

# AIRCRAFT FLIGHT MODEL VARIABLES

The tables below indicate the properties for the [Simulation Variables](#) that can be used to get and set properties related to the physical properties and flight model of an aircraft. For information on the units listed for each variable, please see here: [Simulation Variable Units](#)

**NOTE:** When Microsoft Flight Simulator is running in multiplayer mode, only a small number of variables are communicated between aircraft. Those variables that are available will say so in the description as being either for "All Aircraft" or for "Shared Cockpit".

You can find a complete index of all available SimVars here: [SimVar Index](#)

## General

Simulation Variable	Description	Units	Settable
<code>BETA DOT</code>	Beta dot	Radians per second	
<code>DECISION ALTITUDE MSL</code>	Design decision altitude above mean sea level	Feet ( <i>ft</i> )	
<code>DECISION HEIGHT</code>	Design decision height	Feet ( <i>ft</i> )	
<code>DESIGN CRUISE ALT</code>	This design constant represents the optimal altitude the aircraft should maintain when in cruise. It is derived from the <code>cruise_alt</code> setting in the <a href="#">[REFERENCE SPEEDS]</a> section of the <a href="#">flightmodel.cfg</a> . Default is 1500ft.	Feet ( <i>ft</i> )	

<b>DESIGN SPAWN ALTITUDE CRUISE</b>	<p>This design constant represents the spawn altitude for the aircraft when spawning in cruise. It is derived from the <code>spawn_cruise_altitude</code> setting in the <a href="#">[REFERENCE SPEEDS]</a> section of the <a href="#">flightmodel.cfg</a>. Default is 1500ft.</p>	Feet ( <i>ft</i> )	
<b>DESIGN SPAWN ALTITUDE DESCENT</b>	<p>This design constant represents the spawn altitude for the aircraft when spawning in descent. It is derived from the <code>spawn_descent_altitude</code> setting in the <a href="#">[REFERENCE SPEEDS]</a> section of the <a href="#">flightmodel.cfg</a>. Default is 500ft.</p>	Feet ( <i>ft</i> )	
<b>DESIGN SPEED CLIMB</b>	<p>This design constant represents the optimal climb speed for the aircraft. It is derived from the <code>climb_speed</code> setting in the <a href="#">[REFERENCE SPEEDS]</a> section of the <a href="#">flightmodel.cfg</a>. Default value is -1.</p>	Feet ( <i>ft</i> ) per second	
<b>DESIGN SPEED MIN ROTATION</b>	<p>This design constant represents the minimum speed required for aircraft rotation. It is derived from the <code>rotation_speed_min</code> setting in the <a href="#">[REFERENCE SPEEDS]</a> section of the <a href="#">flightmodel.cfg</a>. Default value is -1.</p>	Feet ( <i>ft</i> ) per second	
<b>DESIGN SPEED VC</b>	<p>This design constant represents the aircraft ideal cruising speed. It is derived from the <code>cruise_speed</code> setting in the <a href="#">[REFERENCE SPEEDS]</a> section of the <a href="#">flightmodel.cfg</a>. The default value is computed an internal function that uses the estimated cruise altitude and estimated cruise percent power,</p>	Feet ( <i>ft</i> ) per second	

	<p>according of the engine type, the number of engines, the density, the wing area and some drag parameters.</p> <p>Normally this value is set in the CFG file and the default value is never used.</p>		
<b>DESIGN SPEED</b> <b>VS0</b>	<p>This design constant represents the the stall speed when flaps are fully extended. It is derived from the <code>full_flaps_stall_speed</code> setting in the <a href="#">[REFERENCE SPEEDS]</a> section of the <a href="#">flightmodel.cfg</a>. Default value is 0.8 x VS.</p>	<i>kias</i>	
<b>DESIGN SPEED</b> <b>VS1</b>	<p>This design constant represents the stall speed when flaps are fully retracted. It is derived from the <code>flaps_up_stall_speed</code> setting in the <a href="#">[REFERENCE SPEEDS]</a> section of the <a href="#">flightmodel.cfg</a>. Default value is 0.</p>	<i>kias</i>	
<b>DESIGN TAKEOFF SPEED</b>	<p>This design constant represents the aircraft ideal takoff speed. It is derived from the <code>takeoff_speed</code> setting in the <a href="#">[REFERENCE SPEEDS]</a> section of the <a href="#">flightmodel.cfg</a>.</p>	<i>Knots</i>	
<b>DYNAMIC PRESSURE</b>	Dynamic pressure	Pounds per square foot ( <i>psf</i> )	
<b>ESTIMATED CRUISE SPEED</b>	Estimated cruise speed	Feet ( <i>ft</i> ) per second	
<b>G FORCE</b>	Current g force	GForce	

<b>G LIMITER SETTING</b>	This returns the setting of the G-limiter, as set using the <b>GLimiterSetting</b> parameter.	Enum:  0 = Off 1 = On 2 = Override	
<b>INCIDENCE ALPHA</b>	Angle of attack	Radians	
<b>INCIDENCE BETA</b>	Sideslip angle	Radians	
<b>IS TAIL DRAGGER</b>	True if the aircraft is a taildragger	Bool	
<b>LINEAR CL ALPHA</b>	Linear CL alpha	Per radian	
<b>MACH MAX OPERATE</b>	Maximum design mach	<i>Mach</i>	
<b>MAX G FORCE</b>	Maximum G force attained	Gforce	
<b>MIN DRAG VELOCITY</b>	Minimum drag velocity, in clean, with no input and no gears, when at 10000ft.	Feet ( <i>ft</i> ) per second	
<b>MIN G FORCE</b>	Minimum G force attained	Gforce	
<b>SEMIBODY LOADFACTOR X</b> <i>Deprecated</i>	<b>Deprecated, do not use!</b>	Number	
<b>SEMIBODY LOADFACTOR Y</b>	Acceleration along the axis Y divided by the gravity constant g (usually around 9.81m.s <sup>2</sup> )	Number	
<b>SEMIBODY LOADFACTOR YDOT</b>	Derivative of <b>SEMIBODY LOADFACTOR Y</b> in relation to time.	Per second	
<b>SEMIBODY LOADFACTOR Z</b> <i>Deprecated</i>	<b>Deprecated, do not use!</b>	Number	
<b>SIGMA SQRT</b>	Sigma sqrt	Number	

<b>SIMULATED RADIUS</b>	Simulated radius	Feet ( <i>ft</i> )	
<b>STALL ALPHA</b>	The angle of attack which produces the maximum lift coefficient before entering into stall conditions.	Radians	
<b>STATIC PITCH</b>	The angle at which static pitch stability is achieved.	Radians	
<b>TYPICAL DESCENT RATE</b>	the typical (normal) descent rate for the aircraft.	Feet ( <i>ft</i> ) per minute	
<b>WING AREA</b>	Total wing area	Square feet ( <i>ft</i> )	
<b>WING FLEX PCT:index</b>	The current wing flex. Different values can be set for each wing (for example, during banking). Set an index of 1 for the left wing, and 2 for the right wing.	<i>Percent Over 100</i>	
<b>WING SPAN</b>	Total wing span	Feet ( <i>ft</i> )	
<b>YAW STRING ANGLE</b>	The yaw string angle. Yaw strings are attached to gliders as visible indicators of the yaw angle. An animation of this is not implemented in ESP.	Radians	
<b>YAW STRING PCT EXTENDED</b>	Yaw string angle as a percentage	<i>Percent Over 100</i>	
<b>ZERO LIFT ALPHA</b>	The angle of attack at which the wing has zero lift.	Radians	

## Center Of Gravity

Simulation Variable	Description	Units	Settable
---------------------	-------------	-------	----------

CG AFT LIMIT	<p>Most backward authorized position of the <b>CG</b> according to the <b>POH</b>.</p> <p><b>NOTE:</b> This is only valid for <b>airplanes</b>.</p>	Percent Over 100	
CG FEET	<p>The longitudinal <b>CG</b> position relative to the <a href="#">Reference Datum Position</a>.</p> <p><b>NOTE:</b> This is only valid for <b>helicopters</b>.</p>	Feet ( <i>ft</i> )	
CG FEET AFT LIMIT	<p>The aft <b>CG</b> limit position relative to the <a href="#">Reference Datum Position</a>.</p> <p><b>NOTE:</b> This is only valid for <b>helicopters</b>.</p>	Feet ( <i>ft</i> )	
CG FEET LATERAL	<p>The lateral <b>CG</b> position relative to the <a href="#">Reference Datum Position</a>.</p> <p><b>NOTE:</b> This is only valid for <b>helicopters</b>.</p>	Feet ( <i>ft</i> )	
CG FEET LATERAL LEFT LIMIT	<p>The left hand lateral <b>CG</b> position relative to the <a href="#">Reference Datum Position</a>.</p> <p><b>NOTE:</b> This is only valid for <b>helicopters</b>.</p>	Feet ( <i>ft</i> )	
CG FEET LATERAL RIGHT LIMIT	<p>The right hand lateral <b>CG</b> position relative to the <a href="#">Reference Datum Position</a>.</p>	Feet ( <i>ft</i> )	

	<p><b>NOTE:</b> This is only valid for <b>helicopters</b>.</p>		
CG FEET FWD LIMIT	<p>The forward <b>CG</b> limit position relative to the <a href="#">Reference Datum Position</a>.</p> <p><b>NOTE:</b> This is only valid for <b>helicopters</b>.</p>	Feet ( <i>ft</i> )	
CG FWD LIMIT	<p>Most forward authorized position of the <b>CG</b> according to the <b>POH</b>.</p> <p><b>NOTE:</b> This is only valid for <b>airplanes</b>.</p>	Percent Over 100	
CG MAX MACH <b>Deprecated</b>	<b>Deprecated, do not use!</b>	Mach	
CG MIN MACH <b>Deprecated</b>	<b>Deprecated, do not use!</b>	Mach	
CG PERCENT	<p>Longitudinal <b>CG</b> position as a percent of reference <b>Chord</b>.</p> <p><b>NOTE:</b> This is only valid for <b>airplanes</b>.</p>	Percent Over 100	
CG PERCENT LATERAL	<p>Lateral <b>CG</b> position as a percent of reference <b>Chord</b>.</p> <p><b>NOTE:</b> This is only valid for <b>airplanes</b>.</p>	Percent Over 100	

<b>STATIC CG TO GROUND</b>	Static <b>CG</b> position with reference to the ground.  <b>NOTE:</b> This is only valid for <b>airplanes</b> .	Feet ( <b>ft</b> )	
----------------------------	---	--------------------	--

## Interactive Points

Simulation Variable	Description	Units	Settable
<b>INTERACTIVE POINT BANK</b>	Interactive Point orientation: Bank	Degrees	
<b>INTERACTIVE POINT HEADING</b>	Interactive Point orientation: Heading	Degrees	
<b>INTERACTIVE POINT JETWAY LEFT BEND</b>	Interactive Point Jetway constant, determining the desired left bend ratio of jetway hood	Percent	
<b>INTERACTIVE POINT JETWAY LEFT DEPLOYMENT</b>	Interactive Point Jetway constant, determining the desired left deployment angle of jetway hood	Degrees	
<b>INTERACTIVE POINT JETWAY RIGHT BEND</b>	Interactive Point Jetway constant, determining the desired right bend ratio of jetway hood	Percent	
<b>INTERACTIVE POINT JETWAY RIGHT DEPLOYMENT</b>	Interactive Point Jetway constant, determining the desired right deployment angle of jetway hood	Degrees	



<b>INTERACTIVE POINT JETWAY TOP HORIZONTAL</b>	Interactive Point Jetway constant, determining the desired top horizontal ratio of displacement of jetway hood	Percent	
<b>INTERACTIVE POINT JETWAY TOP VERTICAL</b>	Interactive Point Jetway constant, determining the desired top vertical ratio of displacement of jetway hood	Percent	
<b>INTERACTIVE POINT GOAL</b>	The Interactive Point goal percentage of opening (if it's for a door) or percentage of deployment (if it's for a hose or cable).	<i>Percent Over 100</i>	
<b>INTERACTIVE POINT OPEN</b>	Interactive Point current percentage of opening (if door) or deployment (if hose/cable)	<i>Percent Over 100</i>	
<b>INTERACTIVE POINT PITCH</b>	Interactive Point orientation: Pitch	Degrees	
<b>INTERACTIVE POINT POSX</b>	Interactive Point X position relative to datum reference point	Feet ( <i>ft</i> )	
<b>INTERACTIVE POINT POSY</b>	Interactive Point Y position relative to datum reference point	Feet ( <i>ft</i> )	
<b>INTERACTIVE POINT POSZ</b>	Interactive Point Z position relative to datum reference point	Feet ( <i>ft</i> )	
<b>INTERACTIVE POINT TYPE</b>	The type of interactive point	Enum:  0: Main exit 1: Cargo exit 2: Emergency exit	

		3: Fuel hose	
		4: Ground Power cable	
		99: Unknown (for error handling)	

## Weight

Simulation Variable	Description	Units	Settable
EMPTY WEIGHT	Empty weight of the aircraft	Pounds	
EMPTY WEIGHT CROSS COUPLED MOI	Empty weight cross coupled moment of inertia	Slugs per feet squared ( <i>Slug sqft</i> )	
EMPTY WEIGHT PITCH MOI	Empty weight pitch moment of inertia	Slugs per feet squared ( <i>Slug sqft</i> )	
EMPTY WEIGHT ROLL MOI	Empty weight roll moment of inertia	Slugs per feet squared ( <i>Slug sqft</i> )	
EMPTY WEIGHT YAW MOI	Empty weight yaw moment of inertia	Slugs per feet squared ( <i>Slug sqft</i> )	
MAX GROSS WEIGHT	Maximum gross weight of the aircraft	Pounds	
TOTAL WEIGHT	Total weight of the aircraft	Pounds	