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WORKING PAPER

TWELFTH AIR NAVIGATION CONFERENCE

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Agenda Item 2: Aerodrome operations – improving airport performance
2.1: Airport capacity

PERFORMANCE REQUIREMENTS FOR SURFACE MOVEMENT GUIDANCE FOR AIRCRAFT, VEHICLES AND PERSONNEL IN LOW VISIBILITY

(Presented by the Republic of Korea)

EXECUTIVE SUMMARY

This working paper is to address the necessity of studying characteristics and performance requirements on surface movement guidance facilities which are required to be implemented to ensure the safety and efficiency of the movement of aircraft, vehicles and personnel at the airports operating advanced surface movement guidance and control system (A-SMGCS) in visibility condition 4 (equivalent to an RVR of 75 m or less).

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

1. INTRODUCTION

1.1 According to the description of the aviation system block upgrade (ASBU) Module B0-75, basic advanced surface movement guidance and control system (A-SMGCS) responding to B0 functionality is already broadly deployed at large sized airports globally. If the ASBU Modules B1-75 and B2-75 are initiated successfully by both airports and aircraft, genuine all-weather operations is expected to come true with A-SMGCS Level 3-4 through implementing state-of-the-art aircraft equipage such as enhanced vision systems (EVS) or synthetic vision systems (SVS), standardizing new or updated criteria relating to enhanced A-SMGCS/surface traffic movement management automation, data link communication, etc.

1.2 Separately from the ASBU modules, ICAO has established SMGCS and A-SMGCS manuals to provide necessary support to ensure safe and efficient surface movements in order to maintain required capacities and safety levels, especially under low visibility conditions in close liaison with take-off and CAT II and III operating minima for decades.

1.3 However, as the decrease of a runway visual range (RVR) for take-off or landing minima applicable in consequence of the development of navigation aids and related systems to support visual

situational awareness of flight deck, increasing traffic volume, a tendency of enlarging airports in size, abnormal change of weather, etc. are being accelerated at this present time. The Republic of Korea would like to address the necessity of studying characteristic and performance requirements on surface movement guidance facilities in visibility condition 4 described in the A-SMGCS manual and giving shape to describe them in the most pertinent ICAO documents at this present time.

2. DISCUSSION

2.1 Application of RVR for take-off or landing minima

Landing

2.1.1 In case of an instrument runway served by an instrument landing system (ILS) and/or microwave landing system (MLS) to and along the surface of the runway that is fully equipped with required navigation aids and operational procedures in order to fulfil CAT III A, B, C operational requirements, the runway can be used for operations with a range of an RVR from 300 m to 0 m.

Take-off

2.1.2 Incheon Airport in the Republic of Korea regulated take-off minima as an RVR of 75 m with the three RVRs installed at each runway, for aircraft with two or more engines, when certified taxiing guidance signs (TGS) and visual aids such as high intensity runway lights (HIRL), runway centre line lights (RCLL) and runway centre lights (RCL) are operational. If more advanced aircraft equipage such as head-up displays (HUD) are widely available, more lowering of the RVR for take-off minima in the near future can be easily expected.

2.1.3 As an RVR for take-off or landing minima is lowered gradually, busy airports, such as Incheon Airport, are concerned about safety of surface movement of aircraft before take-off and after landing. It may go for not only Incheon Airport but others which have been in the establishment of a 75 m RVR for take-off or landing minima.

2.1.4 Incheon Airport has constantly lowered the take-off or landing minima as shown in the table below. Also, the number of airlines which have been approved for operation at an RVR of 75 m has been augmented steadily. (More than ten airlines operating B737s with certified HUD, B777s, B767s, B747s, A320s, A330s, A340s or A380s have obtained operational approvals since 2007).

Minima/Year	2001	2003	2005	2007	2008	2010	2011	2012
Landing	CAT IIIA RVR 200M	CAT IIIB RVR 100M					CAT IIIB RVR 75M	
Take-off	RVR 200M	RVR 175M	RVR 150M			RVR 100M	RVR 75M	

Table 1. Take-off / landing minima at Incheon Airport by year

2.1.5 The number of aircraft landing in CAT III operating conditions (an RVR less than 300 m) has been increased over the last ten years. Furthermore, the duration time of CAT III operating conditions (an RVR less than 300 m) in the past three years has been sharply augmented as shown in the following table.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012 (~AUG)
Number of Landing A/C	121	201	196	296	347	347	571	445	809	697	471
Duration time	37h33m	47h11m	34h36m	34h56m	18h49m	35h32m	57h17m	54h23m	95h32m	85h36m	67h12m

Table 2. The number of landing A/C and duration time of CAT III operating conditions, Incheon Airport by year

2.2 Performance requirements on surface movement guidance facilities in visibility condition 4 (equivalent to an RVR of 75 m or less)

Taxiway centre line lights

2.2.1 The position of a centre line shall be adequately perceived by a minimum of three lights, spaced at 15 m intervals under RVRs of less than a value of the order of 350 m. Thus, the distance of the further perceived light from the pilot will be 45 m. If the distance ahead of the aircraft that is obscured from the pilot by the cockpit and the nose of a wide body aircraft is taken into consideration, a value in the order of 75 m is the maximum distance that can be seen by the pilot. According to the A-SMGCS manual, for wide-body aircraft, the large area ahead of the aircraft that is obscured by the cockpit cut-off results in increased intensities being required to enable an adequate pattern of taxiway lights to be seen when the RVR is less than 75 m. Although the characteristics of high-intensity taxiway centre line lights are drawn in Annex 14 — *Aerodromes*, Volume I — *Aerodrome Design and Operations*, the result of operational experience and simulator trials on them, e.g. the intensities or the number of lights can be seen from the cockpit, is not stipulated neither in Annex 14, Volume I, nor the A-SMGCS manual, nor in the Aerodrome Design Manual.

Aircraft stand manoeuvring guidance lights

2.2.2 These lights are used to guide a pilot approaching along a taxiway at a right angle to the stand centre line. Low-intensity taxiway lights emitting yellow light are normally used and an intensity of approximately 60 cd of yellow light is needed to support operations down to a visibility equivalent to an RVR of 50 m. So it is also necessary to define the guidance on the application of performance requirements under an RVR is less than 50 m as well.

Visual Docking Guidance System (VDGS)

2.2.3 A VDGS, one of the required equipment to operate A-SMGCS, needs to be chosen carefully to provide adequate guidance to a pilot under very low visibility conditions. To do that, specified performance requirements for visibility condition 4 should be described in the most appropriate ICAO document.

On-board guidance system for aircraft and vehicles

2.2.4 According to the A-SMGCS manual, automated runway/taxiway centre line lights, centre line markings and TGS are required for an aircraft to perform and maintain a taxi route in the visibility condition 4, plus on-board guidance system in both aircraft and vehicles. However, the performance requirements for the surveillance, routing and control functions of on-board guidance system are not provided in detail, instead, trials under the FAA Runway Incursion Reduction Programme (RIRP) to evaluate new technology for A-SMGCS in 2000 are introduced briefly in Appendix E of the A-SMGCS manual.

Personnel guidance

2.2.5 Considerations on guidance of personnel are described in the SMGCS manual only. The A-SMGCS manual focuses on guidance of aircraft and vehicles. So the criteria to guide and control essential personnel in visibility condition 4 should be studied and described in the most pertinent document.

3. CONCLUSION

3.1 The Conference is invited to agree to the following recommendation:

Recommendation 2/x – Performance requirements for surface movement guidance for aircraft, vehicles and personnel in low visibility

That the Conference:

a) request ICAO to study characteristic and performance requirements for surface movement guidance facilities for the purpose of expediting safe and efficient ground movements of aircraft, vehicles and personnel in visibility condition 4 (equivalent to a runway visual range of 75 m or less); and

b) request ICAO to include the outcome of the study in the most pertinent document intensively to encourage its Member States to operate enhanced surface movement guidance and control systems efficiently at this present time.

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