's system-wide information management (SWIM) environment, alongside aeronautical information, flight and flow information and other information sources. As meteorological information transitions from today's predominantly gridded, binary, alphanumeric and graphical formats to tomorrow's interoperable, non-proprietary code forms (such as XML/GML) within the SWIM environment using new exchange models like the weather exchange model (WXXM), tremendous potential exists to enhance the safety and the efficiency of the global air traffic management (ATM) system through enhanced availability and use of meteorological information. With this in mind, a planning thread promoting usage of integrated meteorological information to enhance operational decision making, as described in the appendices to this paper and illustrated in the attached Figure 1, is proposed for inclusion in the ASBU framework.

2. METEOROLOGICAL INFORMATION SUPPORTING ENHANCED OPERATIONAL EFFICIENCY AND SAFETY

Overall strategy

2.1 Meteorological challenges in routine operations often arise as a result of adverse and rapidly changing meteorological conditions. The proposed dynamic integration of ATM and meteorological (MET) information is expected to provide timely meteorological information to enable real-time identification, increased predictability and deployment of operationally effective ATM solutions to accommodate changing conditions, as well as facilitate tactical avoidance of hazardous meteorological conditions. Increasing use of airborne capabilities to detect and report meteorological parameters, and enhanced cockpit displays of meteorological information to enhance situational awareness, are additional elements of the strategy.

Incremental development

2.2 At the Block 3 stage, far greater reliance is placed on airborne capabilities to provide meteorological awareness and drive tactical decision making including avoidance of hazardous meteorological conditions. Enhanced meteorological information is dynamically available to support the evolution of 4D trajectory operations. The 4D representations of meteorological information that have replaced traditional gridded, binary, alphanumeric and graphic formats provide wide benefits including increased access to meteorologically constrained airspace. ATM decision-making processes make extensive use of decision support tools that dynamically integrate meteorological information and propose mitigation strategies for consideration. Enhanced interpretation and mitigation of hazardous meteorological conditions results in extended pre-flight and flow planning capabilities.

2.3 In the near-term (Block 0), improved utilization by ATM of products from world area forecast centres, volcanic ash advisory centres and tropical cyclone advisory centres could support dynamic and flexible management of airspace, dynamically optimized flight trajectory planning, improved situational awareness and collaborative decision making. A focus on local arrangements is intended to enhance utilization of aerodrome warnings as well as wind shear warnings and alerts.

2.4 The Block 1 deployment includes initial ATM-MET integration, and actual and forecast meteorological information is compared with pre-characterized meteorological constraints on airspace or aerodrome threshold events using an ATM impact conversion process to identify near term capacity constraints. ATM decision makers are increasingly assisted by decision support tools using integrated meteorological information, consisting of automated systems and processes that create ranked mitigation strategies for consideration and execution.

Technology requirements

2.5 Technology requirements include the progressive establishment of an integrated 4D database capability of global meteorological information (observations and forecasts), as well as the deployment of automated systems to enable:

a) translation of raw meteorological data into predefined ATM constraints on airspace and aerodromes;

b) use of translated data to assess the impact on ATM operations, for traffic flows and individual flights; and

c) decision support tools, for both air navigation service providers (ANSPs) and users, which use ATM impact information to generate proposed mitigation strategies.

2.6 In the longer term, the availability of SWIM will enable further integration of meteorological information into both airborne and ground based tactical decision support tools.

Deployment considerations

2.7 The realization of globally interoperable, exchangeable meteorological information, including enhanced ground-to-air, air-to-ground and aircraft-to-aircraft meteorological reporting and exchange capabilities will be a significant undertaking.

2.8 The transition to integrated meteorological information will require agreement to, and development of, global standards for meteorological information exchange with an emphasis on the exchange of 4D (latitudinal, longitudinal, vertical and temporal) digitized meteorological information. Agreements are also necessary on what will constitute required meteorological information and graphical presentation in the digital information exchange era, to supersede the traditional gridded, binary, alphanumeric and graphic formats. Standardized meteorological information translation parameters and ATM impact conversion parameters will also require global agreement and development. Ensuring the accurate, reliable and wide availability of meteorological information remains a continuing challenge.

2.9 Meteorological information is recognized as a component of, ASBU modules concerning airport capacity, SWIM, flight and flow – information for a collaborative environment (FF-ICE), aeronautical information management (AIM), network operations, airborne separation, remotely-piloted aircraft (RPA), trajectory-based operations (TBO), continuous climb operations/continuous descent operations (CCO/CDO) and the global navigation satellite system (GNSS). Deployments from the meteorological information planning thread will need to take account of these wide interdependencies and States and users are urged to give due consideration to the potential added benefits which could result from the integration of a number of modules across a number of threads.

3. CONCLUSION

3.1 The ASBUs describe ways to apply the concepts defined in the *Global Air Traffic Management Operational Concept* (Doc 9854) to achieve local and regional performance improvements. The ultimate goal is global interoperability. Safety and efficiency demand this level of interoperability and harmonization which must be achieved at a reasonable cost with commensurate benefits. The Conference is invited to agree to the following recommendation:

Recommendation 4/x – ICAO aviation system block upgrades (ASBUs) relating to meteorological information

That the Conference:

a) urge States, according to their operational needs, to implement the aviation system block upgrade module relating to meteorological information included in Block 0, as presented in Appendix A;

b) endorse the aviation system block upgrade module relating to meteorological information included in Block 1, as presented in Appendix B, and recommend that ICAO uses it as the basis of its work programme on the subject;

c) endorse the aviation system block upgrade module relating to meteorological information included in Block 3, as presented in Appendix C, as the strategic direction for this subject;

d) request ICAO to include, following further development and editorial review, the aviation system block upgrade modules relating to meteorological information in the draft Fourth edition of the *Global Air Navigation Plan*;

e) request ICAO to work on defining the weather exchange model format; and

f) request ICAO to invite the next Meteorology Divisional Meeting to develop initial provisions in Annex 3 – *Meteorological Service for International Air Navigation* relating to the aviation system block upgrade modules concerning meteorological information, and to develop a long-term strategy to support their further development and full implementation.

Note.– A Meteorology Divisional Meeting is tentatively planned for July 2014, to be held conjointly with the XVth Session of the World Meteorological Organization Commission for Aeronautical Meteorology.

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Figure 1. Block upgrade modules covered in this working paper