THE SYSTEM OF MOVEMENT OF AERODROME. AN AIRPORT SURVEILLANCE RADAR

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Annotation: *Nowadays all around the world flights are tend to increase and for many airports it is no longer an option to expand terminals and runways, so airports are trying to maximize their operational efficiency. Today a lot of airports already operate near their maximal capacity, especially some busy airports in Europe and Middle East. Peak hours imply operational bottlenecks and cause chained delays across flights impacting passengers, airlines, airports and economies as well. Therefore there is a need for the optimization of the ground movements at the airports. The ground movement problem consists of routing the departing planes from the gate to the runway for takeoff, and the arriving planes from the runway to the gate, and to schedule their movements.*

This article reveals such concepts as: the system of movement of aerodrome, maneuvering area of aerodrome, an airport surveillance radars and their types of, ways to prevent airports with better radar systems.

Keywords: *movement area; maneuvering; priority; surveillance radars; Ground control radars.*

The flight facilities comprise of the **airside area structures** affected by the aircraft's maneuvering, take-off, landing and parking areas. C.E.M.E.S. S.p.A. oversees the construction, maintenance and renovation of these areas, more precisely:

- The landing area;
- The maneuvering area;
- The movement area.

Landing area at an airport allows the **safe landing and take-off maneuvers** of an aircraft. While it is usually associated with the runway, one or more runways can coexist in the same airport, but also other take-off areas for helicopters or VTOL (Vertical Take-Off and Landing) aircrafts and these would all be considered part of the landing area. Maneuvering area is the area of the airport used for take-off, landing and taxiing of aircrafts. It includes **runways, other landing areas and traffic routes leading to these areas**. Parking aprons, maintenance areas and hangars are not part of this area. The **taxiway** is also part of the maneuvering area. This is a specific route used for taxiing aircrafts and provides a link between the two parts of the airport. The taxiway includes:

- The **aircraft stand taxilane**;
- The **apron taxiway**;
- The **rapid exit taxiway**: a connected taxiway, equipped with an acute-angle runway, which allows landing aircraft to exit at a higher speed than other taxiways and minimize runway occupancy time. The movement area includes the areas of the airport used for take-off, landing and taxiing of aircraft (maneuvering area), and the aprons. It therefore includes **any area, whether paved or not, on which an aircraft may pass,** such as taxiways, engine test stands, parking areas and maintenance areas.

At airports, airplanes taking off and landing must ensure there is a minimum separation between them in order to set safety margins in case of an emergency as well as to minimise wake turbulence these separations can be established either in terms of a minimum distance or time between each airplane. In the same way as in roads, in the air, not all aircraft have the same right of way. This priority is established based on the urgency and maneuverability of aircraft. The highest priority is given to emergency airplanes. After them, hot air balloons, given their low maneuverability. In third place, maneuverability corresponds to planners, as they do not have an engine, their flying time is limited.

Following is a priority group formed by refuelling and towing operations.

Finally, we have hovercrafts. When airplanes approach an airport to land, they have higher priority than those which are lower. In the same way, when various airplanes have to wait for a controller to sequence them, the first one to get there is who gets the lowest altitude.

At airports, emergency vehicles, handlers, pushbacks and aircraft share space. It is therefore essential, for correct functioning and to guarantee safety, to know who has the right of way or priority over others. Emergency vehicles have the highest priority.

Vehicles as well as airplanes taxiing at the airport must give way to vehicles being towed. Vehicles in general, must give way to airplane. Both vehicles and airplanes on land must give way to airplanes landing or ready for takeoff. When two airplanes come together, the one furthest to the right has the right of way. If

two aircraft are nose to nose, they will wait until an air traffic controller instructs them to continue.

An airport surveillance radar

An airport surveillance radar (ASR) is a radar system used at airports to detect and display the presence and position of aircraft in the terminal area, the airspace around airports. It is the main air traffic control system for the airspace around airports. At large airports it typically controls traffic within a radius of 60 miles (96 km) of the airport below an elevation of 25,000 feet. The sophisticated systems at large airports consist of two different radar systems, the primary and secondary surveillance radar.[1] The primary radar typically consists of a large rotating parabolic antenna dish that sweeps a vertical fan-shaped beam of microwaves around the airspace surrounding the airport. It detects the position and range of aircraft by microwaves reflected back to the antenna from the aircraft's surface. The secondary surveillance radar consists of a second rotating antenna, often mounted on the primary antenna, which interrogates the transponders of aircraft, which transmits a radio signal back containing the aircraft's identification, barometric altitude, and an emergency status code, which is displayed on the radar screen next to the return from the primary radar.[1]

The positions of the aircraft are displayed on a screen; at large airports on multiple screens in an operations room at the airport called in the US the Terminal Radar Approach Control (TRACON), monitored by air traffic controllers who direct the traffic by communicating with the aircraft pilots by radio. They are responsible for maintaining a safe and orderly flow of traffic and adequate aircraft separation to prevent midair collisions.

Ground control radars

Surface movement control radar (Airfield Surveillance Radar, ALR) is the most common surveillance system currently in use at airports. It is a primary radar that creates a radar field that provides observation of the maneuvering area. The maneuvering zone is the part of the aerodrome used for the takeoff, landing and taxiing of aircraft. It does not include passenger boarding and loading areas. Today, Samarkand International airport also has ALR (Airfield Surveillance Radar). This is currently the only ALR radar in Uzbekistan.

Ground control radars provide surveillance of all aircraft and ground vehicles in the maneuvering area with a high data rate. The antennas of such radars are often installed on towers, which provides a good overview of the maneuvering area. (Very large airports, such as Munich Airport, have a second control tower dedicated to the second terminal and traffic control on the airport taxiways.)

The radar situation on the surface of the Earth is very different from the situation in the airspace due to the presence of a large number of various kinds of

interference and other physical problems. For this reason, the quality of information obtained during the survey of the ground space is often quite low.

Since primary radars are used to control ground movement, identification or identification of objects during the survey is not possible. For this reason, controllers use a visual method of identification (simply by looking at the windows of the control tower). This is one of the reasons for the decrease in the capacity of airports in conditions of limited visibility.

Surface movement radars use rotating antennas. Typically, the rate of rotation of the antenna of such a radar is one revolution per second. As a rule, radars of this type operate in the X and K-bands of frequencies. Higher resolution radars operate at frequencies between 92 and 96 GHz. Most of the new types of ground control radars are interfaced with other types of airport radars, such as landing radars or secondary surveillance radars (SSRs) .

The data processing capabilities of ground control radars make it possible to detect runway entry, generate a conflict warning, and identify detected objects. Existing surfacecontrolradarsare sometimes referred to as airport surface detecti on equipment (ASDE).

Today, most airports use the Automatic Dependent Surveillance-Broadcast (ADS - B) system. The system also decodes and uses information received from secondary surveillance radars (SSRs).

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