ITT Modernizes Launch Ranges with STK

LIFTOFF: Range modernization programs aid all U.S. launches. *Photo: NASA.*

CONTACT: ITT used STK to analyze range instruments that monitor space missions from launch to orbital insertion. STK (above) shows acquisition of signal and loss of signal at each ground station.

For several years, the United States has been modernizing its launch ranges at Cape Canaveral, FL, and Vandenberg Air Force Base, CA. ITT Industries, Inc., of White Plains, NY, is integral to that effort, having won the U.S. Air Force Spacelift Range System Contract (SLRSC) in 2000. Under this 10-year agreement, ITT Systems Division, Colorado Springs, CO, provides modernization and sustainment of the two ranges.

ITT systems engineer Bill Napier, based at the Patrick Air Force Base SLRSC headquarters, works on a key objective of the contract: analyzing and evaluating the range instruments that monitor manned and unmanned missions from liftoff to orbital insertion. He has found STK to be invaluable at streamlining the volume of mathematical computations involved in this work, while providing essential analysis and information that tells his customer the most efficient and cost-effective means to reach its goals.

"Early in the first contract year we had to develop in-house capability fast," Napier says. "We determined that STK was the best product to meet our customer's needs in the shortest amount of time. Every analysis product we have delivered since then confirms that the decision to go with STK was the right one."

Napier's job entails analyzing reams of data to determine the best locations along the eastern and western coasts for placing instruments that track vehicles after launch, collect data from them, and send command/destruct signals to them if they veer off course and threaten people or the environment. He enters into STK flight profiles for the various Space Shuttle missions and expendable launch vehicles that fly out of Cape Canaveral and Vandenberg Air Force Base.

STK generates dynamic 3-D graphics to depict the times each tracking station first gains a signal from the space-bound vehicle to when it loses that signal. Using the STK/MATLAB Interface, Napier charts and graphs the data to aid in analyzing the optimal sites along the seaboard. He also designs the physical layout of the instruments at the sites and calculates the amount of land needed to hold the components, including radar, antennas, generators, and supporting systems. Napier must ensure that each instrument has enough uplink power and downlink signal margin to meet range-safety and range-user requirements. Here, again, he relies on STK and the STK/MATLAB Interface to narrow the combinations and size of assets that each site should contain. Assisting him on the project are Brian Norton, ITT senior software engineer, who produces MATLAB scripts; and John Daugharty, ITT command/destruct engineer, who delivers general support.

> "WE DETERMINED THAT STK WAS THE BEST PRODUCT TO MEET OUR CUSTOMER'S NEEDS IN THE SHORTEST AMOUNT OF TIME"

ADVOCATE: Bill Napier described how he uses STK at the 2004 STK Users' Conference.

"Realistic modeling and simulations of the proposed instrumentation suites, locations, and flight profiles are critical to the modernization program's success," says Napier. "STK has been essential for evaluating and validating the launch support systems and locations because of its iterative process, which previously wasn't possible."

In one instance, Napier evaluated whether to eliminate an existing West Indies site for one on St. Thomas, a U.S. possession. Because STK showed that vehicles went over the horizon at the St. Thomas site before mission commitments were met, it was removed as an option.

In all, Napier says, STK has saved him and his customer time and money, while mitigating risk. "STK analysis lowered the cost of placing sites by showing us the exact number we needed for optimization," says Napier. "STK analysis also reduced the amount of land we needed to buy for instrumentation and environmental impact, and it showed that we could use lower command/destruct transmitter power, alleviating the need for a larger transmitter. In addition, STK verified the proper parabolic antenna diameter, ensuring that we didn't buy one larger than was necessary."

To view Napier's launch modernization presentation from the 2004 STK Users' Conference, please go to *www.agi.com/ucresources.* ▲