



GHANA  
CIVIL AVIATION AUTHORITY

# ADVISORY CIRCULAR AC-AD-015

## EVALUATING AERONAUTICAL EFFECTS OF PROPOSED CONSTRUCTION ON AIR NAVIGATION & AIRSPACE PERMIT PROCEDURE

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### **GENERAL**

Ghana Civil Aviation Authority (GCAA) Advisory Circulars from Aerodrome Safety and Standards (ASAS) contain information about standards, practices and procedures that the Authority has found to be an Acceptable Means of Compliance (AMC) with the associated Regulations.

An AMC is not intended to be the only means of compliance with a regulation, and consideration will be given to other methods of compliance that may be presented to the Authority.

### **PURPOSE**

This Advisory Circular provides methods, acceptable to the Authority, for showing compliance with Part 24 of the Ghana Civil Aviation (Aerodrome) Regulations, 2011, LI 2004, as well as explanatory and interpretative material to assist in showing compliance.

### **REFERENCE**

The Advisory Circular relates specifically to the Aerodrome GCARs and Manual of Standards (MOS).

### **STATUS OF THIS AC**

This is the first AC to be issued on this subject.

### **FOREWARD**

This document provides guidance to Aerodrome Operators and developers on the conduct of aeronautical studies of the effect of proposed construction or alteration on the use of air navigation facilities or Navigable airspace by aircraft.

**APPROVAL**

Issue No : 01	Approved by:  _____ Director-General	_____ 2015
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## 1. INTRODUCTION

It has long been recognized that airports have unique needs for operational safety that interact with surrounding land uses. In particular, the need for runway approaches that are clear of obstructions has long been the target of the Aviation Authorities all over the world. The effective utilization of an aerodrome may be considerably influenced by natural features and man-made obstructions such as towers, masts and high rising buildings within and outside its boundaries. Airports undertake numerous projects each year to remove dangerous obstructions from land either within an airport's control or adjacent to the airport.

For the purposes of this section:

*OBSTRUCTION* - Any structure, growth, or other object, including a mobile object, which exceeds a limiting height set forth by the GCAR Part 24.

*HAZARD TO AIR NAVIGATION* - An obstruction determined to have a substantial adverse effect on the safe and efficient utilization of the navigable airspace.

Unauthorized high rising structures (**Obstructions/Obstacles**), may have negative impact on Aircraft Operations and may contribute to an air disaster.

Obstructions may result in the limitation of the distance available for take-off and landing of an aircraft. Obstructions and other activities such signal transmissions and laser projections may also affect air navigation.

Structures located close to aeronautical installations at various locations countrywide may also distort signals received by aircraft from these installations and may confuse pilots. A degree of freedom from obstacles in these areas is very important in the retention of an aerodrome. For these and other reasons certain areas of the airspace is established as integral part of the aerodrome environment. Heights of structures must therefore be controlled in order not to penetrate these areas of the airspace.

In the aeronautical studies, present and future IFR and VFR aeronautical operations and procedures are reviewed and any possible changes in those operations and procedures and in the construction proposal that would eliminate or alleviate the conflicting demands are ascertained

The conclusion of a study made under the studies is normally a determination as to whether the specific proposal studied would be a hazard to air navigation or not.

## **2. LEGISLATION AND REGULATORY FRAMEWORK**

The Ghana Civil Aviation Act 678, 2004 (as amended by the Ghana Civil Aviation (Amendment) Act, 2016, Act 906) requires the Ghana Civil Aviation Authority (GCAA) to be responsible for;

- (a). ensuring safety of air navigation and aircraft;
- (b). minimizing or preventing interference with the use or effectiveness of apparatus used in connection with air navigation and for prohibiting or regulating the use of that apparatus and display of signs and lights likely to endanger aircraft;

The Act provides for the efficient utilization of the navigable space, including the safe altitude of flights and the prevention of collision between aircraft, between aircraft and land or water, vehicles and any other objects and between aircraft airborne objects.

The GCAA Act 678 and Amended Act, Act 906 and Ghana Civil Aviation Regulations (GCAR) Part 27, establishes requirements for the construction of structures that may project high in the airspace for the protection of navigable airspace.

## **3. GCAA POLICY**

A structure is considered to have an adverse aeronautical effect if it first exceeds the obstruction standards of GCAR, and/or is found to have physical or electromagnetic radiation effect on the operation of air navigation facilities.

GCAA Amendment Act, Act 906 restricts the construction of buildings near existing or proposed navigational facilities and the GCAA is empowered to demolish such incompatible structures, where applicable.

If a structure is found to have a significant adverse impact, a "hazard" determination will be issued. However, in most cases, the GCAA works with the proponent until the conditions are met for a "no-hazard" determination.

GCAA emphasizes the need for conserving the navigable airspace for aircraft; preserving the integrity of the national airspace system; and protecting air navigation facilities from either electromagnetic or physical encroachments that would preclude normal operation.

The GCAR establishes standards for determining obstructions to air navigation. A structure that exceeds one or more of these standards is presumed to be a hazard to air navigation unless the obstruction evaluation study determines otherwise.

## **4. OBSTRUCTION STANDARDS**

There are established standards for determining obstructions to air navigation. These apply to existing and proposed manmade objects, objects of natural growth, and terrain. The standards apply to the use of navigable airspace by aircraft and to existing air

navigation facilities, such as an air navigation aid, airport, airway, instrument approach or departure procedure, or approved off-airway route. Additionally, those standards apply to a planned facility or use, or a change in an existing facility or use, if a proposal therefore is on file with the GCAA on the date the notice required by the GCAA is filed.

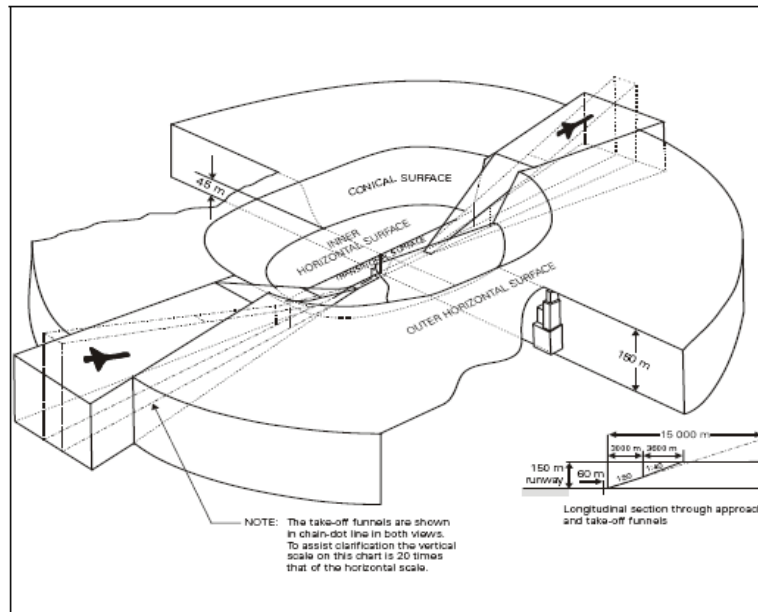
An obstruction evaluation study shall identify:

- (a). the effect the proposal would have:
  - i. On existing and proposed public-use and military airports and/or aeronautical facilities.
  - ii. On existing and proposed visual flight rule (VFR)/instrument flight rule (IFR) aeronautical departure, arrival and en route operations, procedures, and minimum flight altitudes.
  - iii. Regarding physical, electromagnetic, or line-of-sight interference on existing or proposed air navigation, communications, radar, and control systems facilities.
  - iv. On airport capacity, as well as the cumulative impact resulting from the structure when combined with the impact of other existing or proposed structures.
- (b). the nature of marking and/or lighting

Specifications for airport obstacle limitation surfaces (OLS) are contained in Part 27 of the GCARs. The airport obstacle limitation surfaces are:

- The conical surface.
- The inner horizontal surface.
- The inner approach surface.
- The approach surface.
- The transitional surface.
- The inner transitional surface.
- The balked landing surface.
- The outer horizontal surface.
- The takeoff climb surface.

Figure 1 depicts the obstacle limitation surfaces that must be established at airports and protected. Detailed description of the OLS is further treated in the appendix.



**Figure 1 - Obstacle Limitation Surfaces (3-D View)**

#### **4.1. NOTICE REQUIREMENTS FOR CONSTRUCTION OR ALTERATION**

Each sponsor proposing any kind of construction or alteration of a structure, shall apply to the GCAA for obstruction evaluation and grant of AIRSPACE SAFETY PERMITS if:

- (a). The overall height of structure above ground is more than 10m in height above ground level at its site and is within 5000m radius of an existing or proposed aerodrome.
- (b). The proposed Structure within 10nm (60,760ft/18,500m) radius of an existing or proposed aerodrome and beyond 5000m and is between 10 and 46m in height.
- (c). Beyond 10nm radius of an existing or proposed aerodrome any structure which is 150ft (46m) or higher. (1nm=approx.6,076ft)
- (d). A structure on designated low level flying routes or close to major highways
- (e). A construction or alteration of greater height than an obstacle limitation surface in accordance with the criteria specified in GCARs Part 27.
- (f). The object, construction or alteration would be in an instrument approach area.
- (g). The object, construction or alteration is to be located within the distances above from an existing airport, an airport under construction or planned airport that is the subject of a notice on file with the GCAA at the time of the airspace permit application.
- (h). A highway, railroad, or other traverse way for mobile objects, of a height which, if adjusted upward 5 meters for any highway where over crossings are designed for a minimum of 5 meters vertical distance, 4 meters for any other public roadway, 3 meters or the height of the highest mobile object that would normally traverse the road, whichever is greater, for a private road, 7 meters for a railroad, and for any

other traverse way not previously mentioned, an amount equal to the height of the highest mobile object that would normally traverse it, would exceed a standard of (a) and (e) of this section.

Notices received from applicants provide basis for:

- i. Evaluating the effect of the construction or alteration on operational procedures and proposed operational procedure;
- ii. Determining the possible hazardous effect of the proposed construction or alteration on air navigation;
- iii. Determining the requirements for marking and lighting of constructions or alterations, in accordance with GCAR Part 27;
- iv. Determining other appropriate measures to be applied for continued safety of air navigation; and;
- v. Charting and other notification to airmen (NOTAM) of the construction or alteration.

A notice filed with the GCAA does not relieve the sponsor of compliance with laws, ordinances or regulations of any other governmental entity.

The GCAA reserves the right to file a suit against any sponsor who failed to notify the GCAA of a construction or alteration to remove the structure.

#### **4.2. CONSTRUCTION OR ALTERATION NOT REQUIRING NOTICE**

No sponsor is required to notify the Director General for any of the following construction or alteration:

- (a) Any antennal structure of 30 ft (10 m) or less in height outside 50000 ft (15000 m) of the airport.
- (b) Any air navigation facility, airport visual approach or landing aid, aircraft arresting device, or meteorological device, of a type approved by the Director General, the location and height of which is fixed by its functional purpose.

#### **4.3. OBSTRUCTION EVALUATION & APPROVAL PROCEDURE**

- (a). The sponsor shall obtain approval of the Director General of the GCAA by submitting a completed form of a notice (**GCAA FORM /SRD/ASAS – 01 Notice of Proposed Construction or Alteration**) to the Director General at least 60 days prior to the proposed date of commencement of construction or alteration. This form is can be obtained from the Safety Regulation Department of the GCAA. The form may be obtained also on the GCAA website [www.gcaa.com.gh](http://www.gcaa.com.gh).
- (b). The notice specifies the locations, coordinates (in WGS 84), heights, and the natural ground level above mean sea level of the construction or alteration for which notice is required and prescribes the form and manner of the notice.
- (c). GCAA acknowledges the receipt of notice submitted by a sponsor in writing, and provides appropriate quotation of fee subject to the GCAA scheme of charges.
- (d). Sponsor makes payment of fees to GCAA and arranges for site inspection. GCAA Aviation Safety Inspectors conduct site inspection together with applicant's



representatives to verify site information (tower height, location, topography, etc.) provided by the proponent. This is a very important step considering that nearly 30% of the proposals submitted to the GCAA contain errors.

Applicant is required to provide transportation to and from the site.

- (e). GCAA conducts aeronautical study, to determine whether it would be “hazard to air navigation or not”.

#### **4.4. EVALUATING AERONAUTICAL EFFECT AND ISSUING A DETERMINATION**

The outcome of an evaluation of proposed construction or alteration may be one of the following:

- object will exceed any standard and will not be hazard to air navigation; or
- object will exceed a standard but will not be a hazard to air navigation; or
- object will exceed a standard and will be a hazard to air navigation

The GCAA upon conducting aeronautical studies may issue **AIRSPACE SAFETY PERMIT** if the effect of the proposed development will **not** undermine the safe utilization of the navigable airspace.

Only in exceptional cases, where the GCAA concludes that a clear and compelling showing has been made that it would not result in an inefficient utilization of the airspace and would not result in a hazard to air navigation, will a determination of no hazard be issued.

A determination made by the Ghana Civil Aviation Authority does not relieve the proponent of responsibility for compliance with any local law, regulation, or any law of the state. **Aeronautical studies** and determinations do not consider environmental, land ownership or title issues or land use compatibility impacts. Studies conducted by the GCAA specifically evaluate the effect the proposed structure may have on the safe and efficient use of navigable airspace.

#### **4.5. OBJECTION FROM THE GCAA**

The GCAA may decline a permit in the following situations construction or alteration of structure:

- exceeds the obstruction standards outlined in Part 27 and/or have a physical and/or electromagnetic effect on air navigational facilities.
- requires a change to an instrument procedure or minimum flight altitude.
- restricts control tower line-of-sight
- is close to a visual landmark such as a highway, mine, reservoir, or any other point commonly used as a visual reference for VFR pilots.
- underlie terminal airspace, creating traffic compression increasing risk of a midair collision.
- lies in an area in which a high volume of Air training activities is conducted.
- lies along commonly used VFR egress or ingress tracks to an airport.

#### **4.6. ANNUAL INFORMATION REPORT & ANNUAL REVIEW FEE**

In accordance with the GCAR, a person granted an Airspace Permit for a period not less than 12 months shall submit annually on or before January 31 of each year, to the GCAA, a Telecommunications Facility Annual Information Report. The submission of the Annual Report shall include the tower owner name(s), address(s), phone number(s), contact person(s) and annual review fee.

The tower owner shall supply the **tower height** and **current occupancy**. The tower owner shall certify that the tower is still being used. This information shall be submitted on a signed form, designated for such use, and **shall become evidence of compliance**.

The fee submittal is the responsibility of each tower owner. Failure to provide this information shall result in a civil forfeiture of 10 penalty units per day until the information is received by the GCAA.

#### **4.7. COMPLIANCE**

It is the responsibility of the owners of structures issued permit under the Ghana Civil Aviation Regulations to ensure that conditions of the permit are adhered to. Failure to do so will render the permit invalid in accordance with GCAA Act, Act 906.

- (1). The airspace permit ceases to be in force if:
  - (a) The owner of telecommunication tower site, service provider and/or tower owner fails to comply with the requirements of the Permit;
  - (b).The permittee has failed to comply with the conditions of approval imposed;
  - (c).The facility has not been properly maintained with regards to lighting and marking.
  
- (2). Any antenna or tower that is not operated for a continuous period of twelve (12) months shall be considered abandoned. In such circumstances, the following shall apply:
  - (a).The owner of such site, structure and the property owner upon which the site is located shall remove said structure within sixty days (60) days of receipt of notice from the GCAA of such abandonment. If removal to the satisfaction of the GCAA does not occur within said sixty (60) days, the GCAA may order removal. If there are two or more users of a single tower (co-location), then this provision shall not become effective until all operations of the tower cease.
  - (b).The recipient of a Permit for a telecommunications facility shall notify the GCAA within 30 days of when the facility is no longer in operation.

#### **4.8. INSPECTION AUTHORITY**

- (1) Owners of structures must allow GCAA to make any inspections, including unannounced inspections to determine compliance with applicable parts of the GCAR for the purpose of ensuring the safety of aircraft.
- (2) The Director General of the Ghana Civil Aviation Authority shall delegate credentialed aviation safety inspectors to conduct safety inspections in accordance with LI 2004.

#### **4.9. MARKING/PAINTING & LIGHTING OF STRUCTURES**

Structures are to be marked and lit in accordance with specifications contained in the GCAA guidance material on Marking and Lighting Obstacles (ASAS Guidance on lighting and marking of obstacles).

#### **4.10. RESTRICTION AND REMOVAL OF OBSTACLES**

- (a) Objects which do not project through the approach surface but which would nevertheless adversely affect the optimum siting or performance of visual or non-visual aids shall, as far as practicable, be removed.
- (b) Anything which may, in the opinion of the GCAA endanger aircraft on the movement area must be removed.
- (c) Because of the difficulty of recognition, special restrictions must be applied to elevated wires and their supports. Where no other object penetrates a given obstacle limitation surface, overhead wires and their supports should not penetrate a surface passing through the top of the highest existing object and parallel to the established surface for a distance of 1500 meters from the runway threshold.

*Note - In certain circumstances, objects that do not project above any of the surfaces enumerated in GCAR may constitute a hazard to aeroplanes as, for example, where there are one or more isolated objects in the vicinity of an aerodrome.*

#### **4.11. CO-SITING AND CO-MASTING**

The GCAA encourages collocation of telecommunication masts. Co-siting of antenna towers is possible but may require coordination of frequencies in use at the site between the carriers to prevent mutual interference between bases at the site. Co-siting is avoided by carriers because of the added complexity of filtering equipment on both transmitting and receiving equipment and antenna design. The cost of co-sited base stations could be significantly increased for each carrier dependent upon the actual design of the individual base station.

In relation to co-masting the following issues of concern would be who owns the mast; who may have access to it and when may access be denied. Safety, structural strength and future expansion are also matters for consideration. As well, the tower must be correspondingly higher to accommodate the additional antennas and equipment. Not only must the tower offer physical separation between antennas but electrical separation must also be provided for the feeder routes and other control signal entry paths.

#### **5. NOTICE OF USE OF LIGHT OR LASER**

Each person proposing to operate a light or laser within 18,500 meters of an airport reference point and below 3000 meters Above Ground Level (AGL) shall notify the Director General by completing the GCAA form or in manner accepted by the Director General of the GCAA.

A person proposing to use lights, lasers, weapons, or pyrotechnics shall complete form GCAA/SRD/ASAS – 01B and submit it to the Director General at least 60 days of working days prior to the commencement of the use.

## **6. NOTICE OF USE OF WEAPONS**

- a) Any appropriate authority proposing to allow the use of weapons that will fire or launch a projectile that will have a trajectory higher than 60 m shall notify the Director General of the proposal by completing the GCAA form or in manner accepted by the Director General of the GCAA.
- b) The use of weapons is prohibited within 15000 m from the airport reference point.

## **7. NOTICE OF USE OF PYROTECHNICS**

- a) Each person proposing to stage a pyrotechnics display that will involve the firing or launching of a projectile that will have a trajectory higher than 60m, beyond 15000 m from the airport reference point, shall notify the Director General by completing the GCAA form or in manner accepted by the Director General of the GCAA.
- b) Pyrotechnics displays that will involve the firing or launching of a projectile that will have a trajectory higher than 60 m are prohibited within 15000 m from the airport reference point.

## **8. ADDITIONAL NOTICE REQUIREMENTS**

- a) Each person who is required to give notice shall notify the Director General in writing to the GCAA that the construction or alteration has reached its greatest height, within 5 days of it doing so.
- b) The notice required by paragraph (a), when the structure reaches its greatest height, shall include a registered surveyor's determination of structure height and position and proof of compliance with marking and lighting requirements as determined by the Director General.
- c) Each person who abandons a construction or alteration project that is the subject of a notice under GCAR shall notify the Director General in writing within 5 days after the project is abandoned.
- d) Each person who dismantles, removes or suffers the destruction of a structure that is the subject of a notice under GCAR or GCAD, shall notify the Director General in writing, within 5 days after the construction or alteration is removed, dismantled or destroyed.

## **9. EVALUATING EFFECT ON AIR NAVIGATION AND COMMUNICATION FACILITIES**

The information contained in this part represents the minimum standards normally required for the protection of navigational aids and other communications systems.

Structures conforming to these standards would normally be acceptable; however, confirmation must be obtained from the GCAA.

Planners should also be aware that specific applications which contravene the standards contained herein may sometimes be approved, provided analysis indicates that such approvals will be on a non-interfering basis.

Consultation with the Director General must take place at an early stage in the project in order to avoid costly redesign or undue pressure when seeking building and site approvals. It is recommended that consultation take place at the building concept stage, before site approval is sought.

Airways facilities at an airport permit the safe navigation of aircraft within the airspace of an airway, and include; navigation aids along the airway and for approach and landing at aerodromes, communication facilities, meteorological facilities and ATC facilities.

The airways facilities for the safe, efficient operation of aircraft in the terminal area surrounding an airport and on the airport manoeuvring area need, in most instances, to be located on or at the perimeter of the aerodrome. Some of these facilities, in particular the precision approach facilities, must be positioned in precise geometric relativity to runways or runway centerline extensions. Most facilities have associated site clearance areas surrounding the site location to ensure proper operation of the facility.

Nothing should be permitted to derogate the signals generated by any existing or planned electronic NAVAID or an existing ATC facility.

The siting criteria for these facilities define the minimum requirements for uncompromised performance of each facility. In situations where non-compliance or infringement does not result in the facility being unsafe or completely unserviceable, functions of the may be degraded. Such degradation may, however, necessitate the facilities removal from service.

General requirements for airways facilities are a finite site for their physical installation, i.e. shelters, foundations, towers, antennae plus a reasonable service area around the physical features. In many instances, there is also a requirement for a clearance zone around this space, in some instances relatively extensive, for the purposed of ensuring transmission of electromagnetic waves without interference from extraneous sources, or for the purpose of unimpeded vision in the cases of ATC towers or RFFS stations.

The location of the radio navigation aids is largely determined by the air route or approach path on which they are to be used; they cannot normally be moved without some consequential change to or restriction placed on the approach path or air route.

There are a set of siting considerations that must be addressed when siting a NAVAID on airport property. These include consideration of runway-associated safety elements, system object clearance areas, the footprint of the system, critical area impact on airport operations, interference to/from other systems, and installation considerations.

Except for NDBs, radio navigation aids are more complex in terms of the transmitting equipment, the antenna design and the electromagnetic fields which are created about them. The accuracy of the paths defined by a particular navigation aid is determined not only by the transmitting facility but is largely dependent on the reflection of its signals from the objects about the facility; the terrain, vegetation, buildings, power lines, aircraft, other vehicles, fences, ditches, etc. In designing a facility, the position of these objects is taken into account. For example, sites are chosen so that these objects will provide least signal degradation; the vegetation is cleared, the ground levelled in key areas, and power lines may be moved or buried.

For the facility to remain a useful part of the airways system, these environmental characteristics have to be maintained and any proposals for change need to be carefully examined.

During evaluation of structures, factors that may adversely affect any portion or component of the National Airspace System (NAS) must be considered. Electromagnetic interference potential may create adverse effects as serious as those caused by a physical penetration of the airspace by a structure, those effects shall be identified and stated.

Proposed structures must be evaluated to determine if the structure will affect the performance of existing or proposed NAS facilities. The study must also include any plans for future facilities, proposed airports, or improvements to existing airports.

The physical presence of a structure and/or the electromagnetic signals emanating or reflecting there from may have a substantial adverse effect on the availability, or quality of navigational and communications signals, or on air traffic services needed for the safe operation of aircraft.

Airways facilities at an aerodrome may include any or all of the following:

- a) navigation aid facilities
  - ILS (instrument landing system)
  - DME (distance measuring equipment)
  - VOR (very high frequency omni-direction radio range)
  - NDB (non-direction beacon)
- b) radar sensor sites
- c) air/ground and point-to-point communications systems including radio bearer systems and satellite communications sites
- d) \*air traffic services centres
- e) fire stations (and satellite fire station); and
- f) ATC towers.

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## 10. APPENDIX

### Obstacle Limitation Surface

The safe and efficient use of an aerodrome, airport or heliport can be seriously eroded by the presence of obstacles within or close to the takeoff or approach areas. The airspace in the vicinity of takeoff or approach areas (to be maintained free from obstacles so as to facilitate the safe operation of aircraft) is defined for the purpose of either:

- regulating aircraft operations where obstacles exist;
- removing obstacles; or
- preventing the creation of obstacles.

An obstacle limitation surface (OLS), also known as, the aerodrome imaginary surfaces establishes the limits to which objects may project into the airspace associated with an aerodrome yet assure that aircraft operations at the aerodrome will be conducted safely. It includes a takeoff surface, an approach surface, horizontal surface, conical surface and a transitional surface.

The size of each such imaginary surface is based on the category of each runway according to the type of approach available or planned for that runway. The slope and dimensions of the approach surface applied to each end of a runway are determined by the most precise approach existing or planned for that runway end. The following civil airport imaginary surfaces are established with relation to the airport and to each runway:

**(a) Primary surface.** A rectangular area symmetrically located about each runway centerline and extending a distance of 200 feet beyond each runway threshold. When the runway has a specially prepared hard surface, the primary surface extends 200 feet beyond each end of that runway; but when the runway has no specially prepared hard surface, or planned hard surface, the primary surface ends at each end of that runway. Width of the Primary Surface is based on the type of approach a particular runway has. The elevation of any point on the primary surface is the same as the elevation of the nearest point on the runway centerline.

**(b) Horizontal surface.** A horizontal plane (level oval-shaped area) situated 150 feet above the established airport elevation, the perimeter of which is constructed by swinging arcs of specified radii from the center of each end of the primary surface of each runway of each airport and connecting the adjacent arcs by lines tangent to those arcs. The plane limit extends to 5,000 or 10,000 feet outward, depending on the runway category and approach procedure available.



(c) **Conical surface.** A surface extending outward and upward from the periphery of the horizontal surface at a slope of 1:20 for a horizontal distance of 4,000 feet.

(d) **Approach surface.** A surface longitudinally centered on the extended runway centerline and extending outward and upward from each end of the primary surface (200 feet beyond the runway threshold). An approach surface is applied to each end of each runway based upon the type of approach available or planned for that runway end. That is, at a ratio determined by the runway category and type of approach available to the runway.

The width and elevation of the inner end conforms to that of the Primary Surface while approach surface length and width of the outer end are governed by the runway category and approach procedure available.

(e) **Transitional surface.** A sloping area beginning at the sides of the Primary and Approach Surfaces and sloping upward and outward at a ratio of 1:7 until it intersects the Horizontal Surface. Transitional surfaces for those portions of the precision approach surface which project through and beyond the limits of the conical surface extend a distance of 5,000 feet measured horizontally from the edge of the approach surface and at right angles to the runway centerline.

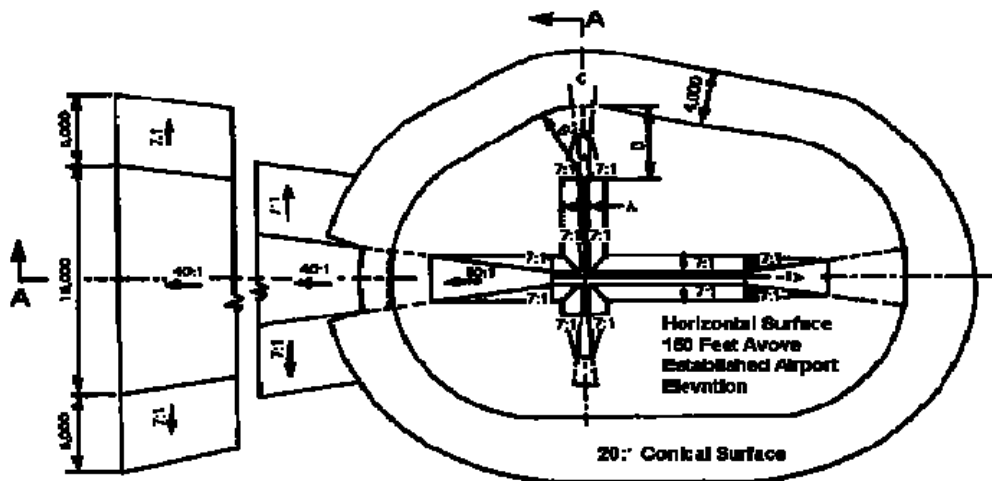


Figure AP1 - Obstacle Limitation Surfaces (plan)

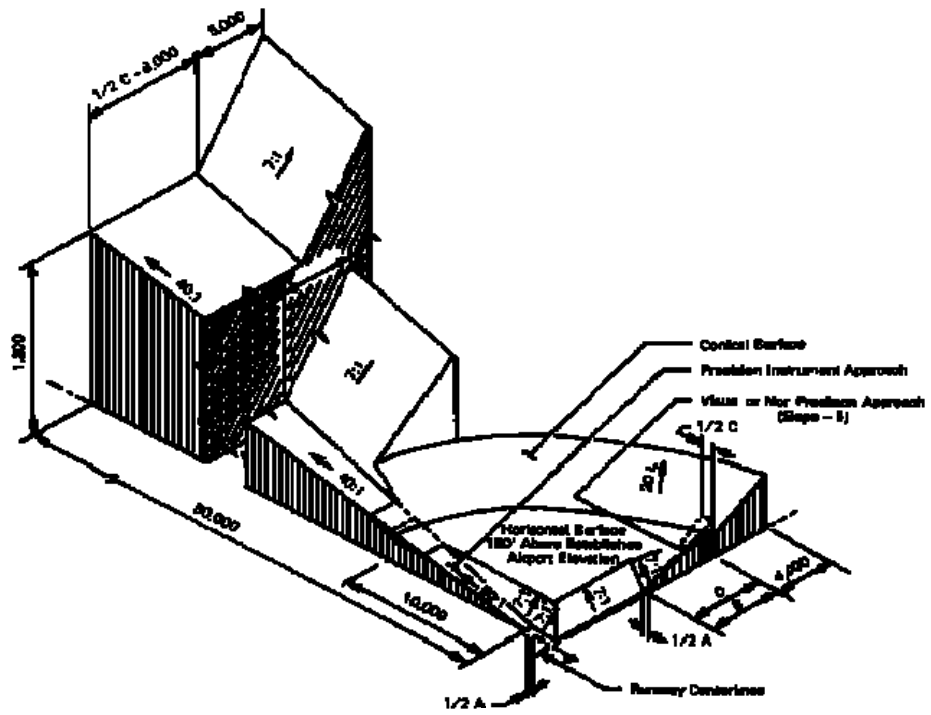


Figure AP2 - Obstacle Limitation Surfaces (sectional view)