Airtanker Ground Maneuvering and Parking Considerations for Temporary Bases and New Designs.

The following information is compiled from: *FAA AC 150/5300-13A "Airport Design", FAA AC 150/5325-4A "Runway Length Requirements for Airport Design", FAA AC 150/5340-1L "Standards for Airport Markings", FAA Airport/Facility Directory, and USFS Tech Tips Publication: "Air Tanker Base Design Considerations for Very Large Airtankers", USFS Bulletin "Equipment Foul Lines and Foul Boxes at Airtanker Bases".*

A. Airport Facilities

1. Airports

Airport, "airside" facilities are located on the portion of the airport from which aircraft operations are carried out. These consist primarily of areas for aircraft operations, e.g., takeoff, landing, taxiing, parking, loading, servicing, etc. These available facilities will limit the aircraft size, and types and numbers used at the intended base of operations. When establishing a new or temporary base a site survey must be conducted of the existing and available facilities before any airtanker base layout can be initiated. If the facilities do not, or cannot be made to accommodate the aircraft needs for the proposed base, aircraft usage must be restricted or a more suitable airport must be used. With any site survey and proposed base layout consider the possibility of base expansion to meet future fire and air operation needs.

2. Runways

Runway requirements depend on many variables. Variables include prevailing wind, temperature, field elevation, aircraft type, aircraft approach category, and airplane design group (ADG). Consideration must also be given to aircraft gross takeoff and landing weight, landing gear size and configuration, number of departures and runway type (visual, precision, instrument, etc.). The maximum takeoff weight, wingspan, landing-gear configuration, approach category, and other data on many fixed-wing aircraft can be found in *the FAA AC# 150/5300-13A "Airport Design"*.

Runway requirements and/or load limits for specific aircraft at various elevations and temperatures should be obtained from the operation manual for each specific aircraft. Reference the *FAA AC# 150/5325-4A "Runway Length Requirements for Airport Design"*.

3. Taxiways

A taxiway is a defined path established for the movement of aircraft from one part of the airport to another. The taxiway must be capable of supporting the maximum takeoff weight of the heaviest aircraft expected. It is usually constructed to hold the same aircraft weight as the runway it serves, but, not always. Taxiways are designed for "cockpit over centerline" taxiing with pavement being sufficiently wide to allow a certain amount of wander. The allowance for wander is provided by the Taxiway Edge Safety Margin (TESM), which is measured from the outside of the landing gear to the taxiway edge. Taxiways must always be wide enough to accommodate the wheelbase of the aircraft used as well as prevent FOD (Foreign Object Damage) caused from engine ingestion, or a propeller strike with loose debris along the edge of the taxiway.

Taxiways are generally designed such that the nose gear steering angle is no more than 50 degrees, the generally accepted value to prevent excessive tire scrubbing during turns. Excessively sharp turns (steering angles of greater than 50 degrees) may require locked wheel turns and/or differential engine thrust and result in excessive tire wear.

For aircraft ramp movement the FAA requires an obstacle free area along the path of an aircraft to ensure safe wing tip clearances. The Airplane Design Group (ADG) is used to determine minimum safe clearance distances for taxiways and taxilanes.

The Airplane Design Group (ADG) is an FAA-defined grouping of aircraft types which has six groups based on wingspan and tail height. These groups are defined in *FAA Advisory Circular 150/5300-13A*. When the aircraft wingspan and tail height fall in different groups, the higher group is used.

Table 1 Aircraft Design Group (ADG)

Group #	Tail Height (ft [m])	Wingspan (ft [m])
I	< 20′	< 49′
II	20′ - 30′	49′ - 79′
III	30′ - 45′	79′ - 118′
IV	45′ - 60′	118′ - 171′
V	60′ - 66′	171′ - 214′
VI	66′ - 80′	214′ - 262′

Using the ADG, the FAA specification for the *taxiway Obstacle Free Area* (OFA) width is .7 times maximum wingspan of the ADG plus 10 feet from the taxiway center line to a fixed or movable object (taxiway center line to aircraft parking limit line).

For *taxiway to taxiway* centerline the necessary separation is equal to 1.2 times the maximum wingspan of the ADG plus 10 feet. This gives a wingtip clearance of 0.2 times the wingspan plus 10 feet. For taxiways designed to different ADGs, the wingtip clearance for the higher ADG must be used. However, this separation may need to be increased based on excessive turning radius.

4. Taxilanes

> On agency owned or controlled taxiways/taxilanes using the maximum wingspan of an ADG to determine clearances may not always be practical. *FAA Engineering Brief 78* allows the computation of taxiway/taxilane clearances using the actual wingspan of an aircraft (always use the largest wingspan of aircraft that will utilize the facility). Always coordinate such practice with the airport authority. Such Modification to Standards (MOS) may require approval by the FAA.

An apron or "ramp" is a defined area on a airport, intended to accommodate aircraft for purposes of loading or unloading passengers or cargo, fueling, parking, or maintenance. Airport apron/ramp design will vary with the size and weight and type of aircraft, and intended aircraft usage.

The area of the aircraft apron or ramp area used for aircraft access between taxiways and aircraft parking positions (pads) is called a taxilane. At towered airports taxiways usually fall under the supervision of the air traffic control, taxilanes usually do not.

The FAA specification for the *taxilane Obstacle Free Area* (OFA) width is .6 times the maximum wingspan of the ADG plus 10 feet from the taxi lane center line to a fixed or movable object (taxilane center line to aircraft parking limit line).

Parallel taxilane to taxilane centerline separation is equal to 1.1 times the maximum wingspan of ADG plus 10 feet. This gives a wingtip clearance between aircraft of 0.1 times the wingspan plus 10 feet. Reduced clearances are acceptable in this instance because taxi speed is very slow outside the movement area, taxiing is precise and special operator guidance and devices are normally present (towing equipment, parking tenders/wing-walkers). As with taxiways; refer to *FAA Engineering Brief 78* to determine taxilane clearance where it is not practicable to meet the standard for the full ADG.

When the taxilane is along the edge of the ramp, locate its centerline inward from the ramp edge at a distance equal to one-half of the required width of a taxiway. Shoulder, safety area, and obstacle free area requirements apply along the outer edge.

Taxiway OFAs are wider than taxilane OFAs because taxiways are designed to be used at higher speeds.

Table 2—Taxiway/Taxilane centerline separation (from AC 150-5300 13A, table 4-1)

TAXIWAY/TAXILANE SEPARATION	**ADG**					
	I	**II**	**III**	**IV**	**V**	**VI**
Taxiway Centerline to Parallel Taxiway/Taxilane Centerline 1	70 ft	105 ft	152 ft	215 ft	267 ft	324 ft
Taxiway Centerline to Fixed or Movable Object	44.5 ft	65.5 ft	93 ft	129.5 ft	160 ft	193 ft
Taxilane Centerline to Parallel Taxilane Centerline	64 ft	97 ft	140 ft	198 ft	245 ft	298 ft
Taxilane Centerline to Fixed or Movable Object	39.5 ft	57.5 ft	81 ft	112.5 ft	138 ft	167 ft

B. Planning Air Base Aircraft Parking and Taxiway/Taxilane Layout

Assuming the airport ramp will accommodate the size and weight of aircraft to be serviced the primary consideration is to provide adequate wingtip clearances for the aircraft positions and the associated taxilanes. The need for ample wingtip clearance is driven by the fact that the pilots of most modern jets cannot see their aircraft's wingtips.

Parked aircraft must remain clear of the Object Free Areas (OFAs) of runways and taxiways and no part of the parked aircraft should penetrate the runway approach and departure surfaces and, if applicable, the Runway Visibility Zone.

The airtanker base ramp layout and configuration must consider ***airtanker nosewheel centerline turning radius***, ***object free area (OFA)***, ***taxiway and taxilane spacing***, and ***loading pad spacing*** for the largest aircraft (or ADG) to be serviced.

1. Aircraft Turning Radius

Layout taxilanes and ramps so that the centerline of the airplane travel path conforms to section 406 of *FAA AC 105-5300-13A*. As a general rule, for a 90 degree turn, the minimum centerline radius can be 100 feet for the C-130 and 150 feet for the DC10 and B747.

2. Object Free Area (OFA)

Determine the Object Free Area (OFA) for ramp layout in accordance with the following computation for the OFA (Reference *AC 150/5300-13A*):

Taxiway Centerline to Fixed or Movable Object = 0.7 x (wingspan) + 10 ft
Taxilane Centerline to Fixed or Movable Object = 0.6 x (wingspan) + 10 ft

Ensure that the taxiway OFA will accommodate the largest airplanes that may use the taxiway/taxilane including agency and other airport users.

3. Taxiway and Taxilane Spacing

In all cases, determine the taxiway and taxilane spacing in accordance with *AC 150/5300-13A*.

Taxiway Centerline to Taxilane Centerline = 1.2 x (wingspan) + 10 ft
Taxilane Centerline to Taxilane centerline = 1.1 x (wingspan) + 10 ft

Use the appropriate formula to determine spacing. Consult the airport authority to determine if the spacing values are safe. Ensure that the separation is adequate for the largest airplanes that may use the taxiway, including agency and other airport users.

When considering a layout that separates operations for B747s, DC10s, or other aircraft on different taxilanes, the distance between taxilanes can be adjusted to consider each aircraft type. Consider this only if it is certain that the separation of operations will continue for the foreseeable future. For instance, the base can be planned with one taxilane (and loading pad) for B747s and separate taxilane(s) for C130s and other aircraft. *AC 150-5300 13A* states "For parallel taxiways/taxilanes serving dissimilar ADGs, the width of the OFA is determined by determining the OFA dimensions for each taxiway/taxilane separately, with the wingtip clearance between them based on the larger ADG or higher use (taxiway versus taxilane)." Required wingtip clearance is given in table 3.

Table 3—Required wingtip clearance (taken from AC 150-5300 13A, table 4-1)

Wingtip Clearance	ADG IV (ft)	ADG V (ft)	ADG VI (ft)
Taxiway Wingtip Clearance	44	53	62
Taxilane Wingtip Clearance	27	31	36

Example: Taxilane wingtip clearance for - ADG IV max. wing span 171' x .6 = 102.6' +10' =112.6', Center Line (CL) to wing tip = 85.6', difference = 27'

4. Loading Pad Spacing

When multiple loading pads are required, the layout may be parallel pads (sometimes referred to as side-by-side or pull-through pads) or tandem pads (sometimes referred to as nose-to-tail pads).

Determine the separation for parallel loading pads using the formulas given for taxilane-to-taxilane centerline spacing.

When a nose-to-tail configuration is required, consider the prop blast or jet blast that will be generated when the design airplane leaves the forward pad. While there are methods for calculating the velocity and effect of the departing aircraft on the pad or object to the rear, the following general rules can be used:

Table 4—Distance Nosewheel Stop Line to

Aircraft Nosewheel Stop Line (ft)	
C130 and smaller airplanes	200 ft
MAFFS operations	240 ft
DC10	335 ft
B747	385 ft

When considering a nose-to-tail configuration that separates operations for B747, DC10, or other aircraft on different loading pads, the dimensions given above still apply. For each loading pad, the distance to the adjacent loading pad nosewheel stop line should be the distance given in *Table 4* for the highest ADG airplane that will use either of the loading pads.

C. Jet Blasts/Engine Exhaust and Engine Intake Concerns.

The forces of jet blast (jet exhaust) produce very high wind velocities and temperatures. Jet blast is capable of causing bodily injury to personnel; damage to equipment and facilities; and/or airfield pavement and erosion of unprotected soil along the edge of pavements.

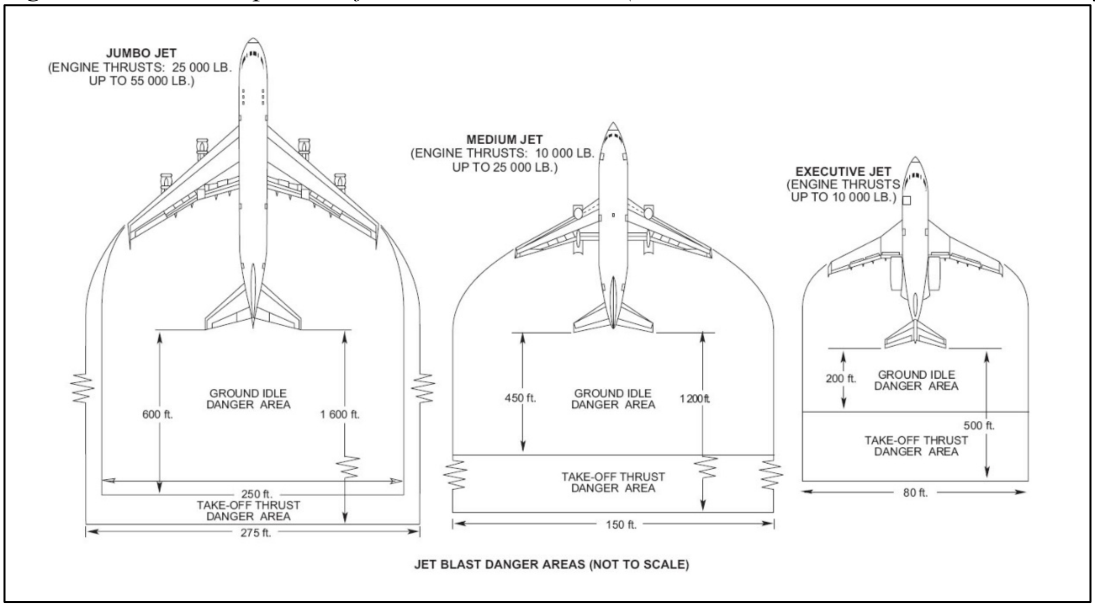
Aircraft manufacturers provide information on the exhaust velocities and temperatures for their respective aircraft and engine combinations. Typically, exhaust contours are provided for ground idle, breakaway (typical taxiing condition), and maximum takeoff power conditions under specific conditions (sea level, static airplane, zero wind, standard day conditions).

Jet engine intake or suction generated by running engines is also a serious hazard. To ensure a safe distance, personnel and equipment should remain at least 30 feet away from the front and sides of a running engine. High noise may make it difficult to determine which jet engines are operating and which are not. Beacons on the top and bottom of the aircraft should be lit when engines are operating. An additional danger associated with engine intake is Foreign Object Debris (FOD). FOD can cause significant damage to engines.

Tandem parking arrangements generally require that smaller aircraft be positioned in front of larger aircraft. Placing a SEAT behind a VLAT may not be the best option. Additionally, personnel working behind idling or taxing aircraft must exercise caution. The geometry of aircraft turning radii should avoid undue exposure of other aircraft, equipment, and personnel to jet blast hazards.

Some airports have engine run-up areas associated with the parking ramp. For larger jet aircraft it may be advisable to erect blast fences to minimize the effect of the jet blast from run-up areas. Consideration should be made for the effects of jet blast as jet aircraft power up to move out of parking positions.

Figure 1. General Depiction of Jet Exhaust Hazards (Actual distances and velocities will vary)



D. Wheel Loading Considerations

When aircraft weight exceed the weight bearing capacity of a runway, taxiway, or ramp it is possible for the aircraft to cause damage to these facilities. In such cases when aircraft weight exceed the rated allowance for runway, taxiway, or ramp strength it will only be possible to operate under an agreement with, or waiver from the airport authority.

E. Ramp and Taxilane Markings and Identification.

Appropriate ramp and taxiway/taxilane markings will increase pilot situational awareness. As feasible, the taxilanes that ingress and egress airtanker loading pads should be clearly marked with permanent paint (temporary bases may use an appropriate high visibility tape or low profile reflector capable of adhering to concrete or asphalt). Days off, overnight, and maintenance parking areas should be clearly identified in the pilot in-briefing. Any ramp markings should conform with FAA standards and only occur with approval of the airport authority. Reference *AC 150/5340-1L Standards for Airport Marking*.

F. Ground Support Equipment (GSE)

Ground support equipment such as ground power units (GPUs), air conditioning carts (A/C carts), man lifts, maintenance stands, Airstairs etc. are normally provided by a Fixed Base Operator (FBO) on the field and operated by FBO or contractor employees. Some of this equipment is moved up to and away from the aircraft for every flight while other pieces are only used if the aircraft has to shut down or undergo maintenance.

GSE must be provided by and operated by FBOs or contractors at Airtanker Bases. Government personnel are not authorized to use or operate GSE at Airtanker Bases. In the case of some Smoke Jumper Bases, Fixed Wing Parking Tenders do operate and move Government Owned Ground Support Equipment. It is the responsibility of Fixed Wing Parking Tenders and Ramp Managers to obtain an initial in-briefing and understand their roles and responsibilities determined by the type of base they are supporting.

1. **Foul Lines/Boxes:**

   To avoid damage from collision with the ground support equipment (GSE) Foul Lines/Boxes shall be established for placing such equipment when not in use.

   a) Sufficient Foul Lines would be defined by permanent paint, (temporary bases could utilize tape) that are placed 10 feet minimum (30 ft preferred) from the wing tip of the largest aircraft when parked in the loading pit or could taxi past while on the ramp. This allows for adequate separation not only in distance from the aircraft, but potential prop or jet blast that could move the GSE equipment into another aircraft or other ramp fixture or facility. Bases should use the method (either Foul Line or Foul Box) that best fits their operation and ramp design

   b) Airtanker Base Managers, Fixed Wing Parking Tenders and Ramp Managers should receive a briefing from the operator of the ground support equipment. Not on its use, but how the piece of equipment is secured once parked inside the Foul Box or secured and parked on the safe side of the Foul Line. This will allow for Government personnel to visually identify if the GSE equipment is properly parked and secured before the aircraft starts and begins taxiing.

   c) At any time an aircraft is starting engines and before it is cleared to taxi by the Fixed Wing Parking Tender (FWPT), the Ramp Manager (RAMP) and FWPT must ensure that the GSE is parked and secured inside the Foul Box, or on the safe side of the Foul Line before that aircraft is cleared to maneuver on the ramp.

2. **Standards for Airtanker Base Equipment Foul Lines/Boxes**

   a) Foul Lines/Boxes will be painted on the ground in white or yellow or per the local airport authorities' color requirements. Lines should be between 4-6 inches in width. At CWN and temporary bases, the lines may be marked with tape to identify the Foul Lines/Boxes.

   b) When using a Foul Line, the line will be placed no less than 10 feet distance (30 feet is preferred) from where the closest aircraft wing tip will taxi. All GSE or other equipment over 3 feet in height will be placed on the "safe" side of the line prior to releasing the aircraft for taxi.

   c) When using Foul Boxes, the Foul Box will fully encompass the GSE or other equipment with a minimum of 18 inches of clearance on all 4 sides. Boxes will be clearly labeled to identify the equipment that is to be parked in the space. Equipment over 3 feet in height must be encompassed by a Foul Box. Only the identified equipment may be placed in each box.

   d) All Foul Boxes will be located in an area that will maintain a 30 foot separation from all aircraft while parked and while taxing.

G. Key to Airport Data:

Accelerate-Stop Distance Available (ASDA). See Declared Distances. (Airport/Facility Directory).

Aircraft Classification Number (ACN). ACN is a number that expresses the relative effect of an aircraft at a given weight and configuration on a pavement structure for a specified standard subgrade strength. The aircraft manufacturer provides the official computation of an ACN value. Computation of the ACN requires detailed information on the operational characteristics of the aircraft, such as maximum aft center of gravity, maximum ramp weight, wheel spacing, tire pressure, and other factors.

Aircraft Approach Category (AAC). As specified in 14 CFR Part 97 § 97.3, Symbols and Terms Used in Procedures, a grouping of aircraft based on a reference landing speed (VREF), if specified, or if VREF is not specified, 1.3 times stall speed (VSO) at the maximum certificated landing weight. VREF, VSO, and the maximum certificated landing weight are those values as established for the aircraft by the certification authority of the country of registry.

Air Traffic Control Facilities (ATC-F). Electronic equipment and buildings aiding air traffic control (ATC) – for communications, surveillance of aircraft including weather detection and advisory systems.

Airplane Design Group (ADG). A classification of aircraft based on wingspan and tail height. When the aircraft wingspan and tail height fall in different groups, the higher group is used.

Airport Elevation. The highest point on an airport's usable runways expressed in feet above mean sea level (MSL).

Airport Layout Plan (ALP). A scaled drawing (or set of drawings), in either traditional or electronic form, of current and future airport facilities that provides a graphic representation of the existing and long-term development plan for the airport and demonstrates the preservation and continuity of safety, utility, and efficiency of the airport to the satisfaction of the FAA.

Airport Reference Code (ARC). An airport designation that signifies the airport's highest Runway Design Code (RDC), minus the third (visibility) component of the RDC. The ARC is used for planning and design only and does not limit the aircraft that may be able to operate safely on the airport.

Airport Reference Point (ARP). The approximate geometric center of all usable runways at the airport.

Airport. An area of land that is used or intended to be used for the landing and takeoff of aircraft, and includes its buildings and facilities, if any.

Aligned Taxiway. A taxiway with its centerline aligned with a runway centerline. Sometimes referred to as an "inline taxiway."

Approach Reference Code (APRC). A code signifying the current operational capabilities of a runway and associated parallel taxiway with regard to landing operations.

Blast Fence. A barrier used to divert or dissipate jet blast or propeller wash.

Blast Pad. A surface adjacent to the ends of runways provided to reduce the erosive effect of jet blast and propeller wash. A blast pad is not a stopway.

Building Restriction Line (BRL). A line that identifies suitable and unsuitable locations for buildings on airports.

Bypass Taxiway. A taxiway used to reduce aircraft queuing demand by providing multiple takeoff points.

Category-I (CAT-I). An instrument approach or approach and landing with a Height Above Threshold (HATh) or minimum descent altitude not lower than 200 ft (60 m) and with either a visibility not less than ½ statute mile (800m), or a runway visual range not less than 1800 ft (550m).

Category-II (CAT-II). An instrument approach or approach and landing with a Height Above Threshold (HATh) lower than 200 ft (60 m) but not lower than 100 ft (30 m) and a runway visual range not less than 1200 ft (350m).

Category-III (CAT-III). An instrument approach or approach and landing with a Height Above Threshold (HATh) lower than 100 ft (30m), or no HATh, or a runway visual range less than 1200 ft (350m).

Circling Approach. A maneuver initiated by the pilot to align the aircraft with a runway for landing when a straight-in landing from an instrument approach is not possible or is not desirable.

Clearway (CWY). A defined rectangular area beyond the end of a runway cleared or suitable for use in lieu of runway to satisfy takeoff distance requirements (see also Takeoff Distance Available [TODA]).

Compass Calibration Pad. An airport facility used for calibrating an aircraft compass.

Crossover Taxiway. A taxiway connecting two parallel taxiways (also referred to as a transverse taxiway).

Declared Distances. The distances the airport owner declares available for a turbine powered aircraft's takeoff run, takeoff distance, accelerate-stop distance, and landing distance requirements. The distances are:

1) **Takeoff Run Available (TORA)** – the runway length declared available and suitable for the ground run of an aircraft taking off;

2) **Takeoff Distance Available (TODA)** – the TORA plus the length of any remaining runway or clearway beyond the far end of the TORA; the full length of TODA may need to be reduced because of obstacles in the departure area;

3) **Accelerate-Stop Distance Available (ASDA)** – the runway plus stopway length declared available and suitable for the acceleration and deceleration of an aircraft aborting a takeoff; and

4) **Landing Distance Available (LDA**) – the runway length declared available and suitable for landing an aircraft.

Departure End of Runway (DER). The end of the runway that is opposite the landing threshold. It is sometimes referred to as the stop end of runway.

Departure Reference Code (DPRC). A code signifying the current operational capabilities of a runway with regard to takeoff operations.

Design Aircraft. An aircraft with characteristics that determine the application of airport design standards for a specific runway, taxiway, taxilane, apron, or other facility (such as Engineered Materials Arresting System [EMAS]). This aircraft can be a specific aircraft model or a composite of several aircraft using, expected, or intended to use the airport or part of the airport. (Also called "critical aircraft" or "critical design aircraft.")

Displaced Threshold. A threshold that is located at a point on the runway beyond the beginning of the runway.

End-Around Taxiway (EAT). A taxiway crossing the extended centerline of a runway, which does not require specific clearance from air traffic control (ATC) to cross the extended centerline of the runway.

Entrance Taxiway. A taxiway designed to be used by an aircraft entering a runway. Entrance taxiways may also be used to exit a runway.

Exit Taxiway. A taxiway designed to be used by an aircraft only to exit a runway:

1) **Acute-Angled Exit Taxiway** – A taxiway forming an angle less than 90 degrees from the runway centerline.

2) **High Speed Exit Taxiway** – An acute-angled exit taxiway forming a 30 degree angle with the runway centerline, designed to allow an aircraft to exit a runway without having to decelerate to typical taxi speed.

Frangible. Retains its structural integrity and stiffness up to a designated maximum load, but on impact from a greater load, breaks, distorts, or yields in such a manner as to present the minimum hazard to aircraft. See AC 150/5220-23, Frangible Connections.

Glideslope (GS). Equipment in an Instrument Landing System (ILS) that provides vertical guidance to landing aircraft.

Hazard to Air Navigation. An existing or proposed object that the FAA, as a result of an aeronautical study, determines will have a substantial adverse effect upon the safe and efficient use of navigable airspace by aircraft, operation of air navigation facilities, or existing or potential airport capacity.

Hot Spot. A location on an airport movement area with a history of potential risk of collision or runway incursion, and where heightened attention by pilots and drivers is necessary.

Instrument Approach Procedure (IAP). A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing or to a point from which a landing may be made visually. It is prescribed and approved for a specific airport by competent authority.

Instrument departure runway. A runway identified by the airport operator, through the appropriate FAA Airports Office, to the FAA Regional Airspace Procedures Team intended primarily for instrument departures.

Island. An unused paved or grassy area between taxiways, between runways, or between a taxiway and a runway. Paved islands are clearly marked as unusable, either by painting or the use of artificial turf.

Landing Distance Available (LDA). See Declared Distances. (Airport/Facility Directory).
Main Gear Width (MGW). The distance from the outer edge to outer edge of the widest set of main gear tires.

Modification to Standards (MOS). Any approved nonconformance to FAA standards, other than dimensional standards for Runway Safety Areas (RSAs), applicable to an airport design, construction, or equipment procurement project that is necessary to accommodate an unusual local condition for a specific project on a case-by-case basis while maintaining an acceptable level of safety. See Order 5300.1.

Movement Area. The runways, taxiways, and other areas of an airport that are used for taxiing or hover taxiing, air taxiing, takeoff, and landing of aircraft including helicopters and tilt-rotors, exclusive of loading aprons and aircraft parking areas (reference Part 139).

Non-movement area. The areas of an airport that are used for taxiing or hover taxiing, or air taxiing aircraft including helicopters and tilt-rotors, but are not part of the movement area (i.e., the loading aprons and aircraft parking areas).

Non-Precision Approach (NPA). For the purposes of this AC, a straight-in instrument approach procedure that provides course guidance, with or without vertical path guidance, with visibility minimums not lower than 3/4 mile (4000 RVR).

Non-Precision Runway. A runway (other than a precision runway) with at least one end having a non-precision approach procedure.

Object. Includes, but is not limited to, above ground structures, Navigational Aids (NAVAIDs), equipment, vehicles, natural growth, terrain, and parked or taxiing aircraft.

Object Free Area (OFA). An area centered on the ground on a runway, taxiway, or taxilane centerline provided to enhance the safety of aircraft operations by remaining clear of objects, except for objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes.

Obstacle. An existing object at a fixed geographical location or which may be expected at a fixed location within a prescribed area with reference to which vertical clearance is or must be provided during flight operation.

Obstacle Free Zone (OFZ). The OFZ is the three-dimensional airspace along the runway and extended runway centerline that is required to be clear of obstacles for protection for aircraft landing or taking off from the runway and for missed approaches.

Parallel Taxiway. A taxiway parallel to a runway:

1) **Dual Parallel Taxiways** – Two side-by-side taxiways, parallel to each other and the runway.
2) **Full Parallel Taxiway** – A parallel taxiway extending the full length of the runway.

3) **Partial Parallel Taxiway** – A parallel taxiway extending less than full length of the runway.

Pavement Classification Number (PCN). PCN is a number that expresses the load-carrying capacity of a pavement for unrestricted operations. A particular PCN value can support an aircraft that has an ACN value equal to or less than the pavement's PCN value.
Precision Approach (PA). For the purposes of this AC, an instrument approach procedure that provides course and vertical path guidance with visibility below 3/4 mile (4000 RVR).

Precision Runway. A runway with at least one end having a precision approach procedure.

Runway (RW). A defined rectangular surface on an airport prepared or suitable for the landing or takeoff of aircraft.

Runway Design Code (RDC). A code signifying the design standards to which the runway is to be built.

Runway Incursion. Any occurrence at an airport 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 Protection Zone (RPZ). An area at ground level prior to the threshold or beyond the runway end to enhance the safety and protection of people and property on the ground.

Runway Safety Area (RSA). A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to aircraft in the event of an undershoot, overshoot, or excursion from the runway.

Shoulder. An area adjacent to the defined edge of paved runways, taxiways, or aprons providing a transition between the pavement and the adjacent surface; support for aircraft and emergency vehicles deviating from the full-strength pavement; enhanced drainage; and blast protection.

Stopway (SWY). An area beyond the takeoff runway, no less wide than the runway and centered upon the extended centerline of the runway, able to support the airplane during an aborted takeoff, without causing structural damage to the airplane, and designated by the airport authorities for use in decelerating the airplane during an aborted takeoff. A blast pad is not a stopway.

Takeoff Distance Available (TODA). See Declared Distances (Airport/Facility Directory).

Takeoff Run Available (TORA). See Declared Distances (Airport/Facility Directory).

Taxilane (TL). A taxiway designed for low speed and precise taxiing. Taxilanes are usually, but not always, located outside the movement area, providing access from taxiways (usually an apron taxiway) to aircraft parking positions and other terminal areas.

Taxiway (TW). A defined path established for the taxiing of aircraft from one part of an airport to another.

Taxiway Design Group (TDG). A classification of airplanes based on outer to outer Main Gear Width (MGW) and Cockpit to Main Gear distance (CMG).

Taxiway Edge Safety Margin (TESM). The distance between the outer edge of the landing gear of an airplane with its nose gear on the taxiway centerline and the edge of the taxiway pavement.

Taxiway/Taxilane Safety Area (TSA). A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an aircraft deviating from the taxiway.
Threshold (TH). The beginning of that portion of the runway available for landing. In some instances, the threshold may be displaced. "Threshold" always refers to landing, not the start of takeoff.

Visual Runway. A runway without an existing or planned instrument approach procedure.

Wheel Load. The wheel loading, in pounds per square inch that the main gear exerts upon a surface.

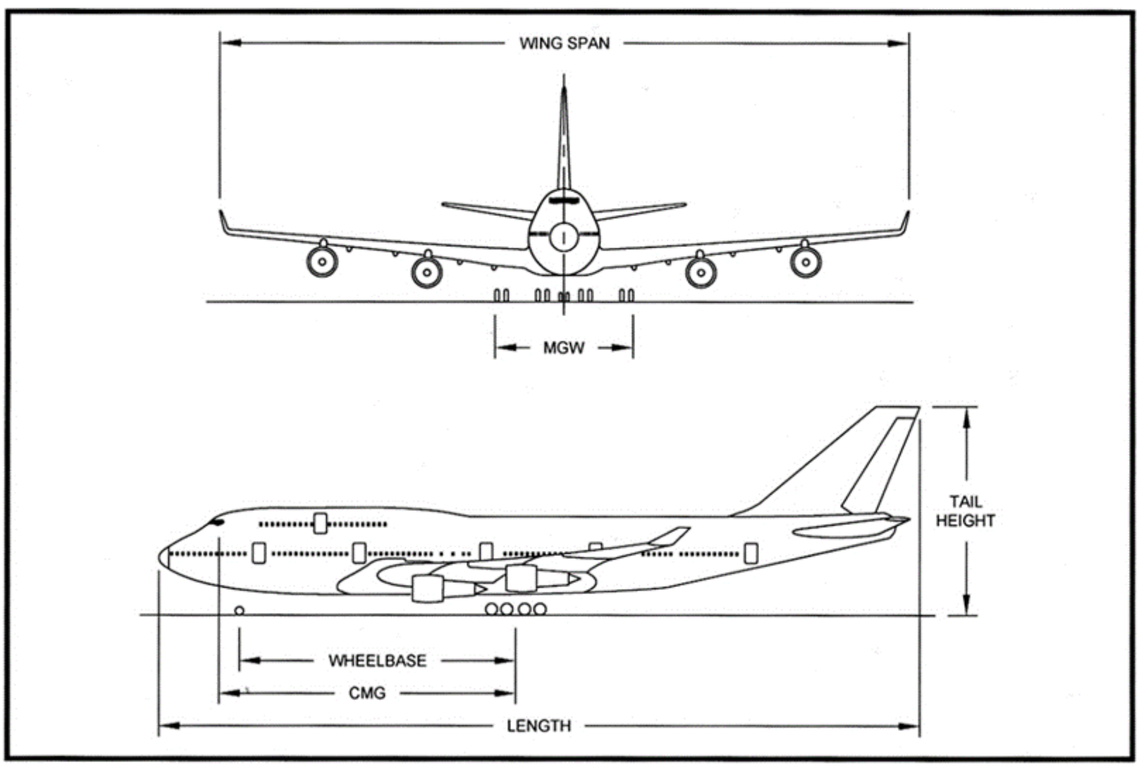
H. Key to Aircraft Data

Airplane Length : The length of the aircraft from the tail section to the nose of the aircraft as specified in the aircraft manual.

Cockpit to Main Gear Distance (CMG). The distance from the pilot's eye to the main gear turn center.

Empty Weight. Empty weight is determined using weight and balance data. Subtracting the Empty Weight from the Maximum Gross Weight generally yields the weight available for crew and optional items, payload, and fuel/fluids. It is determined by actual weighing of the aircraft without fuel/fluids, payload, crew or optional items.

Figure 2. Aircraft Dimensions



Gross Weight. The loaded weight of an aircraft. Gross weight includes the total weight of the aircraft (Empty Weight), the weight of the fuel and oil, the weight of crew and optional items, and the weight of the entire load it is carrying.

Landing Gear Configuration. The configuration of the main landing gear tire(s) / wheel(s); S = Single wheel type, D = Dual wheel type, etc.

Table 5—Landing Gear Configuration Types

Gear	Description (Aircraft)
S	Single wheel type landing gear (C182, C337, B55/58, DC3, King Air 90, DHC-6, DO-228, AC-500-690, AT802, C23/330, CL215/415, S2)
D	Dual wheel type landing gear (King Air 100-350, B737, RJ85, BAe 146, CV580, DC6-7, P3/L188, MD87, Q400)
2S	Two single wheels in tandem (C130/L100/382)
2T	Two triple wheels in tandem (C17)
2D	Two dual wheels in tandem (B707, KC135, B757)
2D/D1	Two dual wheels in tandem/dual wheel body gear (KC10)
2D/2D1	Two dual wheels in tandem/two dual wheel in tandem body gear (A340-600)
2D/2D2	Two dual wheels in tandem/two dual wheels in double tandem body gear (B747)
3D	Three dual wheels in tandem (B777)
D2	Dual wheel gear two struts per side main gear (B52)
C5	Complex dual wheel and quadruple wheel combination (C5)

Large Aircraft. An aircraft with a maximum certificated takeoff weight of more than 12,500 lbs (5670 kg).

Main Gear Width (MGW). The distance from the outer edge to outer edge of the widest set of main gear tires.

Maximum Design Taxi Weight (MTW). Maximum weight for ground maneuver as limited by aircraft strength and airworthiness requirements. (It includes weight of taxi and run-up fuel.)

Maximum Design Gross Weight (MGW). On Maximum gross weight is the absolute maximum allowable weight (crew, passengers, fuel, oil, fluids, payload, and special equipment) as established by the manufacturer and approved by the Federal Aviation Administration.

Maximum Design Zero Fuel Weight (MZFW). Maximum weight allowed before usable fuel and other specified usable agents must be loaded in defined sections of the aircraft as limited by strength and airworthiness requirements.

Maximum Landing Weight (MLW). Maximum weight for landing as limited by aircraft strength and airworthiness requirements.

Maximum Payload. Maximum design zero fuel weight minus operational empty weight.

Maximum Takeoff Weight (MTOW). Maximum weight for takeoff as limited by aircraft strength and airworthiness requirements. (This is the maximum weight at start of the takeoff run.)

Maximum Turn Radius. As listed in the aircraft flight manual the distance the aircraft's outboard wingtip will travel with the steering control fully deflected.

Normal Operating Weight (NOW). The average operating weight of the airtanker with the contract load of fire retardant and 2 1/2 hours of fuel.

Operating Empty Weight (OEW). Weight of structure, powerplant, furnishing systems, unusable fuel and other unusable propulsion agents, and other items of equipment that are considered an integral part of a particular airplane configuration. Also included are certain standard items, personnel, equipment, and supplies necessary for full operations, excluding usable fuel and payload.

Payload. Maximum gross weight minus empty weight, crew, fuel/fluids, and optional items.

Retardant Load Pounds/Gallons The amount of fire retardant that the aircraft will carry based on contract requirements.

Small Aircraft. An aircraft with a maximum certificated takeoff weight of 12,500 lbs (5670 kg) or less.

Useful Load. The maximum allowable weight (passengers and/or payload) that can be carried in any one mission. For Airtankers, the Useful Load is the Payload.

Wheel Base. The distance between the nose wheel and the the main landing gear centerlines.

Wheel Load / Foot Print (FPT). The wheel loading in pounds per square inch that the main gear exerts upon a surface.

Wingspan. The maximum horizontal distance from one wingtip to the other wingtip, including the horizontal component of any extensions such as winglets or raked wingtips.

Manufacturer	Model	Physical Class	# Engine	AAC	ADG	TDG	Wingspan	Tail Height	Length	Wheel Base	CMG	MGW	Main Gear	MTOW	MTW	NOW	EW	MLW	Mission	Pay Load (Gal)
Airtractor	AT802	Turboprop	1	A	II	1B	59.25	11.20	35.70	23.80		10.20	S	16,000	16,000				Airtanker	800
Airtractor	AT802 Fire Boss	Turboprop	1	A	II	1B	59.25	16.20	35.70			13.33		16,000	16,000		9,100		Airtanker/ Water Scooper	800 (R/W)
Beechcraft	King Air 90 (C90GT)	Turboprop	2	B	I	1A	50.25	14.25	35.50	12.30		15.0	S	10,100	10,160		6,950		Logistical / Aerial Supervision	
Beechcraft	King Air 100	Turboprop	2	B	I		45.92	15.42	39.92	13.90		13.70	D	11,800			7,082		Logistical / Aerial Supervision	
Beechcraft	King Air 200	Turboprop	2	B	II	2	54.50	15.0	43.75	15.0		17.70	D	12,500	12,590		7,538		Logistical / Aerial Supervision	
Beechcraft	King Air 250	Turboprop	2	B	II	2	57.92	14.83	43.83	14.92		17.70	D	12,500	12,590				Logistical / Aerial Supervision	
Beechcraft	King Air 300	Turboprop	2	B	II	2	57.92	15.0	43.83	16.25		17.70	D	14,000			8,838		Logistical / Aerial Supervision	
Beechcraft	King Air 350	Turbopro	2	B	II	2	57.92	14.33	46.67	16.25		17.70	D	15,000	15,100		9,051		Logistical / Aerial Supervision	
Beechcraft	Baron B58	Piston	2				37.83	9.16	29.92				S	6,200			4,026			
Boeing	737-300	Turbofan	2	C	III	3	94.75 w/o winglets	36.33	109.58	40.83	46.08	20.92	D	139,500	140,000		72,490		Airtanker	4,000
Boeing	737-300	Turbofan	2	C	III	3	102.08 w/winglets	36.50	109.58	40.83	46.08	20.92	D	139,500	140,000				Airtanker	4,000
Boeing	747-400	Turbofan	4	D	V	5	213.0 w/winglets	64.0	231.85	84.0	91.67	41.33	2D/2D2	610,000	613,500				Airtanker	19,200
Bombardier	Q400	Turboprop	2	C	III	5	93.25	27.42	107.75	45.75	45.75	31.36	D	67,200			39,284	61,750	Airtanker	2,600
British Aerospace	Avro RJ85	Turbofan	4	C	III	2	86.42	28.25	93.67	36.75	36.75	19.0	D	97,000	97,500	92,451	51,431	85,000	Airtanker	3,000
British Aerospace	BAe 146-100	Turbofan	4	C	III	2	86.42	28.25	85.92	36.75	36.75	18.0	D	84,000	84,500				Airtanker	3,000
British Aerospace	BAe 146-200	Turbofan	4	C	III	2	86.42	28.25	93.67	36.75	36.75	18.0	D	93,000	93,500	87,500	49,737		Airtanker	3,000
British Aerospace	BAe 146-300	Turbofan	4	C	III	2	86.42	28.17	101.67	36.75	36.75	18.0	D	99,500	100,000				Airtanker	
Canadair	CL215	Piston	2	A	III	1B	93.83	29.46	65.0	24.61	24.61	13.0	S	43,500	43,500				Water Scooper	1,400 (W)
Canadair	CL415	Turboprop	2	A	III	1B	93.92	29.46	65.0	24.61	24.61	13.0	S	43,850	43,850		28,400	37,000	Water Scooper	1,600 (W)
Cessna	337F	Piston	2	A	I	1A	38.0	9.33	29.75				S	4,630			2,695		Logistical / Aerial Supervision	
Convair	580	Turboprop	2	B	III		105.30	29.20	81.50				D	58,500		58,000		52,000	Airtanker	2,100
DeHaviland	Twin Otter DHC6-300	Turboprop	2	A	III		65.0	19.58	51.75	14.87		12.16	S	12,500			7,487		Logistical / Smoke Jumper	
Douglas	DC-6	Piston	4	B	III		117.50	28.70	105.60	36.20		24.70	D	107,000					Airtanker	2,450
Douglas	DC-7	Piston	4	B	III		117.50	28.60	108.0	36.20		24.70	D	126,000					Airtanker	3,000
Dornier	DO-228	Turboprop	2	B	II		58.40	18.20	54.33				S	8,855					Logistical / Smoke Jumper	
Grumman	Tracker S2T	Turboprop	2				73.0		43.50				S	29,150					Airtanker	1,200
Lockheed	Hercules 382G	Turboprop	4	C	IV		132.60	38.80	97.75	24.56	24.56	15.98	2S	155,000		130,000	77,286		Airtanker	4,000

Manufacturer	Model	Physical Class	# Engine	AAC	ADG	TDG	Wingspan	Tail Height	Length	Wheel Base	CMG	MGW	Main Gear	MTOW	MTW	NOW	EW	MLW	Mission	Pay Load (Gal)
Lockheed	Hercules C-130/Q	Turboprop	4	C	IV		132.60	38.80	97.75	24.56	24.56	15.98	2S	155,000					Airtanker	3,500
Lockheed	Hercules C-130H/J	Turboprop	4	C	IV		132.60	38.80	97.75	24.56	24.56	15.98	2S	155,000					Airtanker	MAFFS 3,000
Lockheed	Hercules C-130J-J30	Turboprop	4	C	IV	2	132.60	38.80	112.75	32.06	32.06	15.98	2S	164,000					Airtanker	MAFFS 3,000
Lockheed	P3 Orion	Turboprop	4	C	IV		99.0	32.83	116	29.70		31.16	D	106,000		97,601			Airtanker	3,000
Lockheed	Electra L188	Turboprop	4	C	IV		99.0	32.83	104.50	29.70		31.16	D	116,000			61,491	96,500	Airtanker	3,300
McDonnell Douglas	MD87	Turbofan	2	C	III	4	107.85	31.17	130.42	62.92	62.92	20.40	D	149,500	150,500	131,000	74,309	128,000	Airtanker	4,000
McDonnel Douglas	DC10-30CF	Turbofan	3	D	IV		165.30	58.60	181.50	72.41	93.37	41.21	2D	555,000		375,000	224,000		Airtanker	11,600
NA/ Rockwell	OV10A	Turboprop	2				40.0	15.17	41.58					14,444			6,893		Aerial Supervision	
Rockwell/Aero commander	AC500	Piston	2	B	II	1A	49.50	14.75	35.08			12.90	S	6,750			4,635		Logistical / Aerial Supervision	
Rockwell/Aero Commander	AC690B	Turboprop	2	B	II		46.66	15.0	44.32			15.40	S	10,325			6,733		Logistical / Aerial Supervision	
Shorts	Sherpa 330/C23	Turboprop	2	B	II		74.67	16.25	58.0				S	25,600			16,040		Logistical / Smoke Jumper	

WARNING: Data provided is typical for each make and model but does not necessarily apply to any specific aircraft. This data must not be used for performance calculations. Specific performance data is contained in each aircraft's flight manual. The Pilot in Command (PIC) is responsible for legal and safe operation of the aircraft.