The Mission Planning Lab: A Visualization and Analysis Tool

Sarah C. Daugherty, Benjamin W. Cervantes

***Abstract*—Simulation and visualization are powerful decision making tools that are time-saving and cost-effective. Space missions pose testing and evaluation challenges that can be overcome through modeling, simulation, and visualization of mission parameters. NASA Wallops Flight Facility capitalizes on the benefits of modeling, simulation, and visualization tools through a project initiative called The Mission Planning Lab (MPL).**

***Index Terms*—simulation, software integration, visualization.**

I. Introduction

THE Mission Planning Lab (MPL) is a project designed and developed by the Wallops Systems Software Engineering Branch. The purpose of MPL is to use simulation and visualization to aid in the planning and decision making processes of a mission project. MPL provides a mathematically correct, visually rich environment that allows realistic simulation, presentation and evaluation of platform selection, flight profiles, and range asset placement. By integrating detailed information on vehicle capabilities, range capabilities, and mission specific objectives, MPL meets several critical needs for the Wallops Research Range, including accurate and timely decisions about vehicle trajectories, attitude maneuvers, and ground range asset usage in order to successfully meet mission objectives.

II. Methods

The goals of MPL are accomplished through four main avenues: visibility, feasibility, variability, and certainty.

A. Visibility

MPL provides visibility for a mission by representing a variety of mission aspects in visually-rich 2-D and 3-D environments. Mission aspects that can be visualized in MPL include dynamic, detailed 3-D models, Geographic Information Systems (GIS) data including high resolution imagery, terrain, and population data, dynamic spacecraft and launch vehicle trajectory and attitude data, magnetic field modeling, radar coverage, and line of sight.

B. Feasibility

MPL provides mission decision makers with the knowledge to decide if a mission can be accomplished. MPL reflects mission feasibility through ground and space-based assets tracking line of sight to spacecraft or launch vehicles, link margin analysis reports, and trajectory formulation to meet mission requirements.

C. Variability

MPL provides the ability to adjust various vehicle and mission characteristics to improve mission operation or success. As a visualization tool, MPL can display multiple trajectories and attitudes for comparison in conjunction with other mission parameters such as mobile telemetry and radar assets. Simulating the variability of a mission allows customers to make cost benefit or mission assurance decisions.

D. Certainty

MPL can represent the accuracy of calculated mission parameters, through its sophisticated 3-D graphics or detailed output reports and graphs. The most valuable aspect of MPL verifying and validating mission certainty is in comparing pre-flight results of MPL with post-flight analysis incorporated inside MPL.

III. Results

To increase flexibility and ease of customer service, MPL produces a variety of deliverables that are versatile and mobile. The deliverables range from an entire simulation and visualization environment to text file reports of specific parameters. MPL provides pre-flight and post-flight mission analysis, mission visualization, radar link analysis, and custom reports and graphs. MPL has yielded a real-time spin-off.

IV. Conclusion

Missions supported by MPL have seen many benefits due to the rapid mission prototyping and visual capabilities. MPL allows project managers, engineers, and scientists to catch potential risks and issues early in the project development cycle, saving time and money. Post mission modeling through MPL also offers benefits to investigators of mission anomalies by showing customers what actually happened in a rich

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S. C. Daugherty is with the National Aeronautics and Space Administration's Wallops Flight Facility, Wallops Island, VA 23337 USA (phone: 757-824-2283; e-mail: Sarah.C.Daugherty@nasa.gov).

B. W. Cervantes is with the National Aeronautics and Space Administration's Wallops Flight Facility, Wallops Island, VA 23337 USA (e-mail: Benjamin.W.Cervantes@nasa.gov).

visualization environment enhanced with reports and graphs.