We are sharpening our focus on Human Space Flight (HSF) Exploration Beyond Low Earth Orbit.

We want to ensure that HSF technologies are ready to take Humans to Mars in the 2030s.

- Various Roadmaps define the needed technologies.
- We are attempting to define our activities and dependencies.

Our Goal: Get within 8 years of launching humans to Mars (L-8) by 2025.

- Develop and mature the technologies and systems needed.
- Develop and mature the personnel needed.

This is one of a number of specific partnership opportunities that you might be interested in to discuss during SpaceCom 2016.
EA Domain Implementation Plan Overview

JSC Engineering: HSF Exploration Systems Development

- Life Support
- Active Thermal Control
- EVA
- Habitation Systems

- Human System Interfaces
- Wireless & Communication Systems
- Command & Data Handling
- Radiation & EEE Parts

- Lightweight Habitable Spacecraft
- Entry, Descent, & Landing
- Autonomous Rendezvous & Docking
- Vehicle Environments

- Entry, Descent, & Landing
- Autonomous Rendezvous & Docking
- Deep Space GN&C

- Reliable Pyrotechnics
- Integrated Propulsion, Power, & ISRU
- Energy Storage & Distribution
- Breakthrough Power & Propulsion

- Crew Exercise
- Simulation
- Autonomy
- Software
- Robotics
Integrated Systems and Projects Challenge

Modeling the integration of hardware and software systems of spacecraft using SysML

The Effort being proposed

- We are implementing the use of a standard system modeling language (SysML) to describe space systems and their interactions

The Idea we have

- Each system can be represented at a high level and a detailed level. Any level of abstraction can be leveraged to demonstrate interfaces, activities, and states between systems

Why is collaboration a good idea?

- Complex and intelligent yet otherwise independent systems that require unattended intercommunication is common among many industries

The kind of Collaboration we envision

- Modeling methodologies, product evaluations, success criteria

The kind of partner we expect

- Provider of systems analogous to space systems (smart home, manufacturing, self-driving cars, remote systems, Internet of Things)

The Problem

- Space systems are becoming increasingly complex
- Space systems are becoming increasingly intelligent
- Space systems are becoming increasingly autonomous
- Interactions among intelligent systems is not consistent and is incomplete
- Can NASA learn from other industry experience?
Modeling the integration of space craft systems

• Space systems are now smart connected systems
  • Avionics
    • Physical – sensors and actuators
    • Smart – embedded processing
    • Connectivity – wired or wireless
  • Behavior
    • Monitoring – conditions, operation
    • Control – functions, behavior
    • Autonomy - independence
• System modeling is needed to understand interactions
  • Common language for representing typically independent systems
  • Interface Description
  • Failure modes

“Smart” Habitat for Deep Space Exploration
The benefits of SysML

• What is SysML
  • OMG standard - System Modeling Language
  • General purpose graphical modeling language

• Abstraction and detail together
  • Blocks with embedded attributes
  • Complex systems simplified

• Hardware and Software description
  • Extension of UML
  • Co-location of hardware and software

• SysML can be used to describe technologies considered different from one another AND their interactions

Model of complex system (family)
How we can work together

• 1 - Share models
  • Is the language really standard?
  • Does the architecting tool matter?
  • How can model libraries help?

• 2 - Start a model together
  • Choose a diverse and integrated scenario
  • Model independently yet cooperatively

Model of system shared from one industry to another
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If you’re interested in one of these, or you have other ideas, let us know at:

https://nasajsc.secure.force.com/ConnectForm