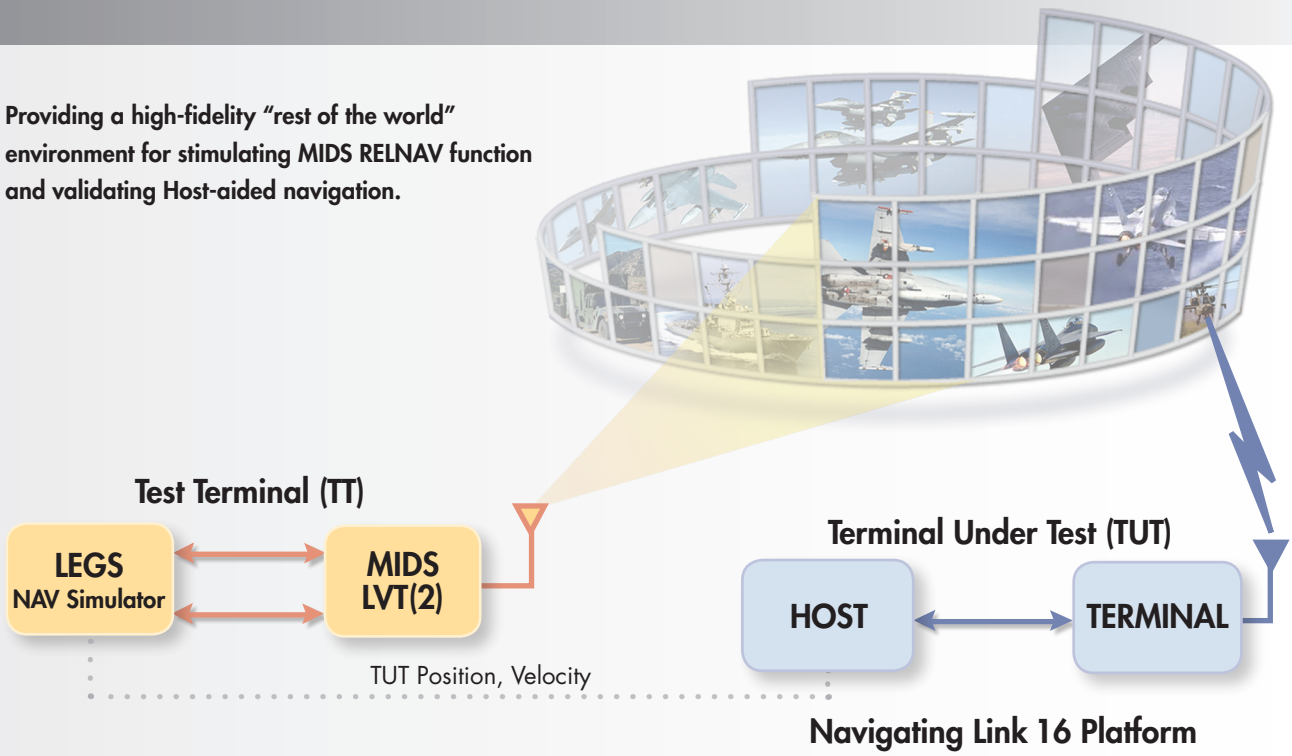
Link 16 Navigation Test Set

LEGS™ Upgrade

Providing a high-fidelity "rest of the world" environment for stimulating MIDS RELNAV function and validating Host-aided navigation.



All Link 16 terminals include a Relative Navigation capability called RELNAV. This function uses a Kalman navigation filter to combine GPS fixes, INS data, and Air Data Computer navigation data from the host with range data from other network participants to determine the position of the terminal. This is the position reported in the Precise Participant Location and Identification (PPLI) message. Periodic position fixes from the host are referred to as host navigation aiding. Mobile platforms may employ Link 16 RELNAV as the source of navigation data when GPS is degraded or denied.

To test the performance of the RELNAV function and verify the implementation of host navigation aiding in the mission computer requires a complex RF environment of multiple moving JTIDS Units (JUs). The ViaSat Link 16 Navigation Test Set generates this environment by simulating these JUs. Each PPLI transmission is delayed to represent the propagation time that a PPLI from the simulated unit takes to reach the Terminal under Test (TUT). The TUT measures this delay as a Time of Arrival (TOA). The TOA together with the position and quality measurements contained in the PPLI message becomes an input to the terminal's Kalman filter.

FEATURES

The simulation control software permits comprehensive testing of the Relative Navigation and Mission Computer Navigation Aiding functions in a laboratory setting.

Features include the following:

- PPLI messages are generated with TOA delays representing the slant range between the simulated JU and the TUT that, on average, are accurate to within nanoseconds.
- Over 100 JUs may be simulated, representing land, surface, and/or airborne units.
- PPLI position qualities, time qualities, TOA error, and even the atmospheric model, may be adjusted to introduce controlled, repeatable errors.
- The trajectories of JUs in motion are easily scripted using waypoints and standard path shapes such as a racecourse and figure eight.

The scripting of the dynamic tests is simple. Analysis tools are provided to quantify terminal performance and document anomalies. A single test analyst can modify the scenario, execute the test, analyze the data, and summarize the results at the rate of two to four scenarios per day.

In addition to accurately representing the PPLIs from multiple JUs, the Navigation Test Set accurately accounts for the Round Trip Timing (RTT) exchange between the TUT and the Network Time Reference. An RTT response that contains the correct TOA measurement, and is delayed the appropriate amount, answers each RTT interrogation from the TUT.

The test set calculates all delays on the basis of the slant range between the simulated unit and the TUT. TOA measurements made by the TUT are accurate to within nanoseconds. Whereas it used to take multiple terminals and special test equipment to present a dynamic Relative Navigation environment to a Class2 or MIDS terminal in a lab setting, now RELNAV can be tested in the lab with a single MIDS LVT(2) terminal and an upgrade to the ViaSat Link 16 Environment Gateway Stimulator (LEGS) host. Customers include Boeing St. Louis, Edwards AFB, and Warner Robins AFB.

Customers who already have LEGS may purchase this LEGS upgrade by ordering PN VA-022801-9005. The upgrade includes three days of advanced LEGS training on Navigation Testing.

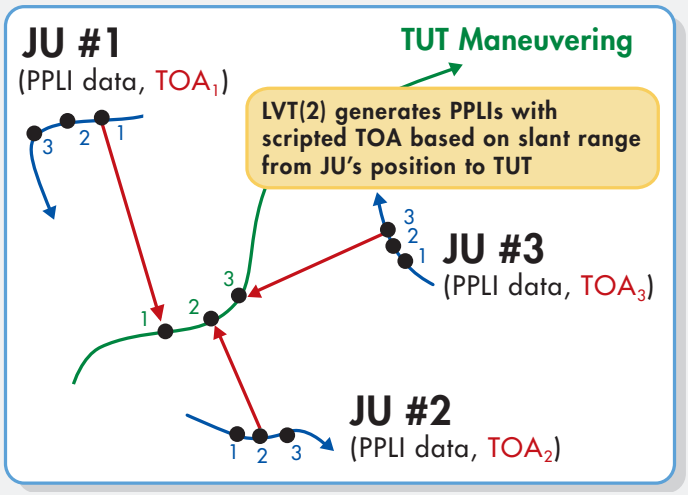
System Components

The MIDS LVT(2) replaces ViaSat's LinkS/S terminal for use in navigation testing. Pairing the MIDS LVT(2) with ViaSat's LEGS host allows the test engineer or analyst to completely and precisely control the RF environment that is used to stimulate a Terminal under Test (TUT). The paths of the simulated JUs and the TUT are specified in a script. A single test analyst can create and analyze up to four scenarios a day – and thus perform a complete regression test of the terminal in a few days.

A special Remote Interface Module (RIM) for LEGS is employed to execute the script that defines the flight paths of the simulated JUs. During execution, the TOA values are calculated 200 milliseconds in advance based on the slant range between the TUT and the simulated JUs. To support wrap-around testing, a RIM that emulates navigation host aiding as implemented in the F/A-18 or the F-16 permits a second LEGS to act as host to the TUT and provide periodic navigation updates. If mission computer testing is desired, ViaSat can work with a customer to integrate LEGS with the master simulator that is providing the navigation stimulus to the aircraft.

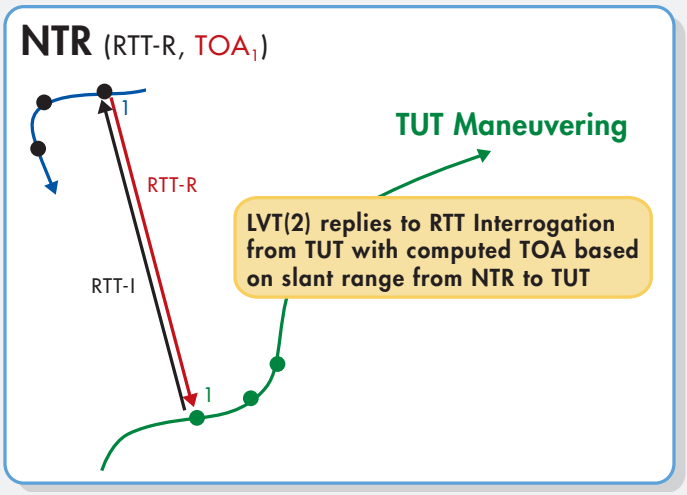
An important characteristic of the LEGS host is that it permits the injection of controlled errors, both in the RELNAV stimulation script and in the host navigation aiding data. The injections of known errors typical of those encountered in the real world in a controlled and repeatable fashion are essential to the evaluation of the terminal's navigation performance. This technique of introducing known errors in a controlled way can also be applied to reproducing problems encountered during live network operations.

LEGS includes a recording capability and analysis tools and methods necessary to extract, evaluate, and document the TUT's performance. The upgrade includes a 3-day Advanced Course in Navigation Analysis.



The ViaSat solution for navigation testing centers on a special test terminal with two important capabilities:

1) It is able to generate realistic PPLI sequences with transmission delays, and
2) It is able to respond to RTT Interrogations containing accurate TOA data and the appropriate transmission delay.



These delays simulate the propagation delay due to the slant range between the transmitter's position and the receiver's position and allow the receiver to make precise time-of-arrival measurements.

Customers who already have a MIDS LVT(1) may want to implement this capability in their terminal. Contact ViaSat for more information.

Ordering Information
Part Number:
LEGS Upgrade: VA-022801-9005
LVT(2): VA-019000-0031

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