



## GETTING STARTED

### CONSTRUCTING AND RUNNING A SCENARIO

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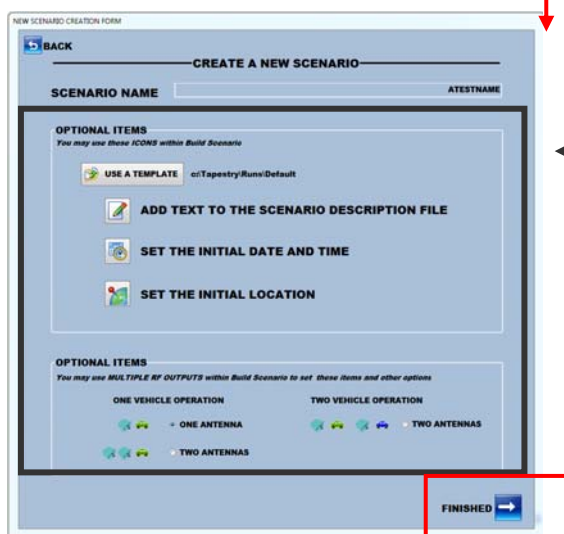
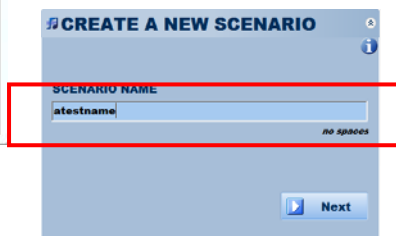
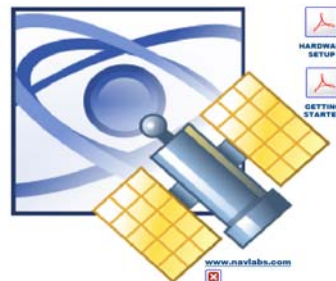
The Tapestry System is a software suite developed by Navigation Laboratories Inc. to provide a modeling and control gateway for our DIGITAL-GPS SIGNAL GENERATION ENGINE.

Tapestry supports both our Legacy and Modernized products. In either configuration, Tapestry blends together our Automotive, Inertial, and Closed Loop capabilities within a single compact design.

This document provides a brief a brief tutorial to help you build and execute a Scenario. Use this [link](#) for Hardware Setup.



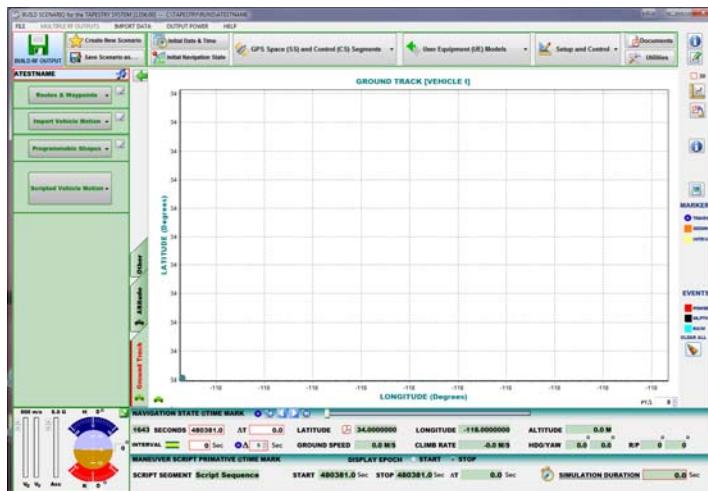
## CREATING A SCENARIO



[TAPSELL\\_CREATENew.PDF](#)

MAINSCREENLAYOUT.PDF

BEGIN CONSTRUCTING THE SCENARIO TO BE  
[ RUN ON THE DIGITAL HARDWARE ]



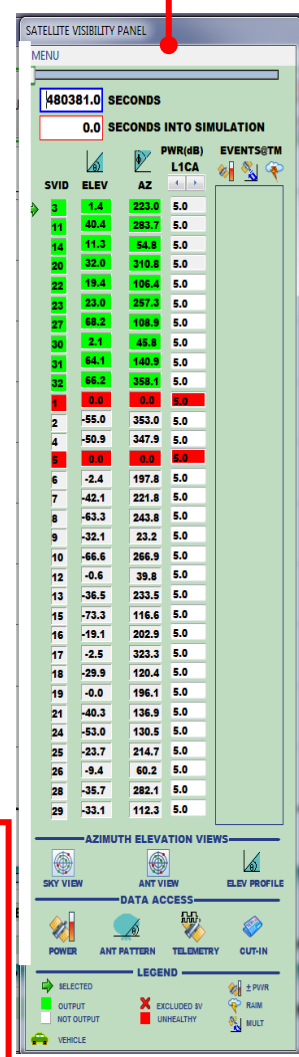
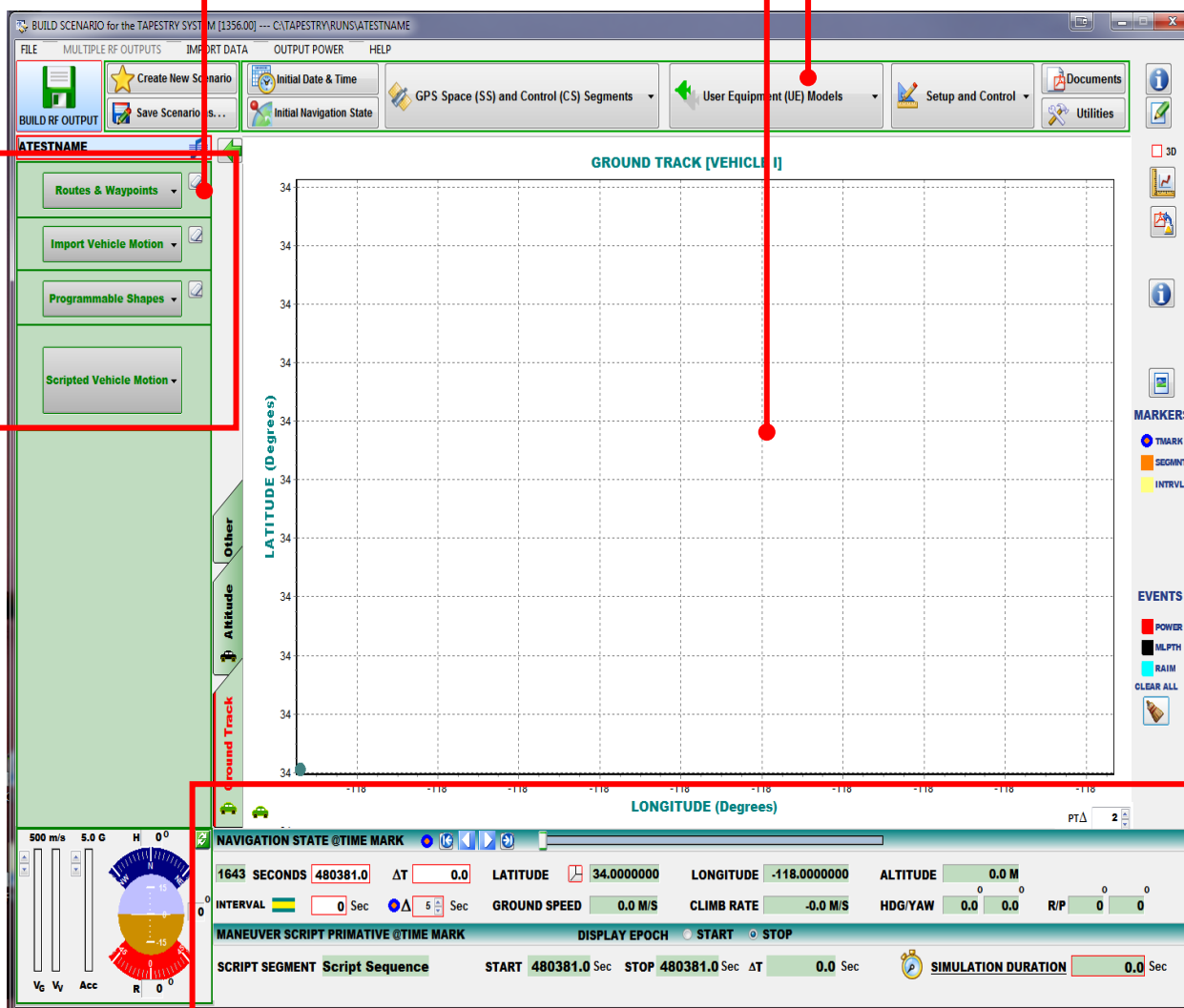
From the Main Form of BUILD SCENARIO we briefly touch on typical usage in no particular order.

## BUILD SCENARIO MAIN FORM

VEHICLE MOTION  
CONSTRUCTIONS OPTIONS

CONFIGURE SIMULATED  
VEHICLES

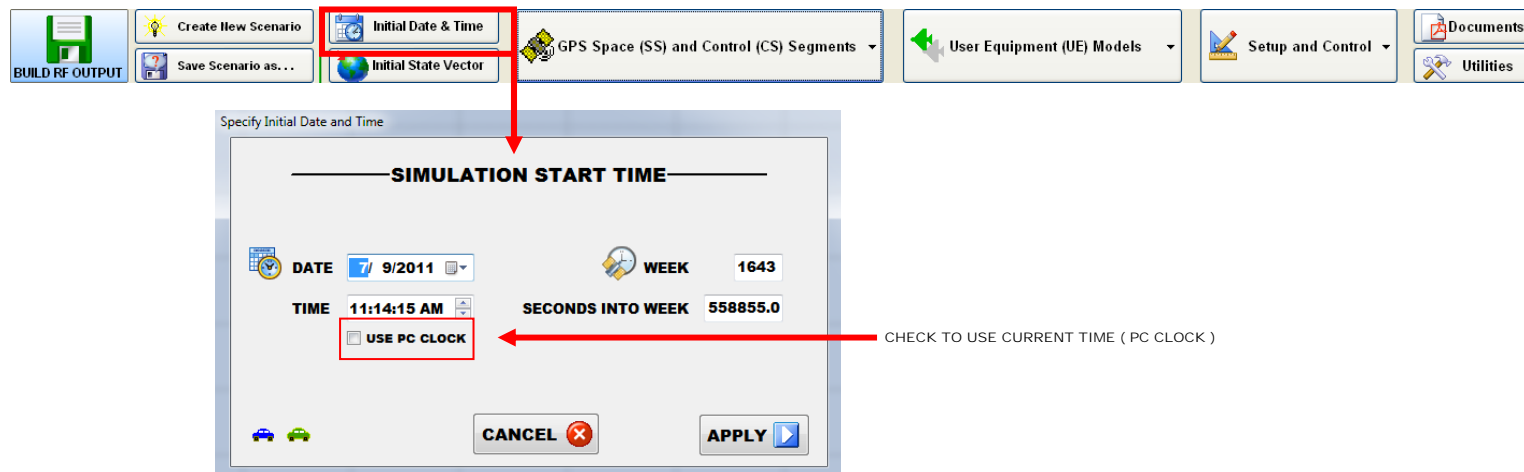
SATELITTE PANEL



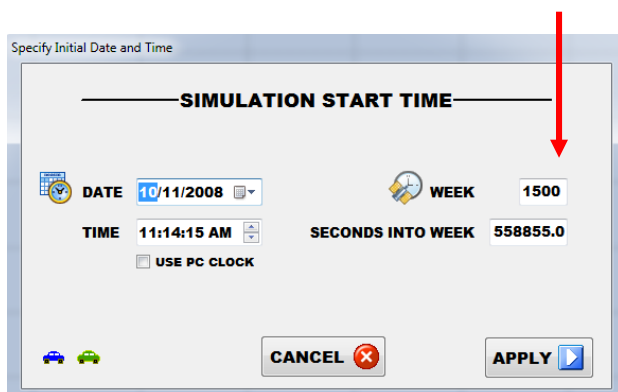
STATUS PANELS

## SPECIFYING THE SIMULATION START TIME

From the **Build Scenario** menu bar, select the [ **Initial Date & Time** ] Icon.



The [ **Date & Time** ] will be initialized with the Date and Time from the DEFAULT Scenario. For this example, change the week to 1500 and press apply:



**Build Scenario** will:

- **automatically**<sup>1</sup> propagate the GPS telemetry data in it's entirety to the simulation start time you've entered. There is no need to import a new Almanac because **Build Scenario** has synchronized everything. However, should you desire to do so, follow this link: [UpdateAlmanacDetails.pdf](#)
- **automatically** propagate Vehicle Motion (Trajectory) Data, Auxiliary Sensor Data, and any time dependant quantities synchronizing them with the new start time.
- **automatically** determine the correct SVIDS consistent with the new Start Time.

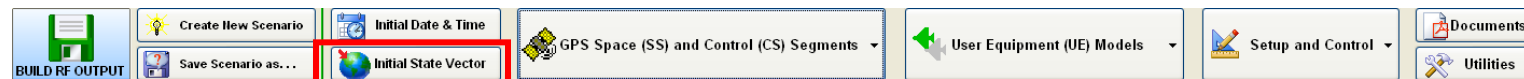
Note that you may use this control at anytime within the scenario construction process and **Build Scenario** will synchronize everything accordingly.

<sup>1</sup> The automatic propagation can be disabled via the [ **Program Setup and Control** ]



## SPECIFYING THE INITIAL VEHICLE LOCATION

From the menu bar select the [ **Initial State Vector** ] Icon.



Initial Vehicle Navigation State [Terrestrial and Spaceborne UE]

### INITIAL STATE VECTOR

**TERRESTRIAL USER VEHICLES [GEODETIC]**

☒ Use Terrestrial Script Motion Interface

Earth Centered Earth Fixed (ECEF)

Latitude <input checked="" type="checkbox"/> N 24 0 0.000	Latitude 34.000000°	X -2485034.263 Meters	Vx 0.000 Meters/Sec
Longitude <input checked="" type="checkbox"/> W 118 0 0.000	Longitude -118.000000°	Y -4673669.705 Meters	Vy 0.000 Meters/Sec
Altitude 0.000 Meters		Z 3546446.564 Meters	Vz 0.000 Meters/Sec
Speed 0.000 m/s	Heading 0.000°	Pitch 0.000°	Roll 0.00°

**SPACEBORNE USER VEHICLES [J2000 ECI]**

(Nominally) Space Craft Attitude

☐ Use Spaceborn Script Motion Interface


☐ Use BODY-to-INERTIAL Direction Cosines & Rates

☒ Nadir Pointing

X -3879637.612 Meters	Vx -262.295 Meters/Sec	$\mathbf{B} = \text{BODY-to-INERTIAL Direction Cosines } [3 \times 2 \times 1]$	$\mathbf{W} = \text{BODY-to-INERTIAL Rate in BODY}$
Y 3596995.789 Meters	Vy -283.178 Meters/Sec	Rotation about Body-X Axis [1] 0.000°	$W_{1B}^x$ 0.000°/sec
Z 3550478.886 Meters	Vz 0.276 Meters/Sec	Rotation about Body-Y Axis [2] 0.000°	$W_{1B}^y$ 0.000°/sec
		Rotation about Body-Z Axis [3] 0.000°	$W_{1B}^z$ 0.000°/sec

As with [ **Initialize Date & Time** ], the starting Vehicle Location is initialized from the Default Scenario. To change it, enter, e.g. S 34° and press:



- **Build Scenario**
- Translate the Vehicle Motion Trajectory and the associated Motion-Script to the new location.
- Compute all Sensor Data associated with the Scenario,
- Satellite RF-generation will automatically be computed consistent with the new location.
-  Details of this form (conventions, coordinate frames, etc.)

## CONSTRUCTING A VEHICLE MOTION TRAJECTORY (SCRIPT)

Vehicle Motion is an essential element of a GPS Constellation Simulator. Tapestry provides a number of different methods by which you can specify the G-forces and Angular dynamics peculiar to your application-specifications.

- **SCRIPTED**

A **scripted- trajectory** is a list of maneuver-primitives, one after another that in totality defines a complete vehicle flight path. Turn, Cruise, Climb etc. and associated parameters form the elements of the script.

**Scripting** is the easiest and fastest way to generate vehicle motion. Open this [file](#) and follow the **B** link for a bulleted overview of the Script Motion Generator built into Tapestry.

- **ROUTE**

A **Route-Trajectory** is a list of incremental steps or segments. These can be based upon a Map, a Shape, a Shape File, or a Bitmap such as a Goggle Map.

- **FILE IMPORT**

The **simulation-user** can import into Tapestry the contents of a file containing a complete vehicle motion profile. Tapestry supports a number of data-formats for importation. Read about importing your own data [here](#).

- **OPEN/CLOSED-LOOP**

Vehicle Motion is generated by the **simulator-user** and communicated real-time to the Tapestry kernel via a high speed data bus such as SCRAMNet. Read more [here](#).

## CONSTRUCT A MANEUVER SCRIPT


Within this document, we are going to generate a simple 1-G figure eight using the built-in **Script Motion Generator**<sup>2</sup>.

Locate the [ **Maneuver** ] icons on the Main Form.

Terrestrial / Projectiles



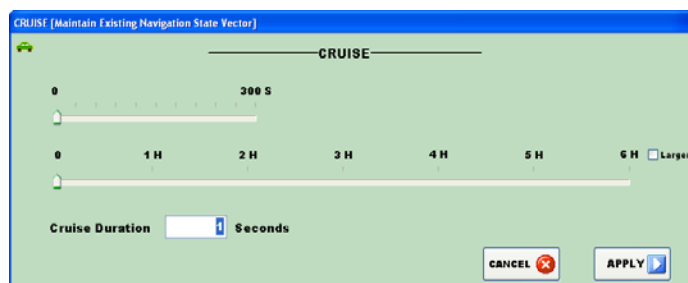
Spaceborne / Exo-atmospheric

 Find this control (LRHC) to switch between **Build Scenario** main screen views.



<sup>2</sup> Fidelity is very import as there ***must not be*** erroneous inputs injected into the receiver-under-test tracking loops from “algorithms” To this purpose, Tapestry uses a coupled 9<sup>th</sup> order differential (step) jerk-driven extrapolation technique to navigate correctly on and above the elliptical earth as defined by WGS84. ref: P.M. Lima, M. Graca /*Journal of Computational and Applied Mathematics* 61 (1995)

CLICK CRUISE

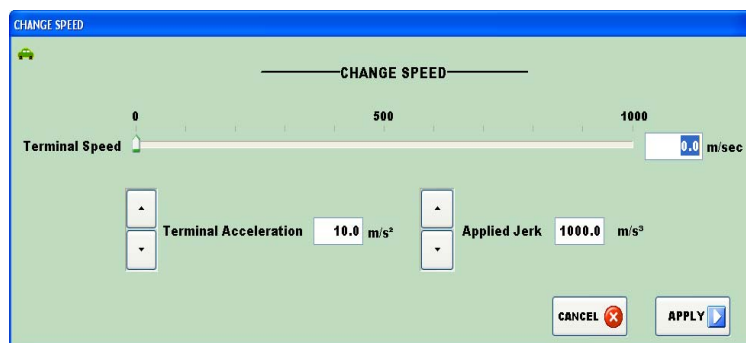


Enter 10 Seconds and press



The vehicle will maintain its current dynamic state for 60 seconds. Since we are initially stationary the vehicle remains at the starting point. If there had been an initial velocity, it would be dead-reckoned. The CRUISE is inserted into the maneuver script list box. The GUI is synchronized with the maneuver stop time.

CLICK SPEED



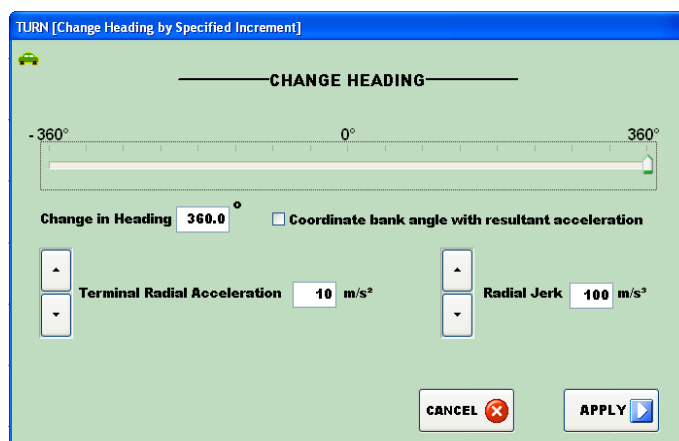
Enter 100 m/sec in the data form, accepting the suggested values for Acceleration and Jerk, press



The GUI is updated and the maneuver inserted into the script



CLICK TURN



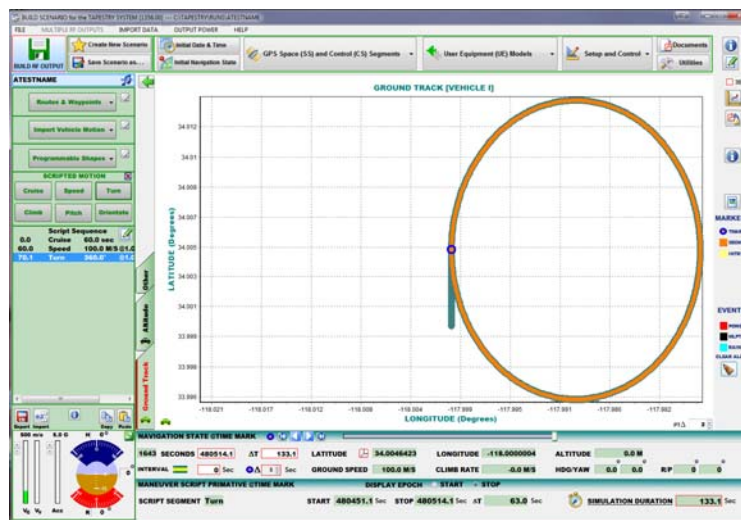
Drag the thumb pointer to + 360° accepting the suggested values for Acceleration and Jerk press



The Ground Track will look as shown. If you click anywhere on the Ground Track, the GUI will update and display the State Vector for the clicked time.

If you click on the maneuver segments to the left, the GUI updates and the selected maneuver ground track segment is highlighted.

If you prefer, you can step through the trajectory using the  $\pm$  counters on the Left Hand Corner of the Main Form:



CLICK TURN



**TURN [Change Heading by Specified Increment]**

CHANGE HEADING

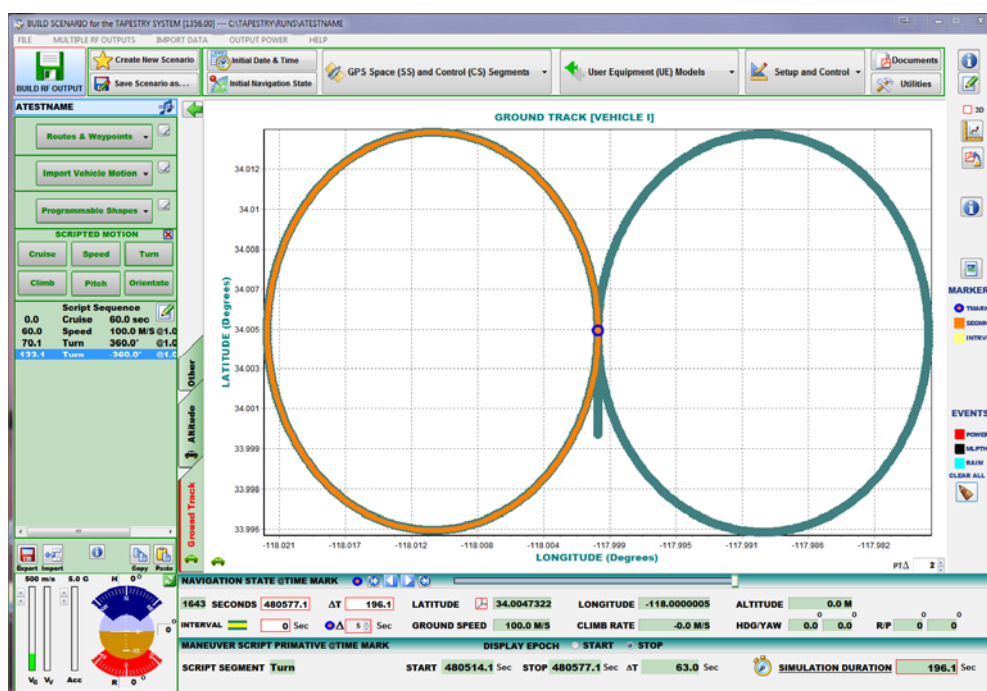
-360° 0° 360°

Change in Heading **-360.0** ☐ Coordinate bank angle with resultant acceleration

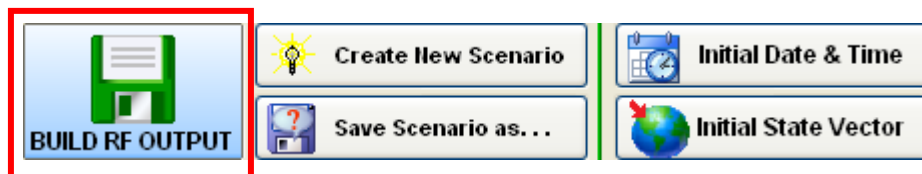
Terminal Radial Acceleration **10** m/s<sup>2</sup> Radial Jerk **100** m/s<sup>2</sup>

**CANCEL** **APPLY**

Drag the thumb pointer to -360° and press

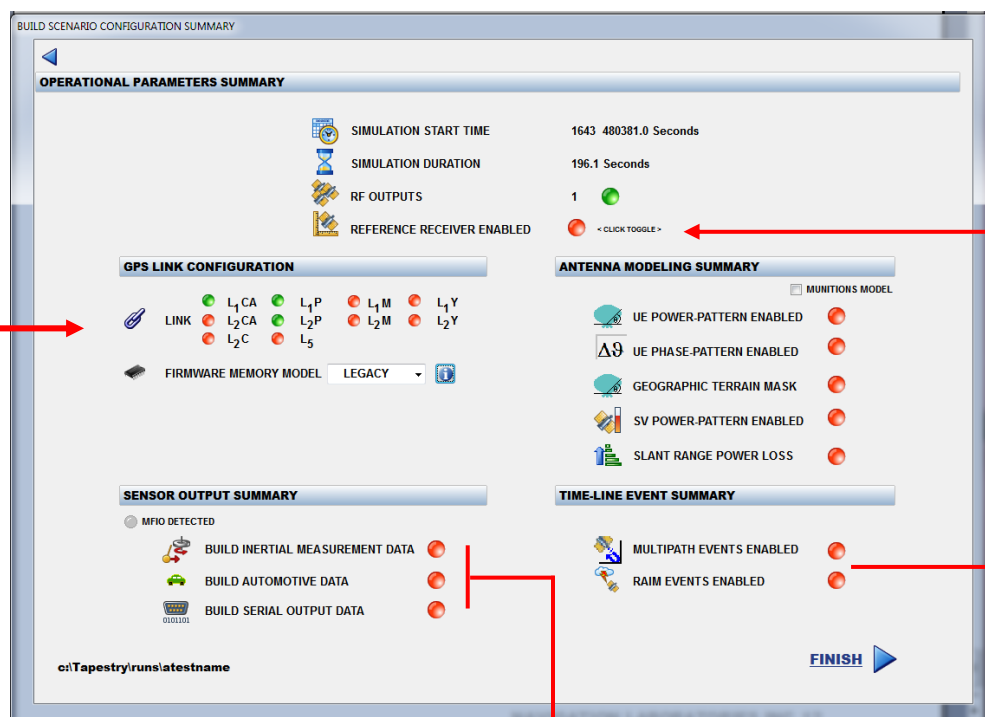


The GUI reflects the completion of a 1-G Figure Eight, all that remains is to [ **Build** ] the Scenario creating the final hardware files needed to **Run** the Scenario.



Clicking the BUILD Icon will display the **Build Scenario Configuration Summary** form similar to that shown below:

Click OK – **Build Scenario** will complete the database construction. Upon completion the Application will close and return you to the *Tapestry Shell* program. The **Scenario** is ready to run.



If you click on one of these ICONS, you may change the output signal characteristics.

TOGGLE  
REFERENCE  
RECEIVER ON/OFF

CLICK TO TOGGLE  
MULTIPATH OFF

CLICK TO TOGGLE  
RAIM OFF

CLICK IMU DATA OFF

CLICK AUTOMOTIVE DATA OFF

CLICK SERIAL DATA OFF

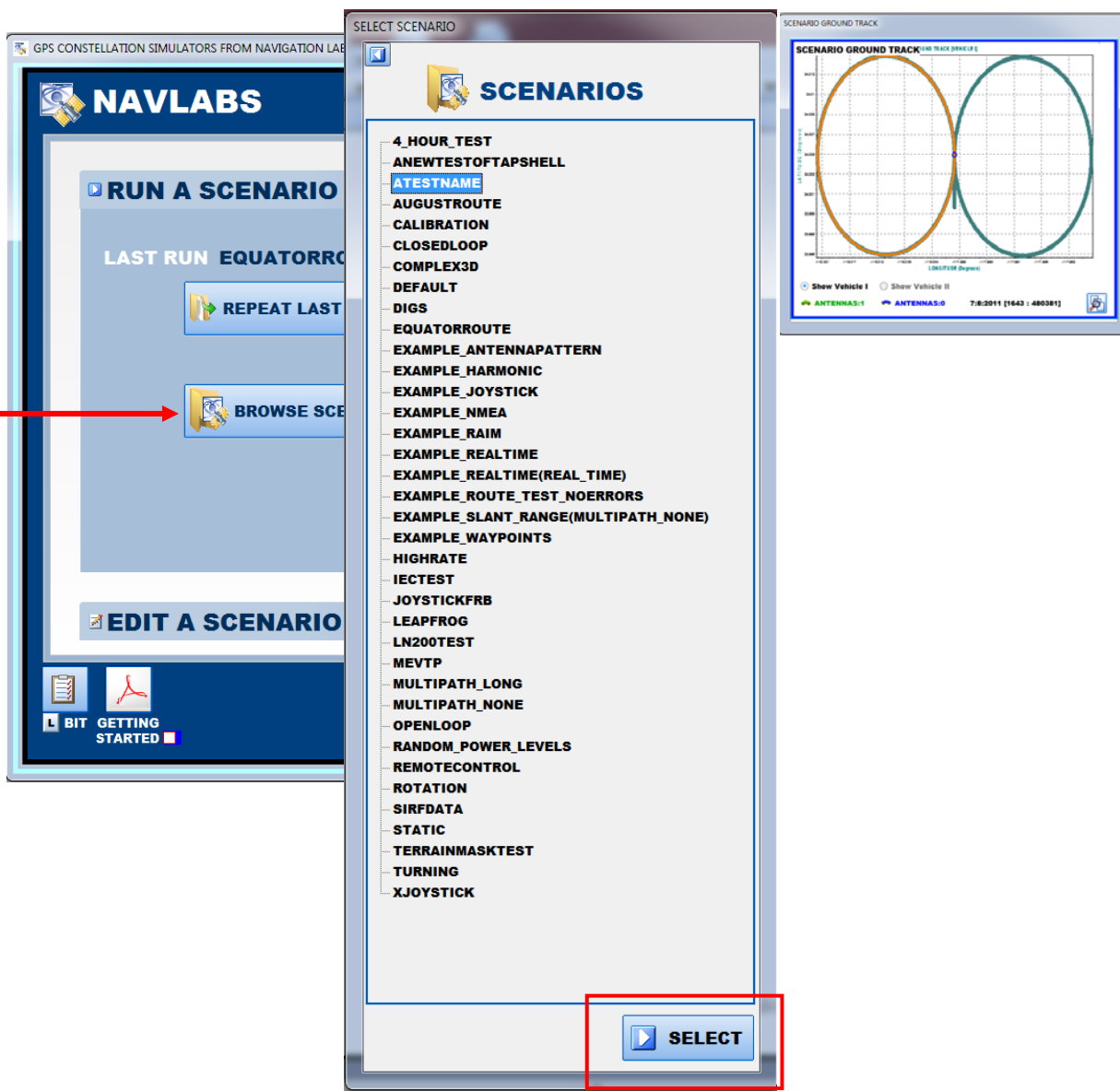
Click when you are satisfied with your configuration – *Build Scenario* will proceed with the database construction

## WE ARE READY TO RUN THIS SCENARIO ON THE HARDWARE

To **Run** a Scenario, select:

## Run a Scenario

SELECT  
ATESTNAME



THE RUN SCENARIO APPLICATION WILL START AND RF OUTPUT WILL COMMENCE



Before you move on, you will enhance your experience with the simulator if you take a moment to follow this link to use the GPS REFERENCE RECEIVER to monitor the RF Output from your scenario [Tapestry\Documentation\Manuals\Using the NavLabs Reference Receiver.pdf](#)

Follow this Link to learn more about The ***Run Scenario Application***  
<Tapestry\Documentation\Manuals\RunScenarioUsersGuide.pdf>

You should take note of the following items.

### **Display Settings**

The display settings are configured in the Windows Control panel. The program will operate correctly at 1900 x 1200 and at least 65536 colors.

### **Device Driver**

A custom device driver has been developed and is installed in the system device menu accessible from the Windows control panel. Do not change the settings for any of these devices.

### **Things you should be aware of.**

Tapestry has been extensively tested and we have discovered a few items that we have been unable to work around and the user should be made aware of them.

1. Incoming Serial Data. One of the most useful features of the Tapestry is the capability of capturing and displaying receiver under test data real-time within the real-time interface. However, if the receiver is connected -and outputting data - to the WindowsXP serial port during boot up, the Plug and Play BIOS will incorrectly try to load a serial mouse into the operating system. Our reference receiver will cause the same problem, which we try to catch and configure before shipping your simulator.

If this happens you will notice the mouse pointer moving and clicking all about the screen. If this happens to you, do not insert the Windows system CD-ROM when requested. Instead, click **Cancel** and the installation will be aborted. If you install the serial mouse drivers you will be unable to log incoming receiver data. See “Using the NavLabs Reference Receiver” for the proper solution to this problem

<Tapestry\Documentation\Manuals\Using the NavLabs Reference Receiver.pdf>

2. Expansion Boards. More often than not, these cause our Digital Simulation Engine to miss interrupts. Don't install any PCI devices without our knowledge.

3. Don't cut power to the simulator. This causes Windows XP to replace the current registry with a backup version. The backup version does not contain the proper settings for our device driver. Often cutting power can result in the device driver having to be re-installed. Always use the WindowsXP Shutdown command!

4. A Power Conditioner is strongly recommended. A voltage spike can cause the same behavior as a power outage and a probable failure of our device driver.

5. Backup. When we ship the simulator, we include a 2<sup>nd</sup> ghosted HD identical to the boot version within the simulator. You can install this disk in the (TOP) removable caddy and manually copy files over to the HD. We recommend, from time-to-time, you copy the c:\tapestry\runs folder to the backup drive. This will save all of your scenarios – everything else is recoverable.