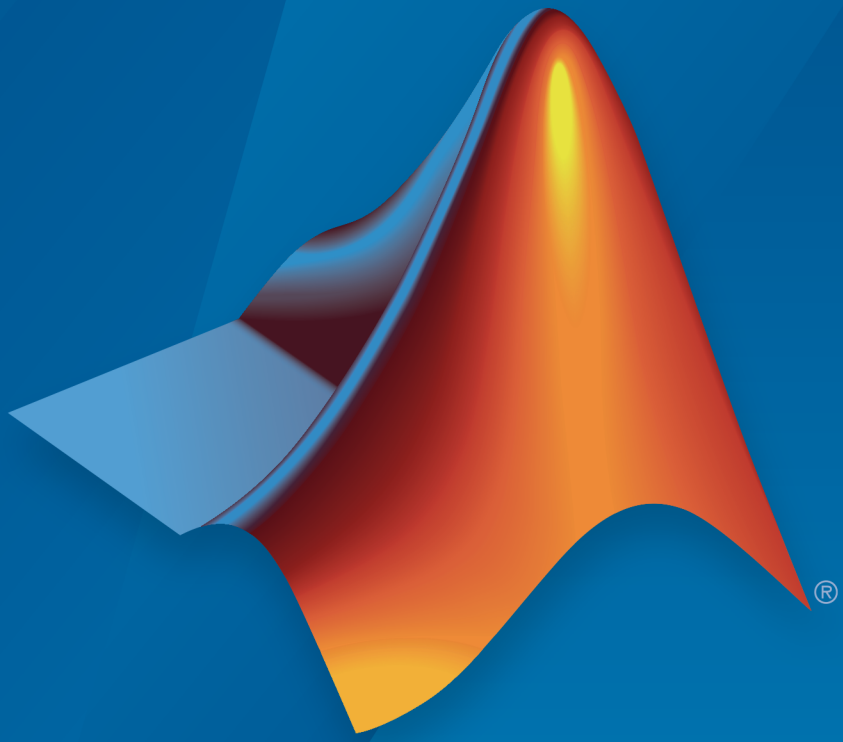
Aerospace Toolbox Release Notes



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Aerospace Toolbox Release Notes

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Contents

R2016a

Quaternion Interpolation: Calculate interpolation between two quaternions 1-2

FlightGear versions earlier than 2.0 no longer supported . . 1-2

Unit conversion function precision changes 1-2

R2015b

FlightGear Versions 3.2 and 3.4 Support: Interface to these FlightGear versions through flight simulator object 2-2

igrfmagm Function: Calculate Earth magnetic field and secular variation 2-2

DATCOM 2014 Support: Import aerodynamic coefficients from this version 2-2

Function and Function Element Being Removed 2-2

R2015a

tdbjuliandate function that calculates barycentric dynamical time for a given terrestial time date 3-2

eci2aer function that converts Earth-centered inertial coordinates to azimuth, elevation, and range **3-2**

Additional ephemerides coefficient support for celestial phenomena functions **3-2**

World Magnetic Model 2015 support **3-2**

New example **3-2**

R2014b

atmoshwm07 function for Horizontal Wind Model 07 data . . **4-2**

FlightGear animation object support for FlightGear Version 3 . . . . . **4-2**

Additional ephemerides coefficient support for celestial phenomena functions **4-2**

R2014a

Functions to convert between latitude, longitude, altitude and Earth-centered inertial coordinates **5-2**

FlightGear animation object support for FlightGear Version 2.12 . . . . . **5-2**

Add ephemeris and geoid data **5-2**

R2013b

FlightGear animation object support for FlightGear Version 2.10 . . . . . **6-2**

dcmeci2ecef function to convert Earth-Centered Inertial to Earth-Centered Earth-Fixed coordinates **6-2**

Latitude inputs outside +90 and -90 degrees **6-2**

Celestial navigation example **6-2**

Phaseout of FlightGear versions earlier than 2.0 . . . . . **6-2**

R2013a

`FlightGear` animation object support for FlightGear Version 2.8 . . . . . **7-2**

`planetEphemeris` function to implement position and velocity of Solar System planets **7-2**

`earthNutation` function to implement nutation in longitude and obliquity of Earth **7-2**

`moonLibration` function to implement relative motion attitude of Moon **7-2**

Recorded video of `Aero.Animation` or `Aero.VirtualRealityAnimation` objects for playback later **7-2**

Architecture selection support for Aero.FlightGearAnimation **7-3**

R2012b

FlightGear animation object support for FlightGear versions 2.4 and 2.6 8-2

R2012a

Support 2011 Version of DATCOM 9-2

Using FlightGear Version 2.4.0 with Aerospace Toolbox . . . 9-2

R2011b

Conversion of Error and Warning Message Identifiers 10-2

Demos 10-2

Function and Function Element Being Removed 10-2

R2011a

New LLA to Flat Earth Function 11-2

New Flat Earth to LLA Function 11-2

New International Geomagnetic Reference Field 11 Function 11-2

The gravityspericalharmonic Function Supports New Planet Model 11-2

R2010b

New Geoid Height Function 12-2

Support to Read File Types 6, 21, and 42 for 2008 Version of DATCOM 12-2

Support for FlightGear 2.0 12-2

Functions and Function Elements Being Removed 12-2

R2010a

New Gravity Centrifugal Effect Function 13-2

New Spherical Harmonic Gravity Model Function 13-2

New Gas Dynamics Functions 13-2

Updated World Magnetic Function 13-2

Demos 13-2

R2009b

New Zonal Harmonic Gravity Model Function 14-2

Support for FlightGear 1.9.1 14-2

R2009a

Support to Read File Type 21 for 2007 Version of DATCOM **15-2**

Using FlightGear Version 1.9.0 with Aerospace Toolbox . . **15-2**

R2008b

Support for 2007 Version of DATCOM File **16-2**

FlightGear Version 1.0 with Aerospace Toolbox **16-2**

FlightGear Animation Object play Method Now Supports Custom Timers **16-2**

R2008a

Support for 1999 Version of DATCOM File **17-2**

Using FlightGear Version 1.0 with Aerospace Toolbox **17-2**

R2007b

Virtual Reality Toolbox Animation Object **18-2**

Support for the COSPAR International Reference Atmosphere 1986 Model **18-2**

Support for 2001 United States Naval Research Laboratory Mass Spectrometer and Incoherent Scatter Radar Exosphere 18-2

Support for the EGM96 Geopotential Model 18-2

quat2angle Function Replaces quat2euler 18-2

angle2quat Function Replaces euler2quat 18-3

R2007a

New Aerospace Toolbox Objects 19-2

New Aerospace Toolbox Demo 19-2

R2006b

Introduction of Aerospace Toolbox Product 20-2

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 2-2.

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

Function or Function Element Name	What Happens When You Use the Function or Element?	Use These Functions or Function Elements Instead	Compatibility Considerations
			appropriate year in the igrfmagm function.

R2015a

Version: 2.15

New Features

Bug Fixes

`tdbjuliandate` function that calculates barycentric dynamical time for a given terrestial time date

The tdbjuliandate function calculates Barycentric Dynamical Time (TDB) for a given Terrestial 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
geoidheight **Note:** Only for the EGM2008 Geopotential Model. Aerospace Toolbox provides EGM96 Geopotential Model data.	Geoid Height **Note:** Only for the EGM2008 Geopotential Model. Aerospace Toolbox provides EGM96 Geopotential Model data.
earthNutation	Earth Nutation
moonLibration	Moon Libration
planetEphemeris	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
`VideoRecord`	Enable video recording.
`VideoFileName`	Specify video recording file name.
`VideoCompression`	Specify video recording compression file type.
`VideoQuality`	Specify video recording quality.
`VideoTStart`	Specify video recording start time for scheduled recording.
`VideoTFinal`	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 gravityspherical harmonic Function Supports New Planet Model

The gravityspherical harmonic 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
geoidegm96	Warns	geoidheight	Replace all existing instances of geoidegm96 with geoidheight.

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 gravityspericalharmonic 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 can not be compiled with the MATLAB Compiler™ software to create a standalone application.