

A CASE STUDY: MERCURY VISUALIZATION TOOL SIMULATES VIEWS NASA MESSENGER SHARES IMAGES OF UNEXPLORED PLANET WITH STK

Challenge:

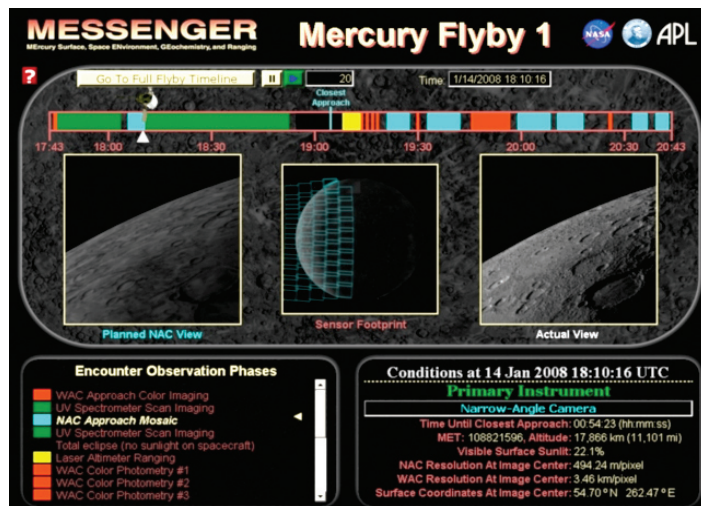
The MESSENGER spacecraft's scientific observation sequences left no time to transmit Mercury images to Earth until many hours after the flyby.

Solution:

The team leveraged AGI software to build a Web-based tool providing imagery from MESSENGER's perspective during close approaches prior to, during, and after the flybys.

Results:

AGI products quickly enabled accurate imagery to be sent in minutes, not days. STK's user-friendly GUI allowed a summer intern to easily understand the software. The innovative tool has garnered two technical awards.



Nearly 30 years after Mariner 10 first visited Mercury, the second mission to this mysterious terrestrial planet launched. MESSENGER (MErcury Surface, Space ENvironment, GEochemistry and Ranging), part of NASA's Discovery Program of lower-cost, robotic planetary exploration missions, has achieved flybys of Earth (1), Venus (2), and Mercury (2) during its 4-½ years in space. Jim McAdams, MESSENGER Mission Design lead engineer at Johns Hopkins University Applied Physics Laboratory (JHU/APL), applied AGI software with NASA Space Grant intern Kevin Webb to create a Web-based tool that provides simulated views of Mercury from MESSENGER's perspective during close approaches. Users of this tool during the Mercury flyby close approach were able to access simulated views of each planned image in real time on the MESSENGER Web site. The simulated images of Mercury, generated using STK's 3-D visualization capabilities, and corresponding image resolution and spacecraft range data, were loaded for Internet-based viewing prior to, during, and after the flybys. AGI's STK/Astrogator software is also being implemented for trajectory correction maneuver (TCM) design.



McAdams and Webb made the tool not only interactive, but able to display simulated images very quickly. "The MESSENGER spacecraft's scientific observation sequence during its first Mercury encounter [Jan. 14, 2008] left no time to transmit Mercury images to Earth until

many hours after the flyby," McAdams says. "This would leave the worldwide Web audience and on-site media with no new images to display until more than a day after the flyby." Since engineers at APL were already using STK software to define a detailed spacecraft model and to illustrate instrument pointing, McAdams leveraged the software too—saving time and cost. "STK's user-friendly graphical user interface enabled my summer intern to easily understand the software."

STK/Astrogator, combined with STK's 3-D visualization capabilities, defines the locations of the spacecraft and Mercury, spacecraft attitude, sensor definition, sensor pointing, and timing for each of the targeted science observations. "One advantage of STK was the ability of the camera path editor to keep the apparent size of Mercury nearly constant through large variations in range from the spacecraft to Mercury," McAdams says.

"The application of AGI tools in innovative ways was a contributing factor in my award as the 2008 Engineer of the Year Award (Baltimore section) from the American Institute of Aeronautics and Astronautics (AIAA) and in the recent MarCom award for the Mercury Flyby Visualization Tool," McAdams says.

MESSENGER will fly by Mercury one more time in September 2009 before becoming the first spacecraft to orbit Mercury in March 2011. For more on the mission and the Mercury Flyby Visualization Tool, visit <http://messenger.jhuapl.edu>.

Image courtesy Johns Hopkins University Applied Physics Laboratory.

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