Navigation Data Bit Editor

The Tapestry system is a software suite developed by Navigation Laboratories Inc. that provides a modeling and control gateway for the LabPro, LabPro Automotive, LabPro Inertial, and LabPro SCS35XX GPS Constellation Simulators.

The Tapestry system provides 16 channels of L_1 (C/A) or L_2 channels of L_1 (C/A, P), L_2 (C/A, P), L_2C, and WAAS. Additionally, all of these configurations are available in an optional 2-RF output configuration.

This document provides the details for using the NAVDATA Editor. The Editor provides bit-level access to the outgoing Telemetry Data from each GPS Satellite.

Preface

Build Scenario contains the **Telemetry Data Editor** that provides the editing functions for NAVDATA Telemetry in *Engineering format*. In contrast, the **Navigation Data Bit Editor** provides access at the *bit-level* to the downlink GPS Telemetry Data:

Legacy Sub-Frames 1, 2, 3
Legacy Sub-Frames 4, 5
Modernized L_2C/L_5 Messaging and Data
Modernized L_1M / L_2M Messaging and Data

It is important to note; The Tapestry system maintains two copies of the Telemetry. Both copies are initialized from the user inputs in **Build Scenario**. When the user edits the original or first copy of Telemetry Data with the **Navigation Data Bit Editor**, the second copy of the Telemetry is created. This copy – edited by the user – is broadcast at RF by the Tapestry **Run Scenario** application. The original copy is used internally by the **Build Scenario** application to generate the line-of-sight truth data for the simulator. This method was implemented to avoid the condition in which the user creates subframe messages that may cause computation errors in the truth model.

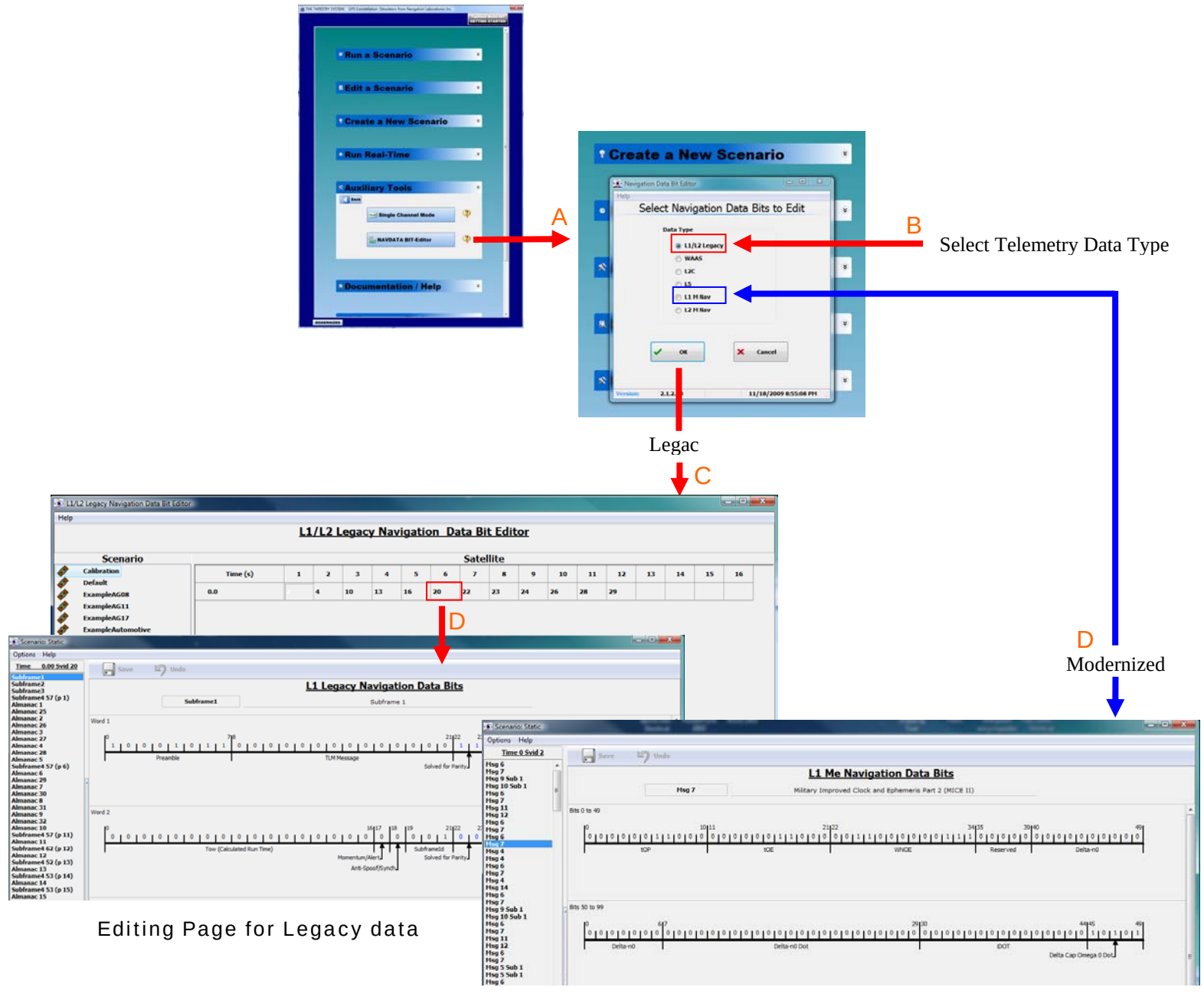
The remainder of this document provides an overview of the operational features associated with the **Navigation Data Bit Editor**.

To use this program properly, use the following sequencing:

- Run the **Build Scenario** application first – save and build the scenario
- Run the **Navigation Data Bit Editor** – modify the Telemetry Data as desired and save the results.
- Run the **Run Scenario** application – this will modulate the modified Telemetry onto the broadcast RF signal.
- Run the **Navigation Data Bit Editor** repeatably to implement additional data bit modifications (if desired). You do not need to run the **Build Scenario** application again.

Navigation Data Bit Editor

Invoke the **Navigation Data Bit Editor** by using the TAPSHELL application and selecting **Auxiliary Tools**. The following schematic illustrates the sequencing - ABCD.



Editing Page for Legacy data

Editing Page for Modernized data

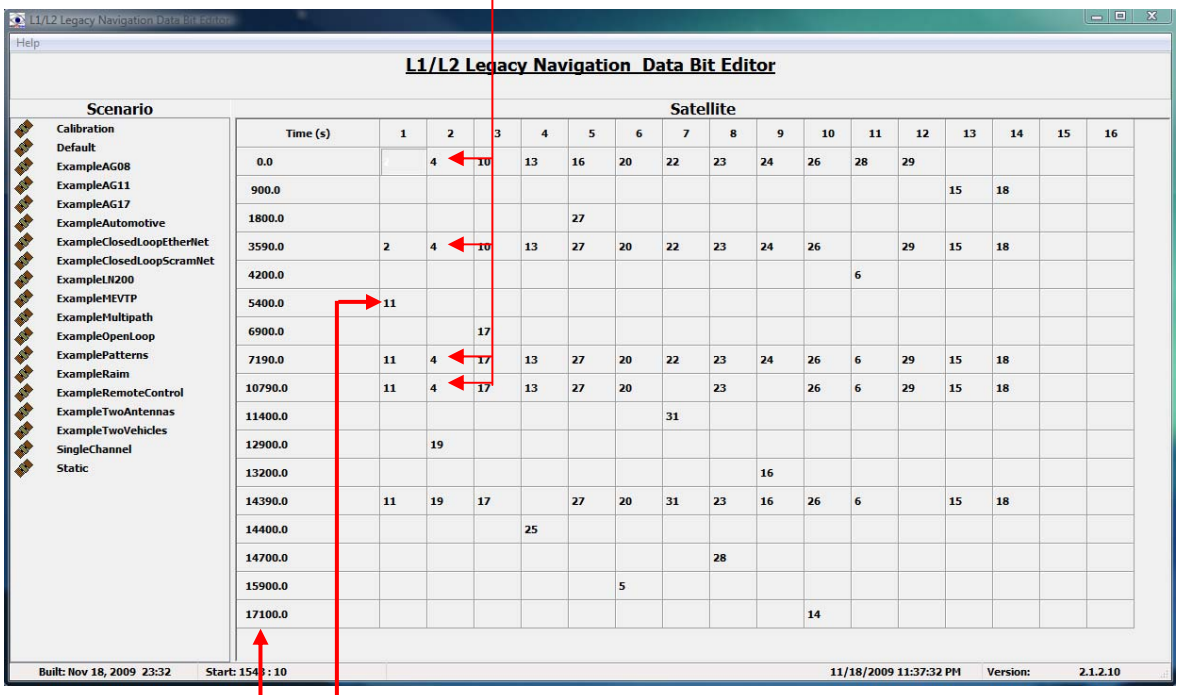
The Payload Page

Upon specification of the Data Type (step B) the Payload Page is shown.

The left hand display contains a list of available Scenarios. In the example shown above, we have selected the ***Static*** scenario. When a scenario is selected, the display is updated as follows:

Select the desired Scenario

Payloads for this Scenario occur on the hour



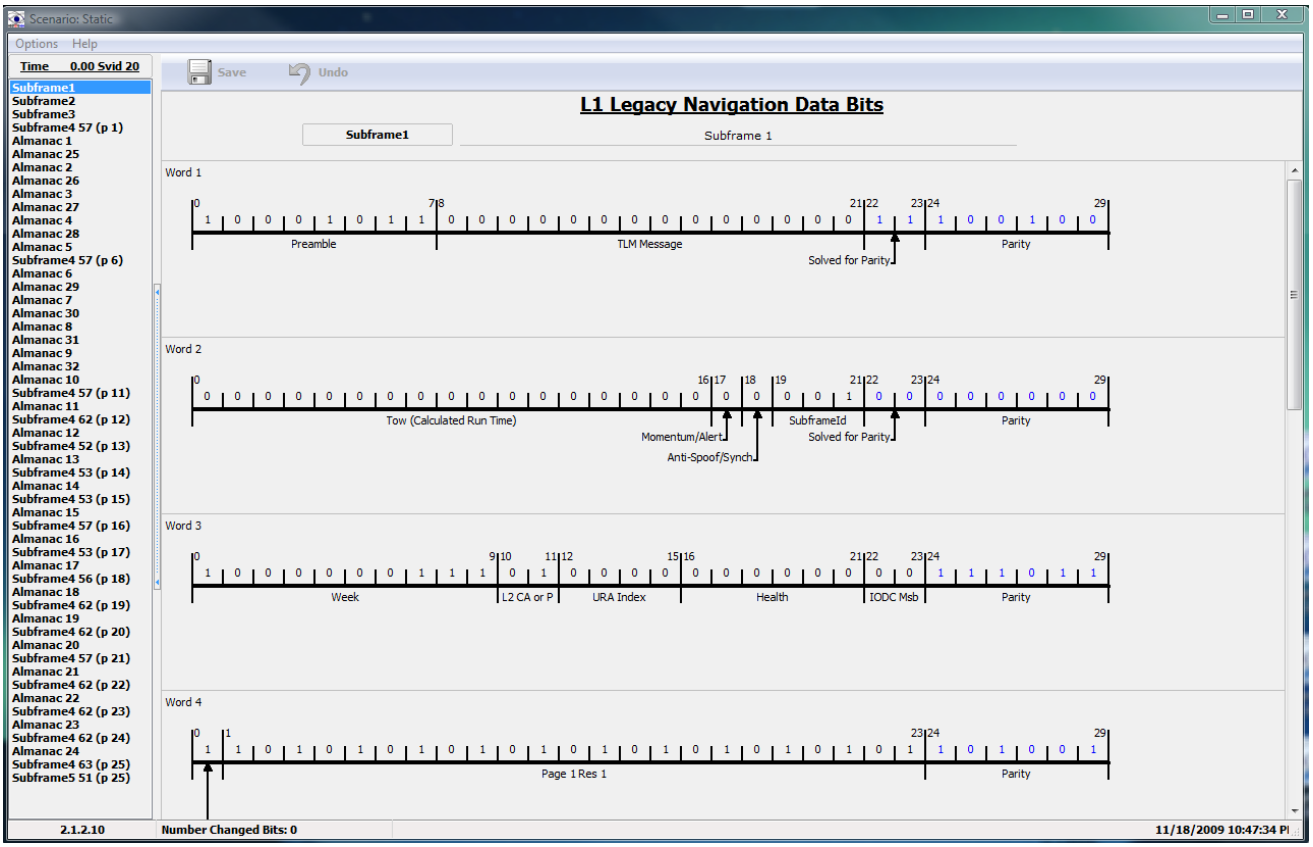
SVID | Payload selection Page

Time of Transmission (Seconds into Simulation)

As Satellites rise, during the Scenario, they are assigned to an available channel

Each satellite data payload can be edited as desired. In general the uploads don't change unless a new telemetry data set is created (see the **Build Scenario Application** for a description of how to create multiple data sets) or a satellite assignment on a given channel is changed or moved to another channel.

To edit the data bits for a particular satellite double click on the satellite desired. The following screen will appear:

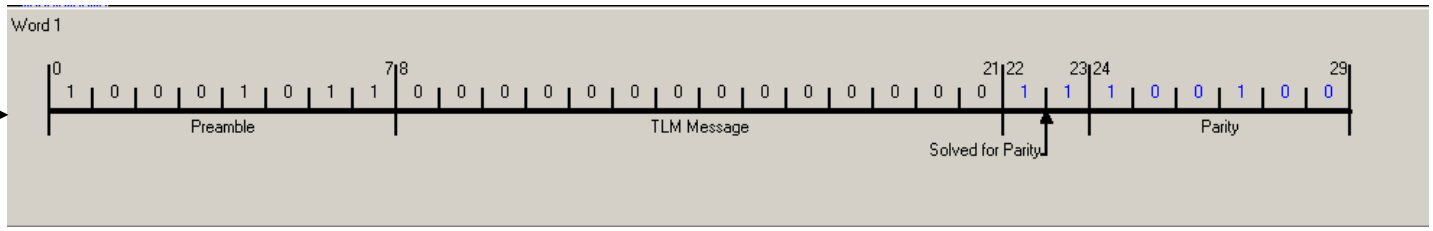


Editing Page for Legacy Data

Select desired navigation data segment

Editing the Payload

From the Editing Page, select the desired Message or SubFrame page. For example, this is the content of **word-1 of subframe 4 page 18**

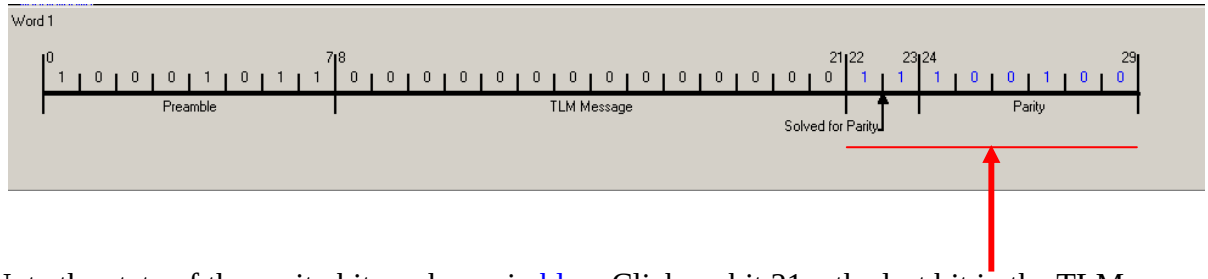


Click on the desired bit, entering either a 0 or 1 into the edit filed. You will note the parity numbers on the right hand portion of the screen – displayed in BLUE. There are two options for these bits that you may select:

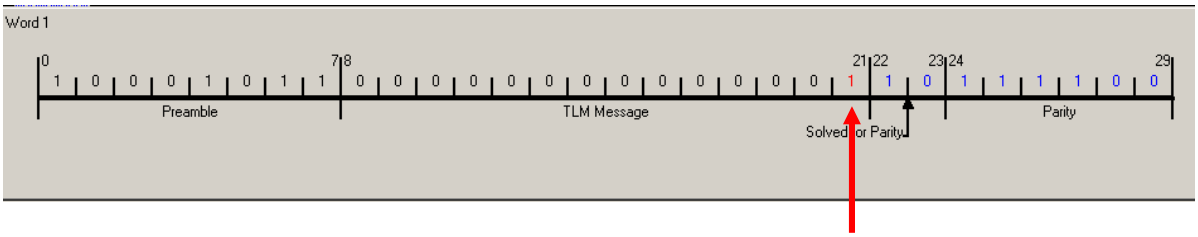
- **[Default]** They **will** be updated automatically – that is, the parity associated with the bit you just edited will be recomputed based upon your entry. In this mode you cannot edit the parity bits. Moreover, the parity bits just computed will always be valid.

- They **will not** update automatically based upon your editing within the data bit field. In this case you may generate parity errors and/or edit the parity bits just as you would the data field bits.

Consider our example, **word-1of subframe 4 page 18**



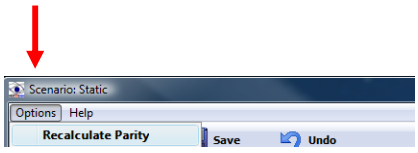
Note the state of the parity bits – shown in blue. Click on bit 21 – the last bit in the TLM Message. Enter a "1" into the bit field and you will obtain the following display:



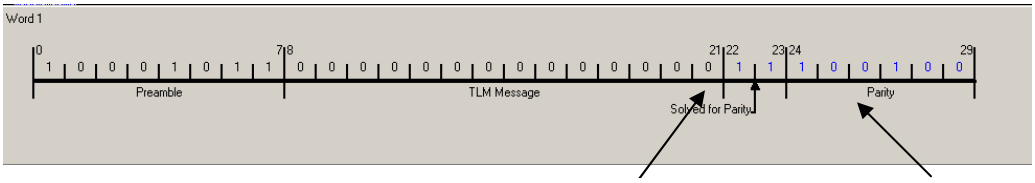
Note the changed bit – shown in RED. Note the parity bits – shown in BLUE - change automatically to reflect the correct parity for the word associtated with the bit field change.

If you try to edit one of the BLUE bits, you will find that you cannot. The parity for the word will always be correct in this operational configuration of the **Naviagtion Data Bit Editor**.

To change this behavior, use the "**Options**" pull down and click off the **Recalculate Parity** feature.



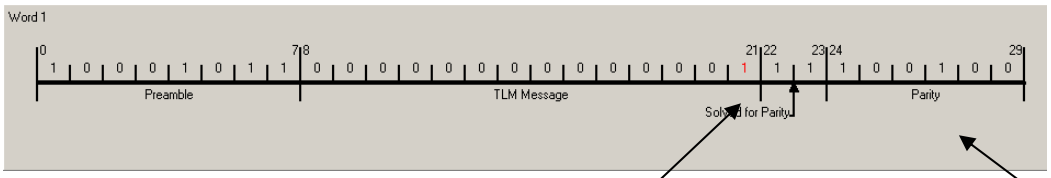
Edit bit 21 of **word-I of subframe 4 page 18** as before, the following behaviour results:



Original setting of Word-I bit 21

Parity is correct (11100100)

When the bit is edited, note the resulting display – in particular the parity bits. The parity keep the same value as before the edit (11100100). The parity of the new word is now **incorrect** – it should have been 10111100.

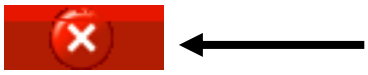


New setting of Word-I bit 21

Parity is incorrect (should be 10111100)

By **default** the setting is to recompute the parity automatically.

You may select another page of data to display from the menu on the left of the display. **When finished** select the **RETURN** button in the top right hand corner of the screen



Use the close button to exit the Data Page and return to the SVID selection page

You will return to the **Satellite Selection Page**. Either select another satellite or close the application. The data you have just created will be output at the appropriate time for the appropriate satellite ID. Note that the truth data associated with the satellite modeling in the simulator software will use the original subframe file as a basis for the truth model computations and not the copy you just created – that copy will be braodcast to the receiver under test via the RF output signal.

The **Navigation Data Bit Editor** is a very powerful program allowing for bit level control of the broadcast subframe data. For this reason, it is recommended that this program be used by experts in the operation and analysis of the data associated with the simulator.