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WORKING PAPER

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Agenda Item 6: Future direction
6.2: Standardization – approach to SARPs development in support of One Sky

SAFETY CONSIDERATIONS IN SUPPORT OF THE ASBUs

(Presented by the Presidency of the European Union on behalf of the European Union and its Member States[1]; by the other Member States of the European Civil Aviation Conference[2]; and by the Member States of EUROCONTROL)

SUMMARY

This paper summarizes safety matters and concepts needed to ensure that the proposed aviation system block upgrades (ASBUs) and regional programmes (e.g. SESAR, NextGen) can be implemented. The outcomes of ASBUs and regional programmes must provide clear and real benefits to the end consumer of ATM services. Changes brought to the Aviation System through ASBU and regional programmes need to ensure that Air Traffic Management remains safe, and along with its regulatory oversight processes, are fit for purpose, capable of fulfilling aviation growth potential and provides real benefits to the end consumer.

The Key Performance Areas (KPA) of the aviation system, including safety, capacity, efficiency and environmental KPAs, must be achievable, measurable, and enduring, but flexible to encourage innovation, of new opportunities for improvement. Targets should not drive negative behaviours. Performance and outcome measurement relies upon the existence and use of appropriate, sensitive and effective indicators of safety. There is at present, no globally accepted definitions for leading, precursor and lagging indicators, which are essential to pre-determine targets and to measure outcomes designed to address and manage safety risk. This paper offers candidate definitions for these categories of safety indicators.

The common goals of the ICAO ASBUs, regional programmes and its stakeholders must be to:

a) ensure the highest common standards of safety are applied in civil aviation worldwide;
b) endorse and adopt the concept of a total system approach;
c) endorse and engage in a performance and risk based approach;
d) encourage horizontal coordination between ATM/CNS, aircraft operations, aerodromes and airworthiness;
e) encourage the use of industry standards for interoperability; and
f) ensure that the present day safety regulatory process is fully engaged at an early stage, so as to evolve and adapt, in a timely manner, to meet the future demands of the predicted paradigm shift in ATM.

Action: The Conference is invited to agree to the recommendation in paragraph 4.

[1] Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom. All these 27 States are also Members of ECAC.

[2] Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Croatia, Georgia, Iceland, Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

1. INTRODUCTION

1.1 The ICAO aviation system block upgrades (ASBUs), which coordinates, at a global level, outcomes from regional programmes such as the European SESAR and FAA NextGen, is an industry led activity which aims to make a paradigm shift in the operational concepts, methods and systems used in air traffic management (ATM).

1.2 In consideration of the European regional programme, the SESAR deliverables are built around a continuous sharing of operational data between aircraft, air navigation service providers (ANSPs) and airport operations, SESAR is set to deliver a new and globally interoperable concept in ATM, which will lead to more fuel efficient flight profiles, reduced emissions and improved safety performance in European ATM.

1.3 The delivery of the ICAO ASBUs and SESAR will bring new challenges to industry and those bodies engaged in legislation, rulemaking and oversight, where changes to schemes and regulations need to ensure that they are - proportionate; risk based, used sparingly and do not place an un-acceptable economic and regulatory burden on the aviation industry, but ensure clear delivery of measurable benefits to the consumer.

1.4 A significant challenge faces today's aviation regulatory bodies to evolve the current regulatory principles and processes in a coherent and timely manner, to meet the new demands of the future ATM environment as brought about by the ASBU and regional programme implementation.

2. THE CHALLENGE

2.1 A key component to successful deployment is a mature and complete implementation Master Plan, which not only serves as a guide to the Governance Regimes, but should also include clear, agreed and acceptable criteria to ensure that deployment is practical and achievable and to drive the demonstration that expected outcomes have been achieved and enduring.

2.2 As with all capability or technology development, all associated aspects of procurement and deployment must be considered, not just the equipment itself. Human factors, personnel, training, legacy and new infrastructure and airspace design, organizations, regulation, data and information requirements and logistical aspects must be adequately addressed before a system or new concept of operations is considered sufficiently mature to be deployed into service.

2.3 The inclusion and direct participation of National Supervisory Authorities (NSA), Regulatory and Certification Agencies at the earliest planning stages and, later, in concept proving and deployment stages of Regional Programmes, is an essential part of a successful governance process. Clear and coherent oversight processes and acceptance criteria needs to be developed, much along the lines of those modules contained within the ICAO ASBUs.

3. SAFETY REGULATION PRINCIPLES FOR REGIONAL PROGRAMMES AND ICAO AVIATION SYSTEM BLOCK UPDATES

3.1 In the deployment of regional programmes (e.g. SESAR and NEXTGEN) and ICAO ASBUs, there needs to be a set of high level safety goals defined with specific performance outcomes, in the form of requirements set for a total system environment, which would cover both airborne and ground based elements, human/machine, and operational goals.

3.2 The European Safety Plan, for example, is a critical document in coordinating the key actions owned by all aviation stakeholders and should include those salient aspects of SESAR, service

provision alliances and functional airspace block arrangements, which will address current and future risks.

3.3 The role of the regulator is therefore one of providing oversight of safety improvements which comes from changes owned and implemented by industry and other stakeholders. The important concept is that the regulator would be seeking to have oversight of whether or not there was effective risk management and not to own that management of risk.

3.4 In the role of the regulator, there are a number of key questions to be asked of the ICAO ASBUs and regional programmes:

1. Have the right risks been identified?
2. Is there a sensible plan that is inclusive and will sustain across the total system to fully address the risk?
3. Are clear and measurable outcomes defined?
4. How will risk mitigation be measured and are there checks and balances instigated to detect deviation or deterioration of risk management performance?

3.5 In this approach two philosophical elements of safety regulation must be employed:

1. Safety cases for validation and certification need to demonstrate that new risks have been mitigated sufficiently, but also, where possible, the extent that current operational risks have been reduced.
2. Goals and requirements should be set as early in the project as possible and validation/certification should consider how well the total system can achieve the operational performance criteria.

3.6 Key to all future regulatory oversight processes is the development of leading indicators for safety. In projects for significant changes to the ATM system, there would be a statement of both the current risks and potential future risks and then a measure of how the new system has improved overall safety performance.

3.7 However, while the ICAO *Safety Management Manual (SMM)* (Doc 9859), defines the predictive, proactive and reactive aspects of data collection systems, there is no agreed global standard definition for a Leading Indicator nor any guidance on how to produce them, which has led to differing interpretations on what is meant by this term. The focus on Leading Indicators should not detract from the importance of Lagging Indicators (for which a standard definition also does not exist), particularly those that monitor the *precursors* to accidents. An effective Safety Management System (SMS) should include the monitoring of both types of indicator. This paper proposes a candidate set of standard definitions for leading and lagging indicators, and precursor events (a specific type of lagging indicator), and their promotion within the international aviation community. Examples have been provided to illustrate their scope and practical use.

LEADING INDICATORS:
Metrics that measure inputs to the safety system (either within an organization, a sector or across the total aviation system) to manage and improve safety performance.
Leading Indicators indicate good safety practices being introduced, developed and adapted, which by their inclusion seek to establish a proactive safety environment that engenders continuous improvement, not only of the systems, but also of the processes. They provide useful information when accident and incident rates are low to assess the impact of latent hazards and potential threats, and consequent opportunities for improvement.
There should be, as much as possible, a connection between a Leading Indicator and the unwanted outcomes (or Lagging Indicators) that their monitoring is intended to warn against.

LAGGING INDICATORS:
Metrics that measure events that have already occurred and that impact on safety performance. As Lagging Indicators only reflect errors or failures their use can only result in determining a reactive response. Although they do measure failure to control hazards, they do not normally reveal why the system failed or if there are any latent hazards.

PRECURSOR EVENTS:
These metrics can be considered as a subset of Lagging Indicators that do not manifest themselves in accidents or serious incidents. They indicate less severe errors, failures or 'near misses', which when combined with other events may lead to an accident or serious incident.

3.8 Safety metrics should also consider the maturity of implementation of safety data collection and safety management processes in the demonstration that an organization or a system is able to manage safety to expected safety levels.

3.9 In a future regulatory process it is possible to develop a high-level risk model that helps to understand the balance of risks and how individual risk mitigations add collectively to meet the overall high level safety goal that may be set at State or group of States level (e.g. in the European Union). At this time it is as valid to develop and implement leading safety indicators to measure and judge operational performance.

3.10 It is essential for ICAO ASBUs and regional programmes to obtain from industry information, based on suitable design process and methods on what they judge to be the key risk areas and which improvements are required to meet defined safety goals. Industry can then do more work in the medium term to validate their judgements and begin to provide evidence that the actions are having the intended effect. There is a possibility that if this is not done, the proposed new technology or procedures will not suitably address current known safety issues.

4. RECOMMENDATIONS

4.1 The Conference is invited to:

a) note and consider the contents of this paper;

b) ensure that the ASBUs and regional programmes are underpinned by a mature and complete ATM plan and prioritization strategy, which includes high level safety goals;

c) ensure that the safety regulation of ASBUs and regional programmes are proportionate and risk based and executed in the context of a total system environment;

d) promote the development and use of 'leading safety indicators' to complement existing 'lagging safety indicators' as an integral and key component to drive improvement in performance and in the achieved management of risk; and

e) encourage the early and close involvement of the regulator and oversight bodies in the development, concepts proving and implementation of ASBUs and regional programmes as an essential element.

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