

**ETHIOPIAN CIVIL AVIATION AUTHORITY  
AERODROME SAFETY AND STANDARD  
DIRECTORATE**

**GUIDANCE ON SURFACE MOVEMENT GUIDANCE AND  
CONTROL SYSTEM(SMGCS)**

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## AMENDMENTS

The issue of amendments is announced with ECAA official letter and on the ECAA Website. The space below is provided to keep a record of such amendments.

### RECORD OF AMENDMENTS

Amendment		Number of pages	Date Entered	Date Effective	Entered By
Number	Date				

	<b>ETHIOPIAN CIVIL AVIATION AUTHORITY AERODROME SAFETY AND STANDARDS DIRECTORATE</b>	REF.ECAA-AC-AGA031/2015
		Rev. 0 Date: February, 2015
<b>Guidance on Surface Movement Guidance and Control System</b>		

## PREAMBLE

**WHEREAS**, it is desirable to consolidate and modernize the aviation Advisory Circular to bring them to international standards,

**WHEREAS**, it is important to set the Advisory Circular as to how the regulatory, administrative, technical and supervisory activities of the Authority shall be performed in the one hand and setting the duties, obligations and standards that shall be respected by operators and aviation personnel,

**WHEREAS**, it is necessary, to provide detailed Advisory Circular for the administration of license, certification, investigation and enforcement of aviation laws.

**NOW THEREBY**, The Authority under its power given by Article 92/2 of the Civil Aviation Proclamation No. 616/2008 issued the following Advisory Circular.

### 1. SHORT TITLE

This Advisory Circular may be cited as "Advisory Circular for Surface Movement Guidance and Control System.NO.ECAA-AC-AGA031/2015

### 2. REPEAL AND INAPPLICABLE LAWS

No law, directive, order or practice shall, in so far as it is inconsistent with this Advisory Circular, be applicable with respect to matters provided for by this Advisory Circular.

### 3. EFFECTIVE DATE

This Advisory Circular shall come into force as of February/ 2015.



Done at Addis Ababa, February, 2015

*[Signature]*  
 Wosenyetch Hunegnaw (Col.)  
 Director General

## **FORWARD**

Ethiopia is a Contracting State to the Convention on International Civil Aviation Organization (ICAO). Civil Aviation Authority of Ethiopia is responsible to conduct certification/surveillance and continuous safety oversight of aerodromes under its jurisdiction to monitor the compliance in accordance with the Civil Aviation Requirements for Aerodromes.

It is also expected that this Advisory Circular will benefit the aerodrome operator as it provides an overall view of the Surface Movement Guidance and Control System.

This Authority may, without any prior notice, change the content of this Advisory Circular as appropriate.

# CHAPTER 1: GENERAL INFORMATION

## 1.1 PURPOSE

This Advisory Circular provides “Guidance Material for SMGCS” is intended to give guidelines along the prescriptions as given in the ECARAS-PART 12, ICAO *Manual of Surface Movement Guidance and Control System*, ICAO Aerodrome Design Manual Part 4.

This should help the aerodrome operator to determine his requirements, needed to assist in the prevention of runway incursions.

## 1.2 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 requirements exist.

## 1.3 AMENDMENT PROCEDURE FOR THE MANUAL

Amendments to the AC will be incorporated on the website of Ethiopian Civil Aviation Authority of (ECAA). Directorate of aerodrome Standards and Safety (DASS) will take steps to introduce necessary amendments to the existing provisions in the AC or incorporate new provisions following the decisions of the director of DASS.

## 1.4 DEFINITIONS

**ACCIDENT:** An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, in which: a person is fatally or seriously injured as a result of: being in the aircraft, or being in direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or direct exposure to jet blast, except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or the aircraft sustains damage or structural failure which: adversely affects the structural strength, performance or flight characteristics of the aircraft, and would normally require major repair or replacement of the affected component, except for the engine failure or damage, when the damage is limited to the engine, its cowlings or accessories; or for damage limited to propellers, wing tips, antennas, tires, brakes, fairings, small dents or puncture holes in the aircraft skin; or the aircraft is missing or is completely inaccessible.

**AERODROME:** Any area of land or water designed, equipped, set apart or commonly used or intended to be used, either wholly or in part, for affording facilities for the and departure, of aircraft, and includes all buildings, sheds, vessels, piers, and other structures thereon or appertaining thereto.

**AERODROME CONTROL SERVICE:** Air traffic control service for aerodrome traffic.

**AERODROME OPERATING MINIMA:** Aerodrome operating minima means the cloud ceiling and visibility, or runway visual range, for take-off; and the decision height, or altitude, or minimum descent height, or altitude, and visibility, or runway visual range, and visual reference, for landing; specified by an operator in his operations manual as being the minima for take-off and landing by an aircraft at an aerodrome.

**AERODROME TRAFFIC:** All traffic on the maneuvering area of an aerodrome and all aircraft flying in the vicinity of an aerodrome.

**AEROPLANE:** A power-driven heavier than air aircraft deriving its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight.

**AIR TRAFFIC:** All aircraft in flight or operating on the maneuvering area of an aerodrome.

**AIR TRAFFIC CONTROL CLEARANCE:** Authorization given to an aircraft to proceed under conditions specified by an air traffic control unit.

**AIR TRAFFIC CONTROL SERVICE:** A service provided for the purpose of preventing collisions between aircraft, and on the maneuvering area between aircraft and obstructions; and expediting and maintaining an orderly flow of air traffic.

**AIR TRAFFIC CONTROL UNIT:** Air traffic control unit means, an area control centre, an approach control office or aerodrome control tower.

**AIR TRAFFIC FLOW MANAGEMENT (ATFM):** A service established with the objective of contributing to a safe, orderly and expeditious flow of air traffic by ensuring that Air Traffic Control (ATC) capacity is utilized to the maximum extent possible and that the traffic volume is compatible with the capacities declared by the appropriate Air Traffic Service (ATS) authority.

**AIR TRAFFIC SERVICE:** A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service, area control service, approach control service or aerodrome control service.

**AIRCRAFT:** Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

**AIR-GROUND COMMUNICATION:** Two-way communication between aircraft and stations or locations on the surface of the earth.

**AIR-GROUND CONTROL RADIO STATION:** An aeronautical telecommunication station having primary responsibility for handling communications pertaining to the operation and control of aircraft in a given area.

**APPROACH AND LANDING OPERATIONS USING INSTRUMENT APPROACH PROCEDURES:** Instrument approach and landing operations are classified as follows:

**Non-Precision Approach And Landing Operations:** An instrument approach and landing which utilizes lateral guidance but does not utilize vertical guidance.

**Approach And Landing Operations With Vertical Guidance:** An instrument approach and landing which utilizes lateral and vertical guidance but does not meet the requirements established for precision approach and landing operations.

**Precision Approach And Landing Operations:** An instrument approach and landing using precision lateral and vertical guidance with minima as determined by the category of operation.

**APPROACH CONTROL SERVICE:** Air traffic control service for arriving or departing controlled flights.

**APPROACH CONTROL UNIT:** A unit established to provide air traffic control service to controlled flights arriving at, or departing from, one or more aerodromes.

**APRON:** A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers, mail or cargo, fuelling, parking or maintenance.

**APRON MANAGEMENT SERVICE:** A service provided to regulate the activities and the movement of aircraft and vehicles on an apron.

**AUTOMATIC DEPENDENT SURVEILLANCE (ADS):** A surveillance technique in which aircraft automatically provide, via a data link, data derived from on-board navigation and position-fixing systems, including aircraft identification, four-dimensional position and additional data as appropriate.

**AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS):** The automatic provision of current, routine information to arriving and departing aircraft throughout 24 hours or a specified portion thereof: Data link-automatic terminal information service (D-ATIS). The provision of ATIS via data link. Voice-automatic terminal information service (Voice-ATIS). The provision of ATIS by means of continuous and repetitive voice broadcasts.

**CAUSES:** Actions, omissions, events, conditions, or a combination thereof, which led to the accident or incident.

**CEILING** the height above the ground or water of the base of the lowest layer of cloud below 6000 meters (20000 feet) covering more than half the sky.



**CLEARWAY:** A defined rectangular area on the ground or water under the control of the appropriate authority selected or prepared as a suitable area over which an airplane may make a portion of its initial climb to a specified height.

**CONTROLLED AERODROME:** An aerodrome designated as a controlled aerodrome by the Director General at which air traffic control service is provided to aerodrome traffic.

**CONTROLLED FLIGHT:** Any flight which is subject to an air traffic control clearance.

**DISPLACED THRESHOLD:** A threshold not located at the extremity of a runway.

**FINAL APPROACH:** The part of an instrument approach procedure which commences at the specified final approach fix or point, or where such a fix or point is not specified, at the end of the last procedure turn, base turn or inbound turn of a racetrack procedure, if specified; or at the point of interception of the last track specified in the approach procedure; and ends at a point in the vicinity of an aerodrome from which: a landing can be made; or a missed approach procedure is initiated.

**FLIGHT CREW MEMBER:** A licensed crewmember charged with duties essential to the operation of an aircraft during a flight duty period.

**FORECAST** A statement of expected meteorological conditions for a specified time or period, and for a specified area or portion of airspace.

**GROUND HANDLING:** Services necessary for an aircraft's arrival at, and departure from, an airport, other than air traffic services.

**GROUND VISIBILITY:** The visibility at an aerodrome, as reported by an accredited

**HAZARD:** Conditions, object or activity with the potential of causing injuries to personnel, damage to equipment or structures, loss of material, or reduction of ability to perform a prescribed function.

**HOLDING BAY:** A defined area where aircraft can be held, or bypassed, to facilitate efficient surface movement of aircraft.

**HOT SPOT:** A location on an aerodrome movement area with a history or potential risk of collision or runway incursion, and where heightened attention by pilots/drivers is necessary.

**HUMAN FACTORS PRINCIPLES:** Principles which apply to aeronautical design, certification, training, operations and maintenance and which seek safe interface between the human and other system components by proper consideration to human performance.

**HUMAN PERFORMANCE:** Human capabilities and limitations, which have an impact on the safety and efficiency of aeronautical operations.

**INCIDENT:** An occurrence, other than an accident, associated with the operation of an aircraft, which affects or could affect the safety of operation.

**INSTRUMENT METEOROLOGICAL CONDITIONS (IMC):** Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling, less than the minima specified for visual meteorological conditions.

**INSTRUMENT RUNWAY:** One of the following types of runways intended for the operation of aircraft using instrument approach procedures:

**Non-Precision Approach Runways:** An instrument runway served by visual aids and a non-visual aid providing at least directional guidance adequate for a straight-in approach.

**Precision Approach Runway, Category I:** An instrument runway served by ILS and/or MLS and visual aids intended for operations with a decision height not lower than 60 m (200 ft) and either a visibility not less than 800 m or a runway visual range not less than 550 m.

**Precision Approach Runway, Category II:** An instrument runway served by ILS and/or MLS and visual aids intended for operations with a decision height lower than 60 m (200 ft) but not lower than 30 m (100 ft) and a runway visual range not less than 350 m.

**Precision Approach Runway, Category III:** An instrument runway served by ILS and/or MLS to and along surface of the runway and: intended for operations with a decision height lower than 30 m (100 ft), or no decision height and a runway visual range not less than 200 m intended for operations with a decision height lower than 15 m (50 ft), or no decision height and a runway visual range less than 200 m but not less than 50 m. intended for operations with no decision height and no runway visual range limitations.

**INTERMEDIATE HOLDING POSITION:** A designated position intended for traffic control at which taxiing aircraft and vehicles shall stop and hold until further cleared to proceed, when so instructed by the aerodrome control tower.

**INVESTIGATION:** A process conducted for the purpose of accident prevention, which includes the gathering and analysis of information, the drawing of conclusions, including the determination of causes, and, when appropriate, the making of safety recommendations.

**LANDING AREA:** That part of a movement area intended for the landing or take-off of aircraft.

**MANEUVERING AREA:** That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons.

**MARKING:** A symbol or group of symbols displayed on the surface of the movement area in order to convey aeronautical information.

**MOVEMENT AREA:** That part of an aerodrome to be used for the surface movement of aircraft, including maneuvering area and the apron(s).

**NIGHT:** Hours between the end of evening civil twilight and the beginning of morning civil twilight or such other period between sunset and sunrise, as prescribed by the appropriate authority.

**NON-INSTRUMENT RUNWAY:** A runway intended for the operation of aircraft using visual approach procedures.

**OPERATIONS MANUAL:** A manual containing procedures, instructions and guidance for use by operational personnel in the execution of their duties.

**OPERATOR:** A person, organization or enterprise engaged in or offering to engage in an aircraft operation.

**PILOT-IN-COMMAND:** The pilot designated by the operator, or in the case of general aviation, the owner, as being in command and charged with the safe conduct of a flight.

**ROAD:** An established surface route in the movement area meant for the exclusive use of vehicles.

**ROAD-HOLDING POSITION:** A designated position at which vehicles may be required to hold.

**RUNWAY:** A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.

**RUNWAY END SAFETY AREA (RESA):** An area symmetrical about the extended runway centre line and adjacent to the end of the strip primarily intended to reduce the risk of damage to an airplane undershooting or overrunning the runway.

**RUNWAY GUARD LIGHTS:** A light system intended to caution pilots or vehicle drivers that they are about to enter an active runway.

**RUNWAY INCURSION:** Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft.

**RUNWAY VISUAL RANGE (RVR):** The range over which the pilot of an aircraft on the centre line of a runway can see the runway surface markings or the lights delineating the runway or identifying its centre line.

**RUNWAY-HOLDING POSITION:** A designated position intended to protect a runway, an obstacle limitation surface, or an ILS/MLS. Critical/sensitive area at which taxiing aircraft and vehicles shall stop and hold, unless otherwise authorized by the aerodrome control tower.

**SERIOUS INCIDENT:** An incident involving circumstances indicating that an accident nearly occurred.

**SERIOUS INJURY:** An injury, which is sustained by a person in an accident and which: requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received; or results in a fracture of any bone (except simple fractures of fingers, toes or nose); or involves lacerations which cause severe hemorrhage, nerve, muscle or tendon damage; or involves injury to any internal organ; or involves second or third degree burns, or any burns affecting more than 5 per cent of the body surface; or involves verified exposure to infectious substances or injurious radiation.

**SIGN:** Fixed Message Sign: A sign presenting only one message.

Variable Message Sign: A sign capable of presenting several pre-determined messages or no message, as applicable.

**SPECIAL VFR FLIGHT:** A VFR flight cleared by air traffic control to operate within a control zone in meteorological conditions below VMC.

**STOP WAY:** A defined rectangular area on the ground at the end of the take-off run available prepared as a suitable area in which an aircraft can be stopped in the case of an abandoned take-off.

**TAKE-OFF RUNWAY:** A runway intended for take-off only.

**TAXIING:** Movement of an aircraft on the surface of an aerodrome under its own power, excluding takeoff and landing.

**TAXIWAY:** A defined path on a land aerodrome established for the taxiing of aircraft and intended to provide a link between one part of the aerodrome and another, including:

**AIRCRAFT STAND TAXI LANE:** A portion of an apron designated as a taxiway and intended to provide access to aircraft stands only.

**APRON TAXIWAY:** A portion of a taxiway system located on an apron and intended to provide a through taxi route across the apron.

**RAPID EXIT TAXIWAY:** A taxiway connected to a runway at an acute angle and designated to allow landing aeroplanes to turn off at higher speeds than are achieved on other exit taxiways thereby minimizing runway occupancy times.

**TAXIWAY INTERSECTION:** A junction of two or more taxiways.

**TOUCHDOWN ZONE:** The portion of a runway, beyond the threshold, where it is intended landing airplanes first contact the runway.

**VFR:** The symbol used to designate the visual flight rules.

**THRESHOLD:** The beginning of that portion of the runway usable for landing.

**VISIBILITY:** Visibility for aeronautical purposes is the greater of: the greatest distance at which a black object of suitable dimensions, situated near the ground, can be seen and recognized when observed against a bright background; the greatest distance at which lights in the vicinity of 1000 candelas can be seen and identified against an unlit background.

**VISUAL METEOROLOGICAL CONDITIONS (VMC):** Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling, equal to or better than specified minima.

## **CHAPTER 2:**

# **INTRODUCTION TO SURFACE MOVEMENT GUIDANCE AND CONTROL SYSTEM**

## **2.1 WHAT IS MEANT BY A SURFACE MOVEMENT GUIDANCE AND CONTROL SYSTEM?**

**2.1.1** 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.

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 "maneuvering" and "apron" areas. These two areas are collectively referred to as the "movement area". Normally the responsibility for regulating the activities and the movement of aircraft and vehicles on the maneuvering area rests with the air traffic control service. In the case of the apron, such responsibility rests with the apron management service.

**2.1.2** 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. 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.

## **2.2 WHAT DOES A SURFACE MOVEMENT GUIDANCE AND CONTROL SYSTEM COMPRISE?**

**2.2.1** 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.

**2.2.2** 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.

### **2.3 WHOM DOES A SURFACE MOVEMENT GUIDANCE AND CONTROL SYSTEM INVOLVE?**

**2.3.1** Because of the multi-disciplinary interests in an SMGC system, there is a need to coordinate 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.

**2.3.2** The aerodrome operator 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.

### **2.4 OPERATIONAL CONDITIONS**

**2.4.1** The SMGC system to be provided at an aerodrome depends primarily upon two Operational conditions. They are:

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

Each of these conditions has been further defined in Chapter 2, Table 2-1 of the ICAO *Manual of Surface Movement Guidance and Control Systems*. For the purpose of selecting the appropriate combination of aids and procedures from Tables 2-2 and 2-3 of the ICAO *Manual of Surface Movement Guidance and Control Systems* ( *REFER APPENDIX A AND B OF THIS DOCUMENT*).

### **2.5 OPERATIONAL REQUIREMENTS**

**2.5.1** The operational requirements to be met by an SMGC system have been discussed for many years. The current operational requirements are shown in Table 1-1 of the *Manual of Surface Movement Guidance and Control Systems*. The requirements in the table 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*.

**Table 1-1. Operational Requirements of Surface Movement Guidance and Control Systems**

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

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 workloads 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.

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:
  - 1) changes in direction;
  - 2) 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.

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.

4. Requirements of ground vehicles on the movement area

a) emergency vehicles

- 1) information on the route to be followed;
- 2) guidance along the route being followed;
- 3) capability to locate the site of an emergency;
- 4) information to prevent collision with aircraft and ground vehicles; and

b) other ground vehicles

- 1) information on the route to be followed;
- 2) guidance along the route being followed;
- 3) information to prevent collision with aircraft and ground vehicles

## **2.6 REASONS TO PROVIDE AN SMGC SYSTEM**

**2.6.1** 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.

**2.6.2** 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.

**2.6.3** 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.

**2.6.4** 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.

## **CHAPTER 3**

### **OPERATIONAL REQUIREMENTS OF SMGCS**



### **3.1 OPERATIONAL REQUIREMENTS**

As defined in the Chapter 1, Table 1-1 of the *Manual of Surface Movement Guidance and Control Systems*, the system should be appropriate to the visibility and traffic density and should provide:

#### **3.1.1 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.

#### **3.1.2 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

#### **3.1.3 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.

#### **3.1.4 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;

- iv. information to prevent collision with aircraft and ground vehicles; and
- b) other ground vehicles
  - i. information on the route to be followed;
  - ii. guidance along the route being followed;
  - iii. information to prevent collision with aircraft and ground vehicles.

## 3.2 FUTURE CONSIDERATIONS

**3.2.1** 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. 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. 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. 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. 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.

## 3.3 VISIBILITY CONDITIONS

**3.3.1** 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; 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 Visibility less than 400 m RVR (low visibility operations).

## 3.4 TRAFFIC DENSITY

(In the mean busy hour as determined by the individual aerodrome)

**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

# CHAPTER 4

## EQUIPMENT REQUIREMENTS

**4.1** The equipment required at a particular aerodrome for provision of an SMGC system will depend on both 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:

### **4.1.1 Markings:**

- runway centre line
- taxiway centre line
- taxi-holding position
- taxiway intersection
- apron
- restricted use areas

### **4.1.2 Lighting:**

- runway edge
- taxiway edge
- obstacle lights
- restricted use areas

### **4.1.3 Signs:**

- mandatory signs, e.g. taxi-holding position, NO ENTRY, STOP
- information signs, e.g. location and destination

### **4.1.4 Other:**

- aerodrome chart
- aerodrome control service
- signaling lamp
- radiotelephony equipment.

## CHAPTER 5

### BASIC PROCEDURAL REQUIREMENTS

#### 5.1 PROCEDURAL REQUIREMENTS

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

##### 5.1.1 Aerodrome authority

- designation of taxiways
- movement area inspections
- regulation of ground staff conduct on the movement area
- regulation of ground staff radiotelephony procedures
- periodic electrical monitoring of SMGC aids
- initiation of amendment of aerodrome chart as necessary
- apron management

##### 5.1.2 Air traffic services

- provision of air traffic control services
- use of radiotelephony procedures and phraseology
- use of signaling lamp
- monitoring of SMGC aids

##### 5.1.3 Pilot

- adherence to ground movement traffic rules and regulations
- use of radiotelephony procedures and phraseology.

# Appendix A

## Guidance on selecting SMGCS system aids

Table 2-2. Guidance on selecting SMGC system aids

Aid	Traffic condition —		Light			Medium			Heavy			ICAO DOCUMENT REFERENCE*
	Visibility condition —		1	2	3	1	2	3	1	2	3	
Apron markings			x	x	x	x	x	x	x	x	x	Annex 14, Chapter 5; <i>Aerodrome Design Manual</i> , Part 4, Chapter 2
Runway centre line marking			x	x	x	x	x	x	x	x	x	Annex 14, Chapter 5
Taxiway centre line marking			x	x	x	x	x	x	x	x	x	Annex 14, Chapter 5
Taxi-holding position marking			x	x	x	x	x	x	x	x	x	Annex 14, Chapter 5
Visual aids for denoting restricted use areas			x	x	x	x	x	x	x	x	x	Annex 14, Chapter 7
Runway edge lights			x	x	x	x	x	x	x	x	x	Annex 14, Chapter 5; <i>Aerodrome Design Manual</i> , Part 5, Chapter 3
Taxiway edge lights			x	x	x	x	x	x	x	x	x	Annex 14, Chapter 5; <i>Aerodrome Design Manual</i> , Part 5, Chapter 3
Obstacle lighting			x	x	x	x	x	x	x	x	x	Annex 14, Chapter 6; <i>Aerodrome Design Manual</i> , Part 4, Chapter 14
Signs			x	x	x	x	x	x	x	x	x	Annex 14, Chapter 5; <i>Aerodrome Design Manual</i> , Part 4, Chapter 11
Taxiway intersection marking			x	x	x	x	x	x	x	x	x	Annex 14, Chapter 5
Charts (aerodrome, movement, apron)			x	x	x	x	x	x	x	x	x	Annex 4, Chapters 13, 14 and 15
Aerodrome control service			x	x	x	x	x	x	x	x	x	Annex 11, PANS-RAC
Signalling lamp			x	x	x	x	x	x	x	x	x	Annex 14, Chapter 5
Radiotelephony equipment			x	x	x	x	x	x	x	x	x	Annex 11, Chapter 6
Taxi-holding position lights					x		x	x	x	x	x	Annex 14, Chapter 5
Clearance bars					x		x	x		x	x	Annex 14, Chapter 5
Electrical monitoring system for lights			x	x		x	x	x	x	x	x	Annex 14, Chapter 8; <i>Aerodrome Design Manual</i> , Part 5, Chapter 3
Taxiway centre line lights					x			x			x	Annex 14, Chapter 5; <i>Aerodrome Design Manual</i> , Part 5, Chapter 3
Stop bars					x		x	x		x	x	Annex 14, Chapter 5; <i>Aerodrome Design Manual</i> , Part 5, Chapter 3
Selective switching capability for taxiway centre line lights								x			x	<i>Aerodrome Design Manual</i> , Part 4, Chapter 10 and Part 5, Chapter 3
Selective switching capability for apron taxiway centre line lights								x			x	<i>Aerodrome Design Manual</i> , Part 4, Chapter 10 and Part 5, Chapter 3
Surface movement radar (SMR)								x		x	x	<i>Air Traffic Services Planning Manual</i>
Aircraft stand manoeuvring guidance lights					x			x			x	Annex 14, Chapter 5
Runway clearance aid					x			x		x	x	Annex 14, Chapter 5
Secondary power supply					x		x	x		x	x	Annex 14, Chapter 8; <i>Aerodrome Design Manual</i> , Part 5, Chapter 2
Visual docking guidance system								x		x	x	Annex 14, Chapter 5; <i>Aerodrome Design Manual</i> , Part 4, Chapter 12

\* See Appendix A for further information on visual aids

## Appendix B

**Table 2-3. Guidance on selecting SMGC system procedures**

Procedure	Traffic condition —	Light			Medium			Heavy			ICAO DOCUMENT REFERENCE*
	Visibility condition —	1	2	3	1	2	3	1	2	3	
<i>Aerodrome authority</i>											
Periodic electrical monitoring of SMGC aids		x	x	x	x	x	x	x	x	x	Annex 14, Chapter 8 and Chapter 3 of this manual
Designation of taxiways		x	x	x	x	x	x	x	x	x	See Chapter 3 of this manual
Movement area inspections and reporting		x	x	x	x	x	x	x	x	x	Annex 14, Chapter 2 and Chapter 3 of this manual
Regulation of ground staff conduct on the movement area		x	x	x	x	x	x	x	x	x	See Chapter 3 of this manual
Initiation of amendment of aerodrome charts as necessary		x	x	x	x	x	x	x	x	x	See Chapter 6 of this manual
Regulation of ground staff radiotelephony procedures		x	x	x	x	x	x	x	x	x	Annex 10, PANS-RAC
Establishment of standard taxi routes				x		x	x	x	x	x	See Chapters 3 and 6 of this manual
Low visibility movement area protection measures				x			x			x	See Chapter 5 of this manual
Continual electrical monitoring of SMGC aids				x			x			x	Annex 14, Chapter 8 and Chapter 3 of this manual
<i>ATS</i>											
Visual monitoring of SMGC aids		x	x	x	x	x	x	x	x	x	Annex 11, Chapter 7 and Chapter 3 of this manual
Use of radiotelephony procedures and phraseology		x	x	x	x	x	x	x	x	x	Annex 10, PANS-RAC, Part 9 and the <i>Manual of Radiotelephony</i>
Use of signalling lamp		x	x	x	x	x	x	x	x	x	Annex 2, Appendix A
Control of other than aircraft traffic on the manoeuvring area		x	x	x	x	x	x	x	x	x	PANS-RAC, Part 5
Operation of lighting aids		x	x	x	x	x	x	x	x	x	PANS-RAC, Part 5
Determination of the taxiway route to be followed				x		x	x	x	x	x	PANS-RAC, Part 5 and Chapter 3 of this manual
Application of sequencing procedure				x	x	x	x	x	x	x	See Chapter 4 of this manual
Initiation and termination of low visibility procedures				x			x			x	PANS-RAC, Part 5 and Chapter 5 of this manual
Application of separation criteria				x			x			x	PANS-RAC, Part 5, and Chapter 4 of this manual
Continual electrical monitoring of SMGC aids				x			x			x	Annex 11, Chapter 7 and Chapter 3 of this manual
Monitoring of surface movement on SMR							x		x	x	See Chapter 4 of this manual
Selective switching of taxiway centre line lights							x			x	<i>Aerodrome Design Manual</i> , Part 4 and PANS-RAC, Part 5
Selective switching of stop bars				x		x	x		x	x	<i>Aerodrome Design Manual</i> , Part 4 and PANS-RAC, Part 5

\* See Appendix A for further information on visual aids

**Table 2-3. Guidance on selecting SMGC system procedures (cont.)**

Procedure	Traffic condition —			Medium			Heavy			ICAO DOCUMENT REFERENCE*
	1	2	3	1	2	3	1	2	3	
Adherence to ground movement traffic rules and regulations	x	x	x	x	x	x	x	x	x	Annex 2, PANS-RAC
Use of radiotelephony procedures and phraseology	x	x	x	x	x	x	x	x	x	Annex 10, PANS-RAC and the <i>Manual of Radiotelephony</i>
<i>Apron management</i>										
Apron regulations and procedures	x	x	x	x	x	x	x	x	x	Annex 14, Chapter 9 and Chapter 8 of this manual
Emergency procedures	x	x	x	x	x	x	x	x	x	Chapters 5 and 8 of this manual
Communication procedures with ATS	x	x	x	x	x	x	x	x	x	Chapters 4 and 8 of this manual
Stand allocation and information	x	x	x	x	x	x	x	x	x	Chapter 8 of this manual
Apron security procedures	x	x	x	x	x	x	x	x	x	Chapter 8 of this manual
Operation of lighting and docking aids			x			x			x	Chapter 8 of this manual
Provision of discrete RTF channel						x	x	x	x	Chapter 8 of this manual
Low visibility procedures			x			x			x	Chapter 5 of this manual

\* See Appendix A for further information on visual aids