SOUTH AFRICAN CIVIL AVIATION AUTHORITY

Technical Guidance Material for Surface Movement Guidance & Control Systems (SMGCS)

Advisory Circular

Subject: TECHNICAL GUIDANCE MATERIAL FOR SMGCS

Date: 06 MARCH 2019

APPLICABILITY

This Technical Guidance Material (TGM) is applicable to aerodrome with operational conditions as listed below:
a) the visibility conditions under which the aerodrome authority plans to maintain operations; and
b) the traffic density.

PURPOSE

The document "Guidance Material for SMGCS" is intended to give guidelines along the prescriptions as given in abovementioned material.

This should help the license holder of an aerodrome to determine the requirements, needed to assist in the prevention of runway incursions.

REQUIREMENTS

In an effort to reduce the number of runway incursions, sometimes resulting in incidents and accidents and a loss in lives and property, a surface movement guidance and control system must be put in place;

The system may be very basic in nature for the less busy aerodromes, or a very advanced system where the requirement exist.

REGULATION REFERENCES CODES

i. ICAO ANNEX 14 VOL 1 Aerodrome Design and Operations
ii. ICAO Doc 9157 Aerodrome Design Manual Part 4
iii. ICAO Doc 9332 Manual on the ICAO Bird strike Information System (IBIS)
iv. ICAO Doc 9426 Air Traffic Services Planning Manual
v. ICAO Doc 9476 Manual of Surface Movement Guidance Control Systems (SMGCS)
vi. South African Civil Aviation Regulations 139

1. WHAT IS MEANT BY A SURFACE MOVEMENT GUIDANCE AND CONTROL SYSTEM?

1.1. In its broadest sense, a surface movement guidance and control (SMGC) system consists of the provision of guidance to, and control or regulation of, all aircraft, ground vehicles and personnel on the movement area of an aerodrome. "Guidance" relates to facilities, information and advice necessary to enable the pilots of aircraft or the drivers of ground vehicles to find their way on the aerodrome and to keep the aircraft or vehicles on the surfaces or within the areas intended for their use. "Control or regulation" means the measures necessary to prevent collisions and to ensure that the traffic flows smoothly and freely.

1.2. An SMGC system provides guidance to, and control or regulation of, an aircraft from the landing runway to the parking position on the apron and back again to the take-off runway, as well as other movement on the aerodrome surface such as from a maintenance area to an apron, or from apron to apron. In other words, the SMGC system extends over both the "manoeuvring" and "apron" areas. These two areas are collectively referred to as the "movement area".

1.3. Normally the responsibility for regulating the activities and the movement of aircraft and vehicles on the manoeuvring area rests with the air traffic control service. In the case of the apron, such responsibility rests with the apron management service.

1.4. The system also provides guidance to, and control or regulation of all ground vehicles on the movement area. In addition, the system provides guidance to, and control or regulation of the personnel authorized to be on the movement area of an aerodrome. Obviously, the provision of such a system plays an important part in guarding against inadvertent or unauthorized entry onto operational runways.

1.5. Although the Manual of Surface Movement Guidance and Control Systems was mainly written with controlled aerodromes in mind, it is nevertheless true that many of the procedures, aids and functions in the manual are applicable to all aerodromes whether controlled or uncontrolled.

2. WHAT DOES A SURFACE MOVEMENT GUIDANCE AND CONTROL SYSTEM COMPRISE?

2.1. The term "surface movement guidance and control system" is applied to the system of aids, facilities, procedures and regulations designed to meet the particular requirements for guidance to, and control or regulation of, surface traffic consistent with the particular operational needs at an aerodrome.

2.2. An SMGC system comprises an appropriate combination of visual aids, non-visual aids, procedures, control, regulation, management and information facilities. Systems range from the very simple at small aerodromes, with light traffic operating in good visibility conditions, to the complex systems necessary at large aerodromes with heavy traffic operating in low visibility conditions. The system selected for an aerodrome will be appropriate to the operational environment in which that aerodrome will operate.

3. WHOM DOES A SURFACE MOVEMENT GUIDANCE AND CONTROL SYSTEM INVOLVE?

3.1. Because of the multi-disciplinary interests in an SMGC system, there is a need to co-ordinate fully all current and planned use of an SMGC system to ensure compatibility with aerodrome engineering, operations, communications, aerodrome air traffic control service, operators and pilot requirements. Additionally, there is a requirement *to* maintain compatibility of practices between States. At aerodromes which are jointly used for civil and military operations, co-ordination with the military is necessary.

3.2. The aerodrome authority should ensure that there is appropriate consultation and co-ordination during planning of the SMGC system with the appropriate branches of the administration of the State concerned, including aerodrome engineering, the air traffic control unit, communications and operations specialists, operators, pilots and, where appropriate, the military, to ascertain and confirm the

requirements of the surface movement guidance and control system.

4. OPERATIONAL CONDITIONS

4.1. The SMGC system to be provided at an aerodrome depends primarily upon two Operational conditions, which are:

a) the visibility conditions under which the aerodrome authority plans to maintain operations; and
b) the traffic density.

4.2. Each of these conditions has been further defined in number 9 of this document.

5. OPERATIONAL REQUIREMENTS

5.1. The operational requirements to be met by an SMGC system have been discussed for many years. The current operational requirements are shown in number 7. The requirements in number 7 are those appropriate to the movement area. It is recognized that a requirement exists for guidance and control of emergency vehicles outside the movement area, but this is considered to be beyond the area of applicability of the surface movement guidance and control system.

6. REASONS TO PROVIDE AN SMGS SYSTEM

6.1. The main reason for providing an SMGC system is to enable an aerodrome to operate safely in the intended conditions. The system should be designed to prevent collisions between aircraft, between aircraft and ground vehicles, between aircraft and obstacles, between vehicles and obstacles, and between vehicles. In the simplest case, i.e. in good visibility and in light traffic conditions, this objective may be achieved by a system of visual signs and a set of aerodrome traffic rules requiring pilots and vehicle drivers to watch out and give way in accordance with specified procedures. In more complex and/or heavy traffic, a more elaborate system will be required.

6.2. An essential safety function of an SMGC system is to safeguard against unauthorized or inadvertent entry onto operational runways. All the different components of the system aid in accomplishing this aim. However, under poor visibility conditions this may require a means of electronic surveillance to assure air traffic control personnel that an operational runway is indeed clear.

Another important safety function of an SMGC system is to provide assistance to rescue and fire fighting vehicles in locating and proceeding to the site of an accident on the movement area.

6.3. It should be emphasized that an SMGC system should be designed so as to maintain regularity of movement under varying operational conditions. Regularity of operations suffers under heavy traffic conditions and when visibility conditions are reduced. The objective is to have a system which is compatible with the landing and take-off capacity of the runways and with the demands placed on the aerodrome. To this end, the requirements of both landing and take-off operations should be taken into account when designing an SMGC system. At some airports it may be that take off operations occur in lower visibilities than landing operations.

7. OPERATIONAL REQUIREMENTS OF SURFACE MOVEMENT GUIDANCE AND CONTROL SYSTEMS

The system should be appropriate to the visibility and traffic density and should provide:

7.1. Requirements of a general nature

a) communication capability between the appropriate control unit(s), between the appropriate control unit(s) and aircraft and between the appropriate control unit(s) and ground vehicles;
b) acceptable work-loads on the users of the SMGC system;
c) optimum use of aids and procedures already specified in ICAO regulatory documents;
d) compatibility between individual elements of the guidance and control systems; and
e) current and forecast meteorological conditions.

7.2. Requirements of pilots

a) orientation, guidance and control beginning at the end of landing roll-out on arrival, to the parking position, and from the parking position up to alignment for take-off on departure;
b) information on the route to be followed;
c) information on position along the route being followed;
d) guidance along the route being followed and parking guidance;
e) warning of:
   i. changes in direction;
   ii. stops and other speed adjustments;
f) identification of areas to be avoided;
g) information to prevent collision with other aircraft, ground vehicles or obstacles; and
h) information on system failures affecting safety.

7.3. Requirements of appropriate control units

a) information on the identity, position and progress of aircraft including aircraft under tow;
b) information on the identity, position and progress of ground vehicles whose movements might conflict with aircraft movements;
c) information on the presence of temporary obstacles or other hazards;
d) information on the operational status of elements of the system; and
e) facilities appropriate to the control to be exercised.

7.4. Requirements of ground vehicles on the movement area

a) emergency vehicles
   i. information on the route to be followed;
   ii. guidance along the route being followed;
   iii. capability to locate the site of an emergency; and
   iv. information to prevent collision with aircraft and ground vehicles.
b) other ground vehicles
   i. information on the route to be followed;
   ii. guidance along the route being followed; and
   iii. information to prevent collision with aircraft and ground vehicles.

8. FUTURE CONSIDERATIONS

8.1. All aerodromes require an SMGC system. However, each system must be related to the operational conditions under which it is intended that the aerodrome shall operate. Failure to provide a system appropriate to the demands placed on an aerodrome will lead to a restricted movement rate.

8.2. Complex systems are not required and are uneconomic at aerodromes where visibility and traffic density will not present a problem for the ground movement of aircraft and vehicles.

8.3. Surface movement guidance and control systems should be developed with a modular concept in mind so that components can be added when traffic requirements justify such expansion. Financial considerations play an important part in the selection of a system: it should, however, be borne in mind that the selection of components in a system and their siting, in the light of planned future development, while initially more expensive can, in the long term, lead to the more advantageous use of financial resources.

8.4. An example would be the provision for taxiway centre line lights during the construction of a taxiway when it is known that at a later date it is intended to upgrade the associated runway to category II or III.

8.5. It should further be borne in mind that technical research will continue in this field and new components will be developed which may either complement or replace existing SMGC system components.

9. VISIBILITY AND TRAFFIC CONDITIONS ASSOCIATED WITH SMGC SYSTEMS — EXPLANATION OF TERMS

9.1. VISIBILITY CONDITIONS

a) Visibility sufficient for the pilot to taxi and to avoid collision with other traffic on taxiways and at intersections by visual reference, and for personnel of control units to exercise control over all traffic on the basis of visual surveillance;
b) Visibility sufficient for the pilot to taxi and to avoid collision with other traffic on taxiways and at intersections by visual reference, but insufficient for personnel of control units to exercise control over all traffic on the basis of visual surveillance; and
c) Visibility less than 400 m RVR (low visibility operations).

9.2. TRAFFIC DENSITY

(in the mean busy hour as determined by the individual State)

Light: Not greater than 15 movements per runway or typically less than 20 total aerodrome movements;
Medium: Of the order of 16 to 25 movements per runway or typically between 20 to 35 total aerodrome movements; and
Heavy: Of the order of 26 or more movements per runway or typically more than 35 total aerodrome movements.

9.3. EQUIPMENT REQUIREMENTS

The equipment required at a particular aerodrome for provision of an SMGC system will depend both on the density of traffic and the visibility conditions in which the operations should take place. However, the following equipment is fundamental to any SMGC system and should therefore be provided at all aerodromes:

a) Markings:
   i. runway centre line
   ii. taxiway centre line
   iii. taxi-holding position
   iv. taxiway intersection
   v. apron
   vi. restricted use areas

b) Lighting:
   i. runway edge
   ii. taxiway edge
   iii. obstacle lights
   iv. restricted use areas

c) Signs:
   i. mandatory signs, e.g. taxi-holding position, NO ENTRY, STOP
   ii. information signs, e.g. location and destination

d) Other:
   i. aerodrome chart

ii. aerodrome control service
iii. signalling lamp
iv. radiotelephony equipment.

10. BASIC PROCEDURAL/ ADMINISTRATION / REQUIREMENTS

10.1. Procedures are an important and integral part of an SMGS system and they are implemented partly by the aerodrome authority, partly by the air traffic control unit, and partly by the pilot. As in the case of SMGCS aids, the procedures to be employed at a particular aerodrome will be dictated by both traffic density and visibility conditions.

10.2. However, the following procedures are fundamental to any SMGC system and should therefore be implemented at all aerodromes:

a) Aerodrome authority
   i. designation of taxiways
   ii. movement area inspections
   iii. regulation of ground staff conduct on the movement area
   iv. regulation of ground staff radiotelephony procedures
   v. periodic electrical monitoring of SMGC aids
   vi. initiation of amendment of aerodrome chart as necessary
   vii. apron management

b) Air traffic services
   i. provision of air traffic control services
   ii. use of radiotelephony procedures and phraseology
   iii. use of signalling lamp
   iv. monitoring of SMGC aids

c) Pilot
   i. adherence to ground movement traffic rules and regulations
   ii. use of radiotelephony procedures and phraseology.

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