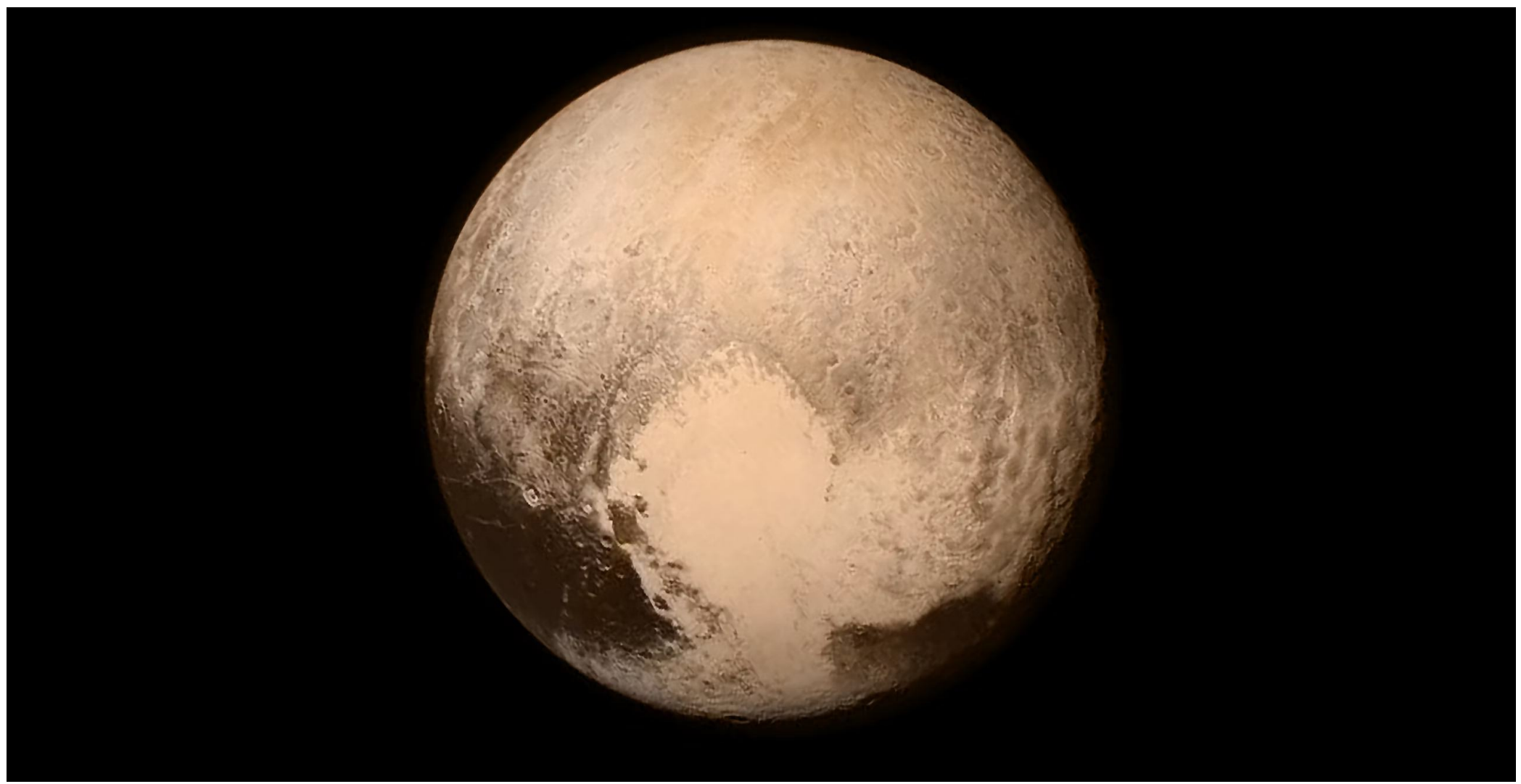


G A L O R A T H

Parametric Method Helps NASA Estimate Pluto Mission Costs



NASA achieves accurate cost estimates with SEER-H™ software for its unmanned Pluto mission.

Background: NASA's Marshall Space Flight Center (MSFC) uses parametric cost estimation to make early cost estimates for a proposed mission to Pluto. Early cost estimates are crucial for budget approval and evaluating various approaches when they can significantly impact the program's cost. MSFC employs a government-developed aerospace cost model, which, though effective at a high level, often lacks the granularity needed for subsystem comparisons. To address this, MSFC has turned to commercial software like SEER-H™, which offers detailed models and an extensive database for generating accurate system, subsystem, and component cost estimates based on real-world experience.

Pluto remains the only planet in our Solar System not yet observed close-up by spacecraft. Studying Pluto is challenging due to its distance and small size. NASA planned to launch the Pluto-Kuiper Express to conduct the first reconnaissance of Pluto and its moon Charon, using advanced technologies to explore the outer Solar System cost-effectively. The mission's goals included characterizing the geology and geomorphology of Pluto and Charon, mapping surface composition, and analyzing Pluto's atmosphere.

Need for a Lower-Cost Approach

Outer Solar System missions are inherently complex and costly. Funding limitations led NASA to cancel the original Pluto-Kuiper Express mission. To address this, NASA solicited proposals for a simpler, less expensive mission under \$500 million.

The proposal emphasized mission success while minimizing costs through careful design and cost management.

MSFC, along with Teledyne Brown Engineering, Los Alamos National Laboratory, and NASA Glenn Research Center, formed a team to meet this challenge. The engineers developed multiple design alternatives and used parametric costing methods to estimate costs accurately. The NASA/Air Force Cost Model (NAFCOM96) provided high-level estimates, while SEER-H™ offered detailed subsystem-level analysis and risk assessment.

Subsystem-Level Analysis

"NAFCOM is excellent for system-level analysis," said Mahmoud Naderi, aerospace technology technical manager at MSFC. "However, it doesn't capture differences at the subsystem level. SEER-H™ complements NAFCOM by providing detailed subsystem-level estimates and analyzing risk factors. It allows us to capture technical details and incorporate them into our cost analysis."

SEER-H™ features approximately 40 knowledge bases for electronic and mechanical elements. It focuses on development and manufacturing cost estimation for low-volume production. The software estimates costs based on the number of components, providing realistic results. SEER-H™ also offers sensitivity analysis to determine the impact of specific project factors, enhancing the accuracy and efficiency of cost estimates.

Generating the Parametric Model

Charles Hunt, a NASA industrial engineer, analyzed proposals for the new Pluto-Kuiper Belt mission using SEER-H™. "I transposed technical specifications into SEER parameters and generated the initial model in two hours," Hunt said.

"The model provided immediate feedback to engineers, prompting them to refine their specifications. We iterated quickly, improving the model's accuracy. SEER-H™'s database enhanced the accuracy by comparing new designs with historical data. I will continue updating the model as the project evolves."

SEER-H™ and other tools enabled NASA to develop a realistic, well-documented budget for congressional approval. The software's ability to quickly evaluate alternative approaches saved time and guided engineers toward cost-effective solutions. If approved, the SEER model will be further refined for subassembly and component decisions, helping manage costs effectively throughout the project.