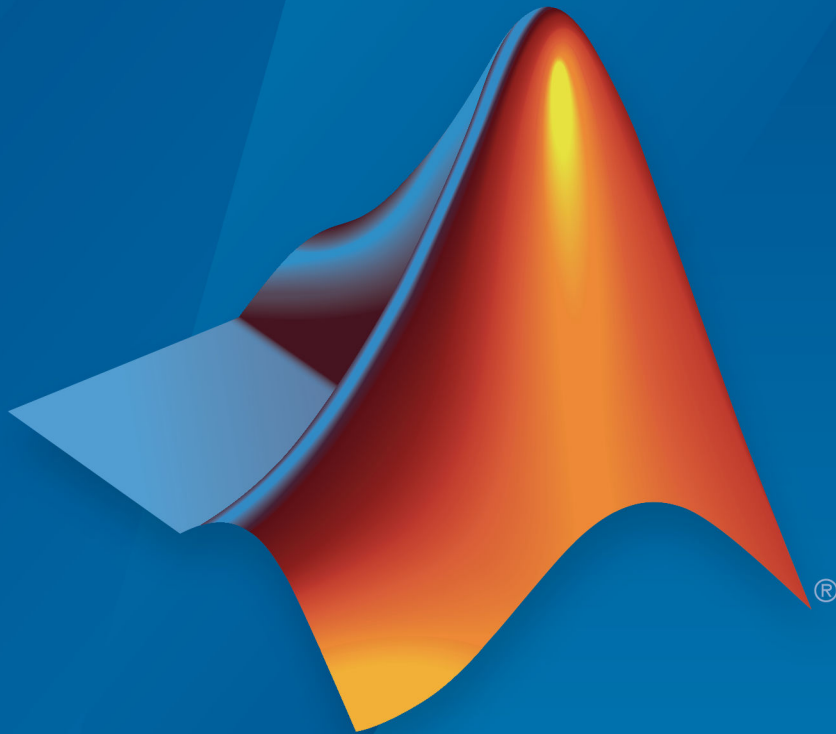


Aerospace Toolbox Release Notes



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Aerospace Toolbox Release Notes

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R2017b

Version: 2.20

New Features

Bug Fixes

Difference Between UT1 and UTC: Calculate time difference with `deltaUT1` function according to the IAU2000A reference system

Use `deltaUT1` to calculate the difference between principal Universal Time (UT1) and Coordinated Universal Time (UTC) according to the IAU2000A reference system.

To optionally create a file containing the current Earth orientation data for `deltaUT1`, use the `aeroReadIERSData` function.

FlightGear Interface: Includes support for Version 2017.1 through flight simulator objects

The Aerospace Toolbox product now supports FlightGear v2017.1.

For more information on working with FlightGear, see “Aero.FlightGearAnimation Objects”.

quat2angle and rod2angle updates

The `quat2angle` and `rod2angle` functions now return values for the middle angle of the 'ZYZ', 'ZXZ', 'YXY', 'YZY', 'XYX', and 'XZX' implementations. In previous releases, these functions returned all zeroes for 0 degrees in the second rotation.

R2017a

Version: 2.19

New Features

Bug Fixes

Compatibility Considerations

Euler-Rodrigues Functions: Convert to and from Rodrigues vectors

These functions convert Euler-Rodrigues vectors to and from direction cosine matrices, rotation angles, and quaternions:

- `angle2rod`
- `dcm2rod`
- `quat2rod`
- `rod2angle`
- `rod2dcm`
- `rod2quat`

FlightGear Interface: Includes support for Version 2016.3 through flight simulator objects

The Aerospace Toolbox product now supports FlightGear v2016.3.

For more information on working with FlightGear, see `Aero.FlightGearAnimation` Objects.

Aerospace Toolbox Software and MATLAB string

The Aerospace Toolbox software now supports MATLAB® `string`.

`angle2quat` Function Replaces `euler2quat`

The `angle2quat` function has replaced the `euler2quat` function.

Compatibility Considerations

The `euler2quat` function is no longer available. Use the `angle2quat` function instead.

R2016b

Version: 2.18

New Features

Bug Fixes

Compatibility Considerations

Horizontal Wind Model 14 Function: Calculate meridional and zonal wind components using U.S. Naval Research Laboratory HWM14 model

The `atmoshwm` function implements horizontal wind modes.

Compatibility Considerations

The `atmoshwm` replaces the `atmoshwm07` function.

Function or Function Element Name	What Happens When You Use the Function or Element?	Use These Functions or Function Elements Instead	Compatibility Considerations
<code>atmoshwm07</code>	Warns	<code>atmoshwm</code>	To use a specific generation of the Horizontal Wind Model, specify the appropriate year in the <code>atmoshwm</code> function.

FlightGear Version 2016.1 Support: Interface with FlightGear through flight simulator object

The Aerospace Toolbox product now supports FlightGear v2016.1.

For more information on working with FlightGear, see `Aero.FlightGearAnimation` Objects.

R2016a

Version: 2.17

New Features

Bug Fixes

Compatibility Considerations

Quaternion Interpolation: Calculate interpolation between two quaternions

The `quatinterp` block interpolates between two quaternions. To support this function, the following functions are also new:

The `quatpower` block calculates the power of a quaternion.

The `quatlog` block calculates the natural logarithm of a quaternion.

The `quatexp` block calculates the exponential of a quaternion.

FlightGear versions earlier than 2.0 no longer supported

The Aerospace Toolbox software no longer supports FlightGear versions earlier than 2.0. For a list of FlightGear versions that the Aerospace Toolbox software supports, see [Supported FlightGear Versions](#).

Compatibility Considerations

If you are using a FlightGear version older than 2.0, update your FlightGear installation to a supported version. The software returns an error if you use a non-supported version. Obtain updated FlightGear software from www.flightgear.org in the download area.

Unit conversion function precision changes

These unit conversion functions may now generate values with better precision:

- `convacc`
- `convang`
- `convangacc`
- `convangvel`
- `convdensity`
- `convforce`
- `convlength`
- `convmass`

-
- convpres
 - convtemp
 - convvel

R2015b

Version: 2.16

New Features

Bug Fixes

Compatibility Considerations

FlightGear Versions 3.2 and 3.4 Support: Interface to these FlightGear versions through flight simulator object

The Aerospace Toolbox product now supports FlightGear v3.2 and v3.4.

For more information on working with FlightGear, see `Aero.FlightGearAnimation` Objects.

igrfmagm Function: Calculate Earth magnetic field and secular variation

The `igrfmagm` function calculates Earth magnetic field and secular variation using the International Geomagnetic Reference Field.

Compatibility Considerations

The `igrfmagm` replaces the `igrf11magm` function. For more information, see “Function and Function Element Being Removed” on page 5-2.

DATCOM 2014 Support: Import aerodynamic coefficients from this version

The `datcomimport` function has been enhanced to support the 2014 version of DATCOM files.

Function and Function Element Being Removed

The following table lists the function being removed for R2015b.

Function or Function Element Name	What Happens When You Use the Function or Element?	Use These Functions or Function Elements Instead	Compatibility Considerations
igrf11magm	Warns	igrfmagm	To use a specific generation of the International Geomagnetic Reference Field, specify the appropriate year in the <code>igrfmagm</code> function.

R2015a

Version: 2.15

New Features

Bug Fixes

tdbjuliandate function that calculates barycentric dynamical time for a given terrestrial time date

The `tdbjuliandate` function calculates Barycentric Dynamical Time (TDB) for a given Terrestrial Time (TT) date.

eci2aer function that converts Earth-centered inertial coordinates to azimuth, elevation, and range

The `eci2aer` function converts Earth-centered inertial coordinates to azimuth, elevation, and range.

Additional ephemerides coefficient support for celestial phenomena functions

The `moonLibration`, and `planetEphemeris` functions now support the DE432t ephemerides database.

World Magnetic Model 2015 support

The `wrldmagm` function supports the world magnetic model for 2015 to 2020 (WMM-2015).

New example

The `Estimate Sun Analemma Using Planetary Ephemerides and ECI to AER Transformation` example shows how to estimate the Sun analemma using the `eci2aer` and `tdbjuliandate` functions.

R2014b

Version: 2.14

New Features

Bug Fixes

atmoshwm07 function for Horizontal Wind Model 07 data

The `atmoshwm07` function implements the U.S. Naval Research Laboratory HWM™ routine to calculate the meridional and zonal components of the wind for a set of geophysical data.

FlightGear animation object support for FlightGear Version 3

The Aerospace Toolbox product now supports FlightGear Version 3.

For more information on working with FlightGear, see `Aero.FlightGearAnimation` Objects.

Additional ephemerides coefficient support for celestial phenomena functions

The `planetEphemeris`, `earthNutation`, and `moonLibration` functions now support the DE430 ephemerides coefficient.

R2014a

Version: 2.13

New Features

Bug Fixes

Functions to convert between latitude, longitude, altitude and Earth-centered inertial coordinates

The `lla2eci` function converts geodetic latitude, longitude, altitude (LLA) coordinates to Earth-centered inertial (ECI) position coordinates, based on the specified reduction method and Universal Coordinated Time (UTC), for the specified time and geophysical data.

The `eci2lla` function converts Earth-centered inertial (ECI) position coordinates to geodetic latitude, longitude, altitude (LLA) coordinates, based on the specified reduction method and Universal Coordinated Time (UTC), for the specified time and geophysical data.

FlightGear animation object support for FlightGear Version 2.12

The Aerospace Toolbox product now supports FlightGear Version 2.12.

For more information on working with FlightGear, see `Aero.FlightGearAnimation Objects`.

Add ephemeris and geoid data

Use the `aeroDataPackage` function to add ephemeris and/or geoid data for these Aerospace Toolbox functions and Aerospace Blockset™ blocks.

Aerospace Toolbox Functions	Aerospace Blockset Blocks
<code>geoidheight</code>	Geoid Height
Note Only for the EGM2008 Geopotential Model. Aerospace Toolbox provides EGM96 Geopotential Model data.	Note Only for the EGM2008 Geopotential Model. Aerospace Toolbox provides EGM96 Geopotential Model data.
<code>earthNutation</code>	Earth Nutation
<code>moonLibration</code>	Moon Libration
<code>planetEphemeris</code>	Planetary Ephemeris

R2013b

Version: 2.12

New Features

Bug Fixes

Compatibility Considerations

FlightGear animation object support for FlightGear Version 2.10

The Aerospace Toolbox product now supports FlightGear Version 2.10.

For more information on working with FlightGear, see `Aero.FlightGearAnimation` Objects.

dcmeci2ecef function to convert Earth-Centered Inertial to Earth-Centered Earth-Fixed coordinates

The `dcmeci2ecef` function calculates the position direction cosine matrix (ECI to ECEF), based on the specified reduction method and Universal Coordinated Time (UTC), for the specified time and geophysical data.

Latitude inputs outside +90 and -90 degrees

These functions now correctly take into account latitude inputs that are outside +90 and -90 degrees.

- `atmosnrlmsise00`
- `geoc2geod`
- `geod2geoc`
- `flat2lla`
- `lla2flat`
- `geoidheight`
- `gravitywgs84`

Celestial navigation example

The Marine Navigation Using Planetary Ephemerides example shows how to perform celestial navigation of a marine vessel using the planetary ephemerides and Earth-Centered Inertial to Earth-Centered Earth-Fixed (ECI to ECEF) transformation.

Phaseout of FlightGear versions earlier than 2.0

The Aerospace Toolbox software will not support FlightGear versions earlier than 2.0 in a future release of Aerospace Toolbox. For a list of FlightGear versions that the Aerospace Toolbox software supports, see [Supported FlightGear Versions](#).

Compatibility Considerations

If you are using a FlightGear version older than 2.0, update your FlightGear installation to a supported version.

R2013a

Version: 2.11

New Features

Bug Fixes

FlightGear animation object support for FlightGear Version 2.8

For more information on working with FlightGear, see `Aero.FlightGearAnimation`.

planetEphemeris function to implement position and velocity of Solar System planets

The `planetEphemeris` function implements the position and velocity of an astronomical object.

earthNutation function to implement nutation in longitude and obliquity of Earth

The `earthNutation` function implements the nutation in longitude and obliquity of Earth according to the International Astronomical Union (IAU) 1980 nutation series.

moonLibration function to implement relative motion attitude of Moon

The `moonLibration` function implements the relative motion attitude of Earth's Moon.

Recorded video of Aero.Animation or Aero.VirtualRealityAnimation objects for playback later

You can now record flight data animations for `Aero.Animation` and `Aero.VirtualRealityAnimation` objects. The following properties are new for both classes:

Property	Description
<code>VideoRecord</code>	Enable video recording.
<code>VideoFileName</code>	Specify video recording file name.
<code>VideoCompression</code>	Specify video recording compression file type.
<code>VideoQuality</code>	Specify video recording quality.
<code>VideoTStart</code>	Specify video recording start time for scheduled recording.
<code>VideoTFinal</code>	Specify video recording stop time.

Architecture selection support for Aero.FlightGearAnimation

You can specify the architecture the FlightGear software is running on. `GenerateRunScript` takes this setting into account when generating the run script. These architecture settings are available.

Architecture	Setting
Windows® (32-bit)	'Win32 '
Windows (64-bit) architecture.	'Win64 '
Mac OS X (64-bit) architecture.	'Mac '
Linux® (64-bit) architecture.	'Linux '

R2012b

Version: 2.10

New Features

Bug Fixes

FlightGear animation object support for FlightGear versions 2.4 and 2.6

The Aerospace Toolbox product now supports FlightGear Versions 2.6 and 2.4.

For more information on working with FlightGear, see `Aero.FlightGearAnimation` Objects.

R2012a

Version: 2.9

New Features

Support 2011 Version of DATCOM

The `datcomimport` function has been enhanced to support the 2011 version of DATCOM files.

Using FlightGear Version 2.4.0 with Aerospace Toolbox

Aerospace Toolbox Version 2.9 does not support FlightGear Version 2.4.0. Use this procedure as a workaround.

- 1 In the MATLAB Command Window, create a FlightGear animation object.

```
h = Aero.FlightGearAnimation;
```

- 2 Set the FlightGear animation object property `FlightGearVersion` to 2.0.

```
h.FlightGearVersion = '2.0';
```

- 3 Set the FlightGear animation object property `FlightGearBaseDirectory` to the location of FlightGear Version 2.4.0.

```
h.FlightGearBaseDirectory = 'C:\Program Files\FlightGear240'
```

- 4 Generate the run script.

```
GenerateRunScript(h)
```

- 5 Save and close this file.

For more information, see `Aero.FlightGearAnimation` Objects in the Aerospace Toolbox User's Guide.

R2011b

Version: 2.8

New Features

Compatibility Considerations

Conversion of Error and Warning Message Identifiers

For R2011b, error and warning message identifiers have changed in Aerospace Toolbox.

Compatibility Considerations

If you have scripts or functions that use message identifiers that changed, you must update the code to use the new identifiers. Typically, message identifiers are used to turn off specific warning messages.

For example, the `Aero:FlightGearAnimation:NeedTimeData` identifier has changed to `aero:FlightGearAnimation:NeedTimeData`. If your code checks for `Aero:FlightGearAnimation:NeedTimeData`, you must update it to check for `aero:FlightGearAnimation:NeedTimeData` instead.

To determine the identifier for a warning, run the following command just after you see the warning:

```
[MSG,MSGID] = lastwarn;
```

This command saves the message identifier to the variable *MSGID*.

Note Warning messages indicate a potential issue with your code. While you can turn off a warning, a suggested alternative is to change your code so it runs warning-free.

Demos

The following demos are new:

- Visualizing World Magnetic Model Contours for 2010 Epoch — Visualize contour plots of the calculated values for the Earth's magnetic field using World Magnetic Model 2010 (WMM-2010) overlaid on maps of the Earth.
- Visualizing Geoid Height for Earth Geopotential Model 1996 — Calculate the Earth's Geoid height using the EGM96 Geopotential Model.

Function and Function Element Being Removed

The following table lists the function and function element name being removed for R2011b.

Function or Function Element Name	What Happens When You Use the Function or Element?	Use These Functions or Function Elements Instead	Compatibility Considerations
wrldmagm '2000' or '2005' epoch year	Warns	For model years between 2000 and the start of 2010, use igrf11magm. For model years between 2010 and the start of 2015, use wrldmagm.	For model years between 2000 and the start of 2010, use igrf11magm. For model years between 2010 and the start of 2015, use wrldmagm.

R2011a

Version: 2.7

New Features

New LLA to Flat Earth Function

The `lla2flat` function estimates a flat Earth position from geodetic latitude, longitude, and altitude coordinates.

New Flat Earth to LLA Function

The `flat2lla` function estimates geodetic latitude, longitude, and altitude coordinates from a flat Earth position.

New International Geomagnetic Reference Field 11 Function

The `igrf11magm` function calculates the Earth's magnetic field using the 11th generation of the International Geomagnetic Reference Field.

The gravitysphericalharmonic Function Supports New Planet Model

The `gravitysphericalharmonic` function now supports the EIGEN-GL04C gravity field model.

R2010b

Version: 2.6

New Features

Compatibility Considerations

New Geoid Height Function

The `geoidheight` function calculates the height of geoid undulations/height using one of three geopotential models.

Support to Read File Types 6, 21, and 42 for 2008 Version of DATCOM

The `datcomimport` function has been enhanced to read file types 6, 21, and 42 for 2008 DATCOM files. In previous releases, the Aerospace Toolbox read only file type 6 and 21.

Support for FlightGear 2.0

Aerospace Toolbox now supports FlightGear Version 2.0.

For more information on working with FlightGear, see `Aero.FlightGearAnimation` Objects in the Aerospace Toolbox User's Guide.

Functions and Function Elements Being Removed

Function or Function Element Name	What Happens When You use the Function or Element?	Use This Instead	Compatibility Considerations
<code>geoidegm96</code>	Warns	<code>geoidheight</code>	Replace all existing instances of <code>geoidegm96</code> with <code>geoidheight</code> .

R2010a

Version: 2.5

New Features

New Gravity Centrifugal Effect Function

The `gravitycentrifugal` function implements the centrifugal effect for eight planets and the Moon, plus the capability to customize this effect.

New Spherical Harmonic Gravity Model Function

The `gravitiesphericalharmonic` function implements the spherical harmonic gravity models for Earth (EGM2008, EGM96), Moon (LP100K, LP165P), and Mars (GMM2B), plus the capability to customize these models.

New Gas Dynamics Functions

New gas dynamics functions, including isentropic flow (`flowisentropic`), normal shock (`flownormalshock`), Rayleigh flow (`flowrayleigh`), Fanno flow (`flowfanno`), and Prandtl-Meyer flow (`flowprandtlmeyer`).

Updated World Magnetic Function

Updated `wrldmagm` function to include world magnetic model for years 2010-2015 (WMM-2010).

Demos

The Comparing Zonal Harmonic Gravity Model to Other Gravity Models demo has been updated to include comparison of other gravity models.

R2009b

Version: 2.4

New Features

New Zonal Harmonic Gravity Model Function

The `gravityzonal` function implements the zonal harmonic gravity model.

Support for FlightGear 1.9.1

Aerospace Toolbox Version 3.4 now supports FlightGear Version 1.9.1.

For more information on working with FlightGear, see `Aero.FlightGearAnimation` Objects in the Aerospace Toolbox User's Guide.

R2009a

Version: 2.3

New Features

Support to Read File Type 21 for 2007 Version of DATCOM

The `datcomimport` function has been enhanced to read file type 21 for 2007 DATCOM files. In previous releases, the Aerospace Toolbox read only file type 6.

Using FlightGear Version 1.9.0 with Aerospace Toolbox

Aerospace Toolbox Version 2.3 does not support FlightGear Version 1.9.0. You can use this procedure.

- 1 In the MATLAB Command Window, create a FlightGear animation object.

```
h = Aero.FlightGearAnimation;
```
- 2 Set the FlightGear animation object property `FlightGearVersion` to 1.0.

```
h.FlightGearVersion = '1.0';
```
- 3 Set the FlightGear animation object property `FlightGearBaseDirectory` to the location of FlightGear Version 1.9.0.

```
h.FlightGearBaseDirectory = 'C:\Program Files\FlightGear190'
```
- 4 Generate the run script.

```
GenerateRunScript(h)
```
- 5 Open the custom FlightGear run script with a text editor and change the input parameter `--airport-id=` to `--airport=`.
- 6 Save and close this file.

For more information on working with FlightGear, see `Aero.FlightGearAnimation` Objects in the Aerospace Toolbox User's Guide.

R2008b

Version: 2.2

New Features

Support for 2007 Version of DATCOM File

The `datcomimport` function has been enhanced to support the 2007 DATCOM file in addition to the 1976 and 1999 DATCOM files.

FlightGear Version 1.0 with Aerospace Toolbox

Aerospace Toolbox Version 2.2 now supports FlightGear Version 1.0. To access this version of FlightGear, you can use this procedure.

- 1 In the MATLAB Command Window, create a FlightGear animation object.

```
h = Aero.FlightGearAnimation;
```

- 2 Set the FlightGear animation object property `FlightGearVersion` to 1.0.

```
h.FlightGearVersion = '1.0';
```

- 3 Set the FlightGear animation object property `FlightGearBaseDirectory` to the location of FlightGear Version 1.0.

```
h.FlightGearBaseDirectory = 'C:\Program Files\FlightGear10'
```

For more information on working with FlightGear, see `Aero.FlightGearAnimation` Objects in the Aerospace Toolbox User's Guide.

FlightGear Animation Object `play` Method Now Supports Custom Timers

The FlightGear animation object `play` method now supports custom timers.

In previous releases, you needed to create your own `play` method if your FlightGear animation object was used with custom timers. This is no longer necessary.

R2008a

Version: 2.1

New Features

Support for 1999 Version of DATCOM File

The `datcomimport` function has been enhanced to support the 1999 DATCOM file in addition to the 1976 DATCOM file.

Using FlightGear Version 1.0 with Aerospace Toolbox

Aerospace Toolbox Version 2.1 does not support FlightGear Version 1.0. You can use this procedure.

- 1 In the MATLAB Command Window, create a FlightGear animation object.

```
h = Aero.FlightGearAnimation;
```

- 2 Set the FlightGear animation object property `FlightGearVersion` to 0.9.10.

```
h.FlightGearVersion = '0.9.10';
```

- 3 Set the FlightGear animation object property `FlightGearBaseDirectory` to the location of FlightGear Version 1.0.

```
h.FlightGearBaseDirectory = 'C:\Program Files\FlightGear10'
```

For more information on working with FlightGear, see `Aero.FlightGearAnimation` Objects in the Aerospace Toolbox User's Guide.

R2007b

Version: 2.0

New Features

Compatibility Considerations

Virtual Reality Toolbox Animation Object

This release introduces the following new objects and their associated methods to visualize flight data using the Virtual Reality Toolbox™ product:

- `Aero.VirtualRealityAnimation`
- `Aero.Node`
- `Aero.Viewpoint`

Support for the COSPAR International Reference Atmosphere 1986 Model

The `atmoscira` function implements the COSPAR International Reference Atmosphere (CIRA) 1986 environmental model.

Support for 2001 United States Naval Research Laboratory Mass Spectrometer and Incoherent Scatter Radar Exosphere

The `atmosnrlmsise00` function implements the 2001 United States Naval Research Laboratory Mass Spectrometer and Incoherent Scatter Radar Exosphere (NRLMSISE) environmental model.

Support for the EGM96 Geopotential Model

The `geoidegm96` function implements the 1996 Earth Geopotential Model (EGM96).

quat2angle Function Replaces quat2euler

The `quat2angle` function converts spatial representation from any of 12 standard sequences of rotation angles to quaternions.

Compatibility Considerations

The `quat2euler` function is deprecated. Applications that contain this function continue to be supported, but an error message will be displayed. Use the `quat2angle` function instead.

angle2quat Function Replaces euler2quat

The `angle2quat` function converts spatial representation from quaternions to any of 12 standard sequences of rotation angles.

Compatibility Considerations

The `euler2quat` function is deprecated. Applications that contain this function continue to be supported, but an error message will be displayed. Use the `angle2quat` function instead.

R2007a

Version: 1.1

New Features

New Aerospace Toolbox Objects

This release introduces the following new objects and their associated methods to create a six-degrees-of-freedom animation of multiple bodies that have custom geometries:

- `Aero.Animation`
- `Aero.Body`
- `Aero.Camera`
- `Aero.Geometry`

New Aerospace Toolbox Demo

The Aerospace Toolbox product has a new demo, *Overlaying Simulated and Actual Flight Data*, which illustrates the use of the Aero objects.

R2006b

Version: 1.0

New Features

Introduction of Aerospace Toolbox Product

This product extends the MATLAB technical computing environment by providing reference standards, environment models, and aerodynamic coefficient importing for performing advanced aerospace analysis to develop and evaluate your designs. An interface to the FlightGear flight simulator enables you to visualize flight data in a three-dimensional environment and reconstruct behavioral anomalies in flight-test results. To ensure design consistency, the Aerospace Toolbox software provides utilities for unit conversions, coordinate transformations, and quaternion math, as well as standards-based environmental models for the atmosphere, gravity, and magnetic fields. You can import aerodynamic coefficients directly from the U.S. Air Force Digital Data Compendium (DATCOM) to carry out preliminary control design and vehicle performance analysis.

The toolbox provides you with the following main features:

- Provides standards-based environmental models for atmosphere, gravity, and magnetic fields.
- Converts units and transforms coordinate systems and spatial representations.
- Implements predefined utilities for aerospace parameter calculations, time calculations, and quaternion math.
- Imports aerodynamic coefficients directly from the U.S. Air Force Digital Data Compendium (DATCOM).
- Interfaces to the FlightGear flight simulator, enabling visualization of vehicle dynamics in a three-dimensional environment.

The Aerospace Toolbox software has the following limitation:

- The FlightGear animation object cannot be compiled with the MATLAB Compiler™ software to create a standalone application.