GNSS SIMULATOR

# GENOS™

# Quick Start Guide

Revision Date: 6/6/2013

# Important Notice

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# Purpose

This Quick Start Guide provides Genos hardware and software users with instruction for accomplishing satellite simulation for GNSS receivers. In this guide you will find procedures to connect the Genos system, initiate a satellite simulation test, observe test results, and provide reports of the test results.

# Minimum Hardware Requirements

- Genos Simulator
- Genos Computer
- Ethernet 1 Gbe cable (provided with Genos system)
- RF Cable RG-58 (provided with Genos system)
- Passive antenna (provided with Genos system)
- 2 AC power cables for simulator and computer (provided with Genos system)

# Internet Requirements

Internet connection that is used to run Google Earth™. This connection can be wireless or wired.

Google Earth is used in creating custom trajectory paths. The Genos PC uses its only Ethernet connection for communicating with the Genos Simulator. The simulator does not have to be running to capture a Google Earth KLM file, so the Ethernet cable can be temporarily disconnected from Genos Simulator and connected to an Internet source.

# Genos Simulator Device


**Figure 1. Genos Device - Front Panel**

The front of the Genos device has the following features:

- **RF OUT Port**: Streams the simulated signal to receivers. This port can be connected directly to receivers via a standard RF cable. A splitter can be used in order to connect to two or three receivers. Future Genos versions will enable the connection of an antenna that will transmit the emulated signal.

- **Power On Indicator LED**: Indicates that the Genos firmware is properly loaded and operational.
- **Reset button**


**Figure 2. Genos Device - Rear View**

The back of the Genos device has the following features:

- **Ethernet Port**: Connects to the Genos PC via a Ethernet cable provided in the Genos package.
- **Power Button**
- **Power Inlet**: Universal AC power (110-230)

## Software Installation

The Genos Simulator System software is pre-installed and ready for use out-of-the-box. There is no need for further installation. Users will receive instructions for installation of updates as they occur.

Should you have problems with your software or any part of the Genos contact Frontline technical support. See Technical Support on page 14

## Hardware Installation

1. Connect the Genos PC to the Genos Simulator using the provided Ethernet cable.

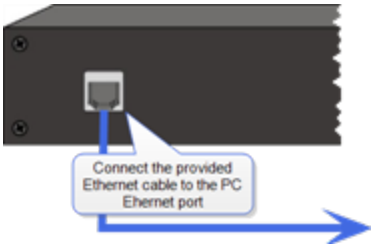


**Figure 3. Genos Simulator Left Rear Panel - Ethernet Port**

2. Connect the **RF Out** port of the Genos Simulator to the GNSS Device Under Test (DUT) - up to three receivers can be connected using a RF splitter(not provided).


**Figure 4. Genos Simulator Left Front Panel - RF Out Port**

3. For Closed loop option test connect each DUT to the Genos PC using a USB port. Each receiver should be connected to a different USB port on the PC.
4. For viewing the trajectory on a Google Earth map Connect the Genos PC to the Internet

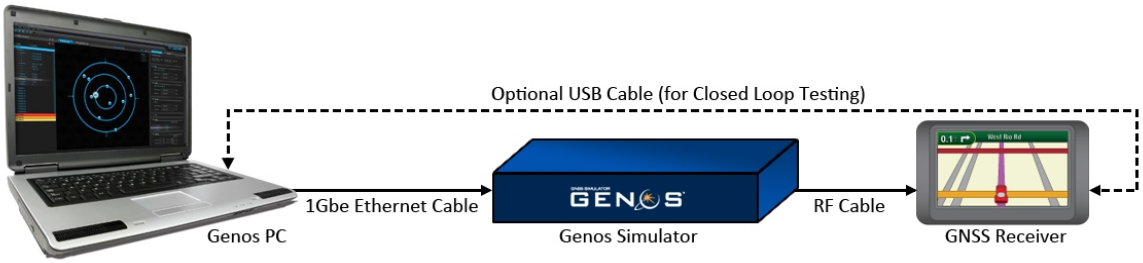


**Figure 5. Genos System Setup**

## Starting a Simulation

1. Power on the Genos Simulator. The power button is shown in Figure 2. Genos Device - Rear View on page 2.
2. Power on the GNSS DUT.
3. Power on the Genos PC. The Genos software automatically loads and the following window is displayed.


**Figure 6. Genos Simulator Shown on Genos PC**

4. The Genos system transmits simulated signals by clicking on the Play button. Genos comes out-of-the-box with a default trajectory (ongoing longitude, latitude, and altitude), satellite constellation, time period, dynamic, attenuation, Ephemeris and Almanac so it can start transmitting immediately.

   ***Congratulations, your GNSS receivers should now be receiving the Genos simulated GNSS signal.***

## Sky Map Tab

The Sky **Map** tab displays the position of the overhead satellites' azimuth and elevation according to the currently loaded configuration. The satellite constellation reflects their position relative to the user, at the defined date and time. As the simulated scenario progresses in time and along the trajectory, the Satellite Map visually reflects the satellites' movement along their orbits.

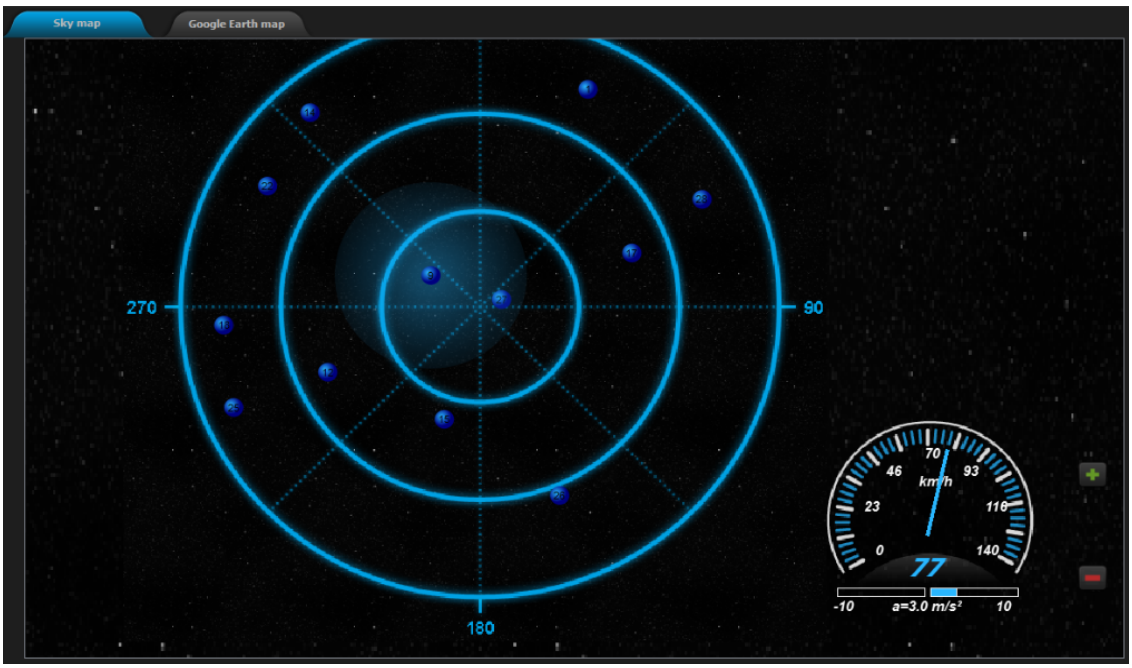


**Figure 7. Genos Sky Map Showing Satellite Positions Directly Overhead**

By default the **SkyMap** tab is displayed showing the orbit of the satellites of the currently selected satellite systems. The color of a satellite indicates its satellite system, such as GPS, Galileo, GLONASS, SBAS and EGNOSS, as shown in the Satellite System Legend in the bottom left of the window.

Each colored ball, representing a satellite, has an associated number, starting from 1 and going up to the number of satellites in that satellite systems. For example, the GPS satellite system shows satellites numbered from 1 to 32.

On the lower right-hand corner is a speed odometer that displays the current speed of the trajectory. Below the speedometer is an accelerometer. The accelerometer has two bars. The bar to the right shows acceleration, and the bar to the left shows deceleration. The length of the blue bar shows the amount of acceleration or deceleration.

## Google Earth Map™ Tab

The **Google Earth Map** tab displays on a Google Earth map the trajectory of the simulated signal and *when in closed loop mode* the output trajectory of the DUT receivers.


**Figure 8. Genos Google Earth Map™ Showing Trajectories**

The globe turns to show the position of the current configuration and starts displaying the trajectory path(s) on the map. A green line representing the Google Earth trajectory path is displayed with a yellow line, in this example, representing the DUT trajectory path while in *closed loop mode*. DUT path colors are selectable in Simulation Properties tab.

## Trajectory difference

The **Trajectory difference** displays the trajectory difference between the path transmitted by the Genos and the path that was transmitted by the DUT. This difference is presented as an **Overall difference** (in meters) or the **LLA difference** that was calculated separately in every dimension (longitude, latitude, altitude). Note: Trajectory difference is only displayed when operating Genos Simulator in *closed loop mode*.

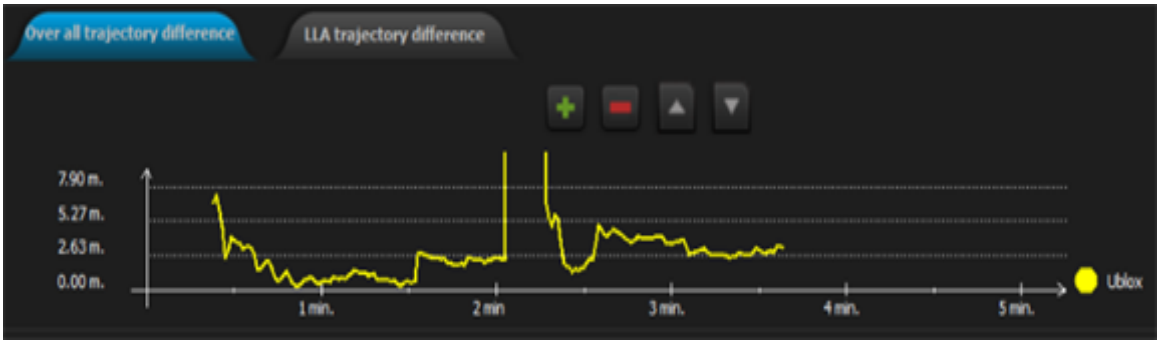


**Figure 9. Genos Simulator Overall Trajectory Difference**


**Figure 10. Genos Simulator LLA Trajectory Difference**

### Results Tab

This Tab is functionally divided into two parts, one is addressing test results and the other provides indication regarding the current state that is executed in automatic testing.
The test results part shows the following:

- Position transmitted by the Genos Simulator
- Position calculated by each of up to four receivers
- Receiver time.
- Errors between Simulator position and Receiver position in meters.

The bottom of the **Results** tab shows the commands of the test script as they are executed. The line that is currently running is displayed in red.

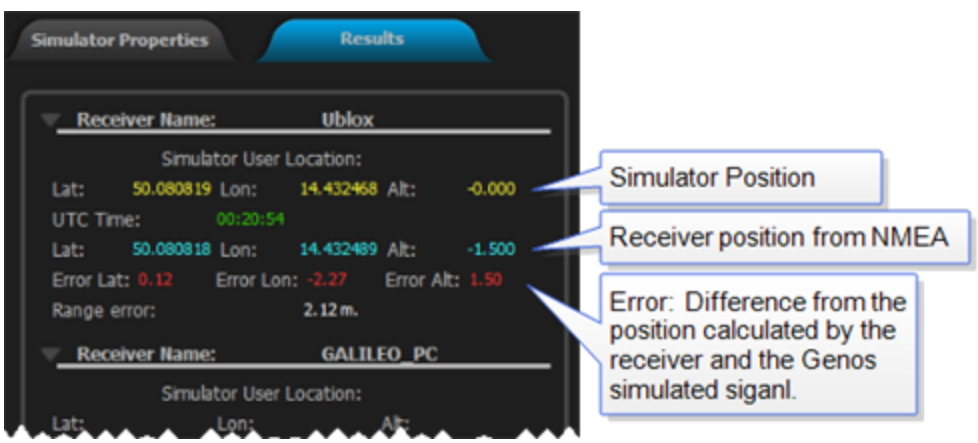


**Figure 11. Genos Results**

## Automatic Test

The Genos system is provided with a set of automatic tests for common GNSS simulation.

### Test Definition

The Genos has the following predefined automatic tests:

- TTFF - This test inspect the time the DUT requires in order to have a preliminary first result assuming that signals are received at 130 dB.

- Searching sensitivity– This test inspect DUT search sensitivity, the test starts by transmitting signals at -170 dB and inspecting if the DUT was able to recognize at least one satellite in this power level. If no satellite was found, after predefined time frame the Genos increases transmitted power and repeats the search. This test is repeated until at least one satellite is found and at this transmitted power level the system is looking for a position fix.
- Tracking sensitivity - This test inspect the DUT tracking sensitivity and report the positioning error of the DUT at every transmitted power level up to the point the DUT looses position.

## Running Tests

The following describes how to run Genos Simulator preconfigured tests or custom defined tests. Each test that you run is executed four times. The first test starts running immediately. Each subsequent test, runs at an offset of an additional three hours.

**To run a test:**

1. From the **TestReceiver** menu, select the **Run Scenario** option.

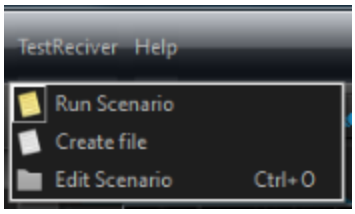


**Figure 12. Genos TestReceiver Menu**

2. To run a preconfigured test, select the **Run Scenario** option to display the list of predefined tests provided with the Genos or custom user defined test. Each option performs the test suggested by its name, for example, **Time to First Fix** tests how long it takes the receiver to get first fix. The user can select one or all tests to execute by checking the box next to the test. Click on the **Next** button to proceed.


**Figure 13. Genos TestReceiver Scenario Selection**

The user can select one or all tests to execute by checking the box next to the test.

3. You can then optionally fill in the test information window. This information is then included in the Genos results report.


**Figure 14. Genos TestReceiver Scenario Optional Information**

- **Produced by**: Specifies the name of the person or business running the test.
- **Results File Name**: Specifies the name of the text file (.txt )into which the results are to be saved.
- **Unit under Test Name**: Select the name of the receiver from the drop down list of available receivers.
- **Loop Scenario**: The number of times to execute the test .
- decrease power level - in case of multiple tests transmitted signal power can be decreased by 30 dB following an additional 69 dB reduction.
- **RMF File**: selected RMF trajectory file for the test.
- **Comments**: added comments will be appeared in the result file.

4. Click the **Start Test** button to start running the test.

While the test is running the results are visually displayed in the **Google Map™ tab**, the **Trajectory difference**, and the **Results tab**.

# Creating a Trajectory

The Genos PC is provided with Google Earth™ installed. This section describes how to use Google Earth™ to create a new trajectory and to convert it into Galileo's proprietary trajectory format (RMF – RGSN100 MGSN100 FGSN100).

To create a new trajectory:

1. Launch Google Earth, by selecting **Start Google Earth** from the Genos PC Desktop.


2. Select the **Directions** tab.
3. In the **Destinations** tab, in the **From** field, enter the starting location of the trajectory and in the **To** field, enter the destination.
4. Click the **Search** button. Goggle-Earth then draws the trajectory on the map, as shown below as a purple line.

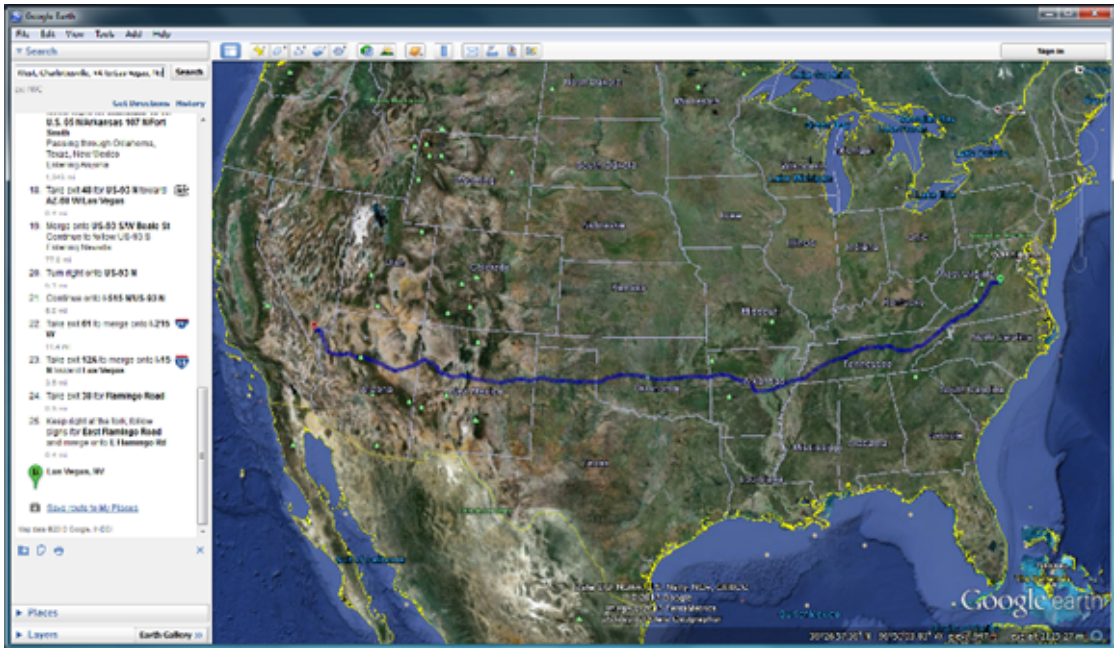

**Figure 15. Google Earth Directions Results to Define a New Trajectory**

5. In Google Earth expand the **Places** and scroll to **Route**. Rigth-click on **Route** and then on **Save As...**.

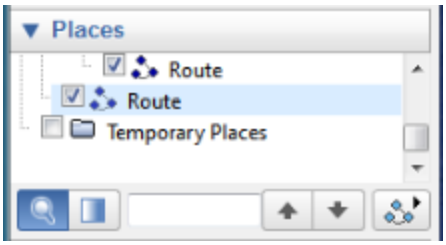


**Figure 16. Google Earth Places - Route**

6. In the **Save file...** window that is displayed, save the route as a KML file anywhere on the Genos PC, and record or remember the location.

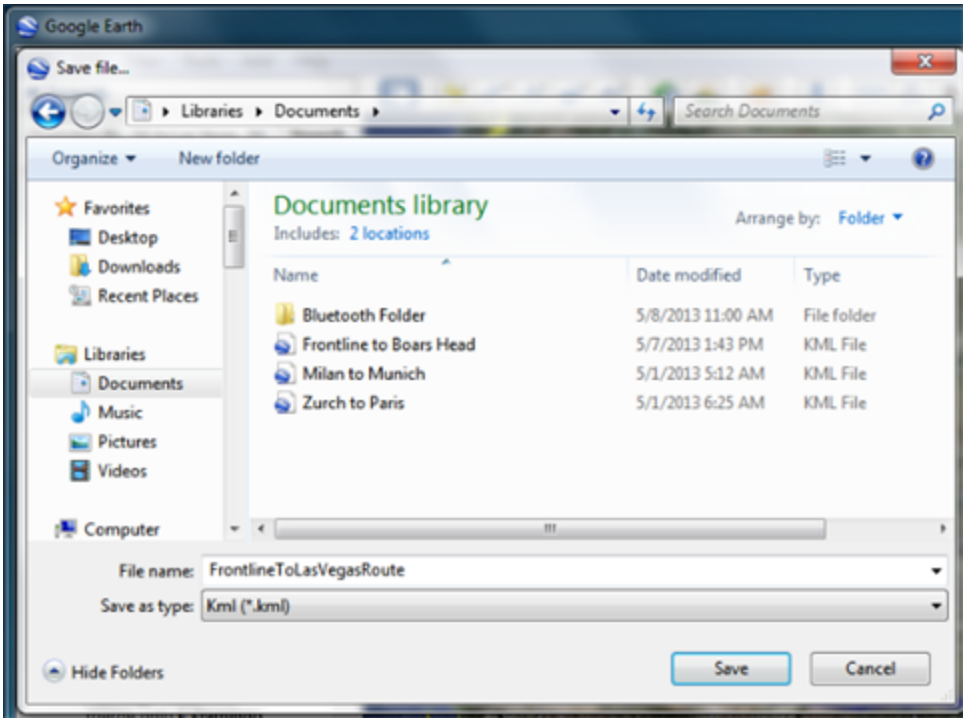


**Figure 17. Google Earth Route Save As... Dialog**

7. In the Genos **Menu** select **Tools**, **Trajectory File Conversion**.

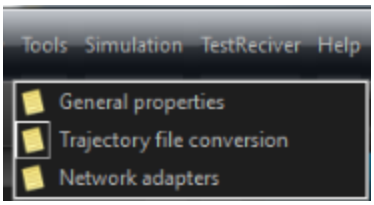


**Figure 18. Genos Tools Menu - Trajectory File Conversion**

8. In the Genos Trajectory File Conversion dialog provide the **Trajectory** and **Fix Point** information. At the **klm file** field click the browser button. Navigate to the saved KLM file.


**Figure 19. Convert Google Earth KLM file to Genos Trajectory RMF file.**

9. When the KLM file is selected click on **Convert to rmf file**. The RMF file is stored on the Genos PC Desktop in folder *Simulator-Install-release\Simulator_Installed64\deploy\data\RMF*. This is the default RMF file location. Once the conversion is completed you will be notified by the following window. Click the **OK** button.

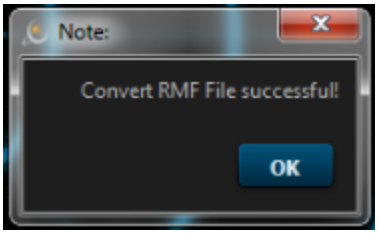


**Figure 20. Conversion from KLM to RMF complete.**

10. In the Genos **Simulator Properties** tab expand the **Trajectory** pane. Click inside the trajectory field and click the Edit icon  .

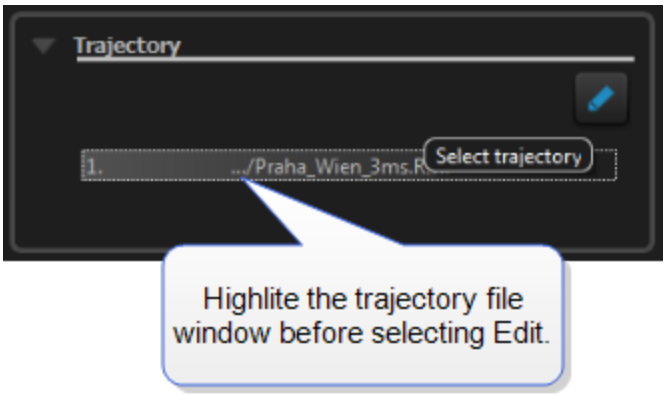


**Figure 21. Simulation Properties Trajectory Selection**

11. Select the trajectory RMF file that you just created, or what ever trajectory you want to simulate.

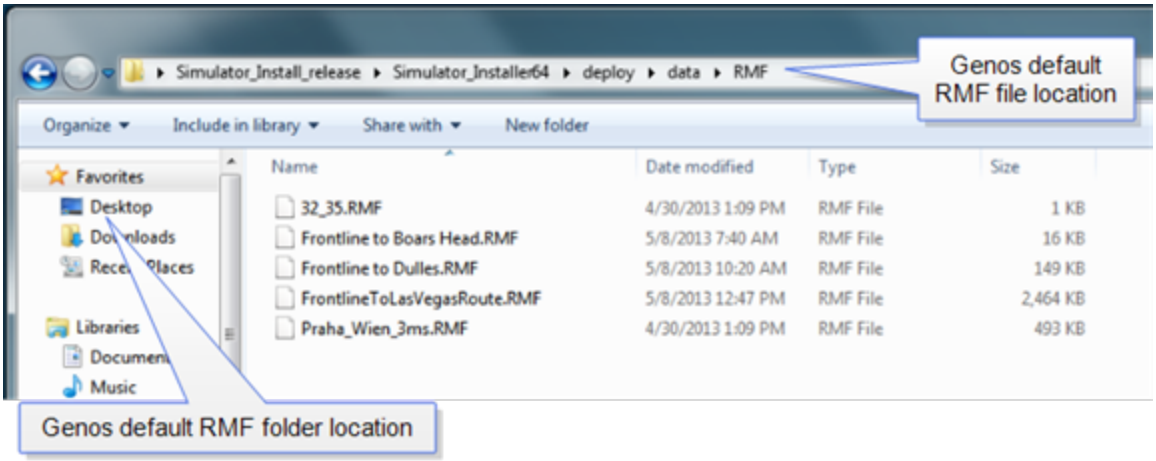


**Figure 22. Genos Default RMF File location.**

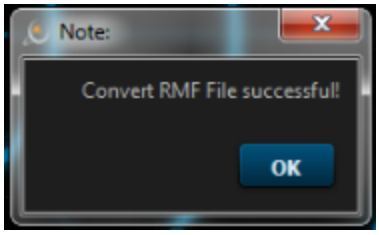


**Figure 23. Conversion from KLM to RMF complete.**

# Technical Support

Technical support is available in several ways. The online help system provides answers to many user related questions. Frontline's website has documentation on common problems, as well as software upgrades and utilities to use with our products.

Web: http://www.fte.com, click Support

Email: tech_support@fte.com

If you need to talk to a technical support representative, support is available between 9am and 5pm, U.S. Eastern time, Monday through Friday. Technical support is not available on U.S. national holidays.

Phone: +1 (434) 984-4500

Fax: +1 (434) 984-4505