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TWELFTH AIR NAVIGATION CONFERENCE

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Agenda Item 6: Future direction
6.1 Implementation plans and methodologies

HUMAN CENTERED DESIGN CRITERIA FOR THE TRANSFORMATION OF THE GLOBAL TRANSPORTATION SYSTEM

(Presented by the International Federation of Air Line Pilots' Associations)

SUMMARY

Airspace procedures that are introduced to achieve the efficiencies described in the aviation system block upgrades (ASBUs) must be usable by both the pilots and controllers and must be compatible with aircraft and space-based/ground-based systems. Therefore airspace procedures, aircraft systems, and space-based/ground-based systems must be designed to take into account human capabilities and limitations. Failure to incorporate this could seriously impact the level of safety of the entire operation by both reducing the ability of the operators (pilots and controllers) to effectively monitor the progress of the operation and potentially impacting the airspace available for manual intervention when that becomes necessary. Both hardware and procedure design must make allowances for such human interaction from the first design iteration. Reliance on training to "work around" such design deficiencies should be discouraged as ineffective mitigation.

Action: The Conference is invited to specifically agree to Recommendation 6/x, a) through e). (Note.– Recommendation 6/x, b) through e) are also contained in Secretariat AN-Conf/12-WP/20 under Agenda Item 6.1)

1. BACKGROUND

1.1 The airline community has continued to stress the need for a human centred approach to the design and operation of the aviation system. Pilots mitigate operational risk in all areas in which they are involved. In fact, the aviation system is designed to rely on that mitigation to maintain safe operations. This system is composed of not only the pilots and their aircraft hardware and software but also the operators, air navigation service providers, regulators and all airspace design procedures in which they must operate.

1.2 The commercial aviation system is the safest transportation in the world with an enviable sustained low accident rate. This impressive record is due to many factors including advances in design, reliability, automated systems, training, and air traffic procedures. Pilots have had to adapt to this increasingly complex automated environment by becoming effective system managers.

1.3 Pilots retain primary responsibility for the navigation and control of their aircraft at all times. Because pilots are legally responsible for the safety of the aircraft and passengers, pilots must have the ability to manually fly the aircraft during all phases of flight when the automated systems fail or are unable to maintain a safe level of flight. This primary obligation is in addition to their system manager function. For this reason there is increased emphasis on the retention of basic flying skills that will come into play when manual pilot intervention is required.

2. DISCUSSION

2.1 There has been much discussion on the need to carefully integrate human factors design considerations into both airframes and their component parts such as controls and software. Similarly, airspace procedures, space- and ground-based systems must also be designed to take into account human capabilities and limitations. It would seem that this is an accepted requirement that needs only reinforcement by this Conference.

2.2 A review of the aviation system block upgrade (ASBU) reveals several advanced concepts where the metric proposed would seem to be beyond the manual flight capability of a human crew (e.g. 4D trajectory operations in Module B3-05, Airborne self-separation in Module B3-85). The concept of employing automation to enhance performance beyond the capability of a pilot flying manually is by no means a new concept. Enroute operations have long required the use of an autopilot to maintain cruise flight. This is both an efficiency requirement and a means to contain the flight path of the aircraft in certain high density upper altitude airspace. During cruise, with aircraft spacing either at today's limits or at the limits proposed by some ASBUs, there is ample space for a flight crew to manually intervene should there be a malfunction in either an aircraft system or the air traffic infrastructure.

2.3 When an aircraft approaches or departs terminal airspace, the required separation decreases for any number of perfectly valid reasons. Currently the flight crew or the controller retains the ability to manually intervene when necessary. There is sufficient space for this manual intervention. Such a buffer must be maintained in any future airspace procedure design. Reducing separation to the point that the use of automation is mandatory, with no margin maintained for human intervention should something go wrong, would seem to unacceptably increase the risk of the operation when any intervention is required.

2.4 In short, advances in technology and automated systems must be viewed in the context of a systems approach where the human is at the centre of the system. Pilots must be able to manage every level of automation and be able to manually intervene when required. There must be a clear indication of the status of any automated function, including the expected future state. Automation training should enable pilots to correctly identify and predict the actions of the systems and to control them during both normal and abnormal situations.

2.5 While automation should generally not be required during terminal operations, it could be used to the fullest extent when appropriate for operational efficiency. Automation is simply a tool. It cannot be a substitute for well-trained pilots and controllers fully capable of operating the system at all levels of automation as demanded by the particular situation and especially during any abnormal event or loss of separation when manual intervention is required.

3. CONCLUSION

3.1 Aircraft automation, air traffic management automation, and modern airspace design offer the prospect of significantly enhanced operational efficiency and flexibility to the future aviation system. Before such technology is designed and implemented, industry and government must consider and incorporate measures to ensure that a human-centred design approach is used to develop the future aviation system which takes into account human capabilities and limitations and allows the human operators to have the information and flexibility to manage the operation or intervene when required. The fact that there will be a Loss of Control Avoidance and Recovery Symposium at ICAO in 2014, while laudable, is a response to the lack of a fully integrated human factors approach to present system design. The Conference is invited to agree to the following recommendation:

Recommendation 6/x – Human performance

That the Conference:

a) urge States and industry, to adopt design criteria for airspace procedures, aircraft systems, and space-based/ground-based systems that take into account human capabilities and limitations and allow sufficient margins to allow humans (pilots or controllers) to intervene and for pilots to be able to manually perform the same function to maintain aircraft safety of flight;

b) urge States and industry, to support ICAO through the contribution of human performance expertise, to ICAO's work in this field;

c) urge States and industry, to work with ICAO on a change management strategy to ensure that aviation professionals are prepared and able to adjust to the changes that will be introduced by future concepts, systems and technologies;

d) encourage States to consider human performance at the planning and design phase of new systems and technologies, as well as at the implementation phase, as part of a safety management approach; and

e) request ICAO to establish a means to facilitate the sharing of best practices in human performance approaches during the design and implementation of the block upgrades and other future aviation systems/technologies.

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