NASA SBIR 2016 Phase I Solicitation

S5.04   Integrated Science Mission Modeling

Lead Center: JPL

Participating Center(s): GSFC, JSC, KSC

NASA seeks innovative systems modeling methods and tools to:Â

- Define, design, develop and execute future science missions, by developing and utilizing advanced methods and tools that empower more comprehensive, broader, and deeper system and subsystem modeling, while enabling these models to be developed earlier in the lifecycle. The capabilities should also allow for easier integration of disparate model types and be compatible with current agile design processes.
- Enable disciplined system analysis for the design of future missions, including modeling of decision support for those missions and integrated models of technical and programmatic aspects of future missions. Such models might also be made useful to evaluate technology alternatives and impacts, science valuation methods, and programmatic and/or architectural trades.

Specific areas of interest are listed below. Proposers are encouraged to address more than one of these areas with an approach that emphasizes integration with others on the list:Â

- Conceptual phase modeling and tools that assist design teams to develop, populate, and visualize very broad, multidimensional trade spaces; methods for characterizing and selecting optimum candidates from those trade spaces, particularly at the architectural level. There is specific interest in models that are able to easily compare architectural variants of systems.
- Capabilities to rapidly and collaboratively generate models of function or behavior of complex systems, at either the system or subsystem level. Such models should be capable of eliciting robust estimates of system performance given appropriate environments and activity timelines, and should be tailored:
  - To support design efforts at the conceptual and preliminary design phases, while being compatible with transition to later phases.
  - To operate within highly distributed, collaborative design environments, where models and/or infrastructure that support/encourage designers are geographically separated (including Open Innovation environments).Â This includes considerations associated with near-real-time (concurrent?) collaboration processes and associated model integration and configuration management practices.
  - To be capable of execution at variable levels of fidelity/uncertainty. Ideally, models should have the ability to quickly adjust fidelity to match the requirements of the simulation (e.g. from broad-and-shallow to in-depth).
- Processes, tools, and infrastructure to support modeling-as-design paradigms enabled by emerging model-based engineering (MBE) capabilities. MBE approaches allow a paradigm shift whereby integrated modeling becomes the inherent and explicit act of design, rather than a post hoc effort to represent designs

converged using traditional methods. Modeling-as-design processes will first instantiate changes and/or refinements to models at all relevant levels, accompanied by frequent simulations that drive the integrated models to elicit performance of the system being designed.

- Target models (e.g., phenomenological or geophysical models) that represent planetary surfaces, interiors, atmospheres, etc. and associated tools and methods that allow them to be integrated into system design models and processes such that instrument responses can be simulated and used to influence design. These models may be algorithmic or numeric, but they should be useful to designers wishing to optimize systemsâ€™ remote sensing of those planets.