

INNOVATION & OPPORTUNITY CONFERENCE

ADVANCING AEROSPACE AND DEFENSE
November 7-8, 2018 | Aurora, Colorado



NASA Avionics Needs

Stephen Horan, PhD

Principal Technologist for Avionics

Space Technology Mission Directorate

Avionics Background



- Working Avionics Definition
 - The sensors and instruments, signal processing, and data processing used to give a space entity (launch vehicle, spacecraft, or human) situational awareness and state-of-health status
- What Do We Include
 - Individual sensing devices for subsystems
 - Flight computers (including memory and supporting devices)
 - Communications devices (including RF and optical elements)
- What Do We Not Include
 - Power systems, except point-of-load converters
 - GN&C devices such as thrusters and reaction wheels
 - Standards development

Avionics Themes

- Where Do We Need Help?
 - Supporting NASA activities from LEO to the end of the solar system
 - NASA has a special emphasis for the next few years for lunar activities so this will be a prime area of need to support all phases of activities
 - This means that solutions should be tailored for the relevant environment (temperature, radiation, etc.)
 - For example, can the solution last for one year on the Moon exposed to the natural environment there?
- Approach Examples
 - Devices that can enhance existing capabilities with innovative signal processing and communications approaches
 - Exploit new advances in photonics circuitry to provide higher speed and lower power

BLUF

- Avionics is a cross-disciplinary activity with many areas of interest all revolving around generating point data and delivering that data to a decision maker. There are many places where the current Internet of Things and smart systems approaches will benefit the NASA needs if the devices can work well in a space environment.
- **Note:** Examples from FY18 may not exactly match the FY19 content.

Avionics Themes

- Value Added
 - Lower Size, Weight, and Power (SWaP) relative to the current state of the art
 - Added functionality: pack more into a single package; add “smarts” to the package to provide greater capabilities for the same SWaP profile
 - Be a “two-fer” by providing a solution supporting both avionics and science instrumentation
 - Leverage COTS to bring greater functionality/lower cost/new approaches

FY18 Examples



Focus Area	Subtopic	Primary Mission Directorate
Focus Area 2: Power Energy and Storage	S3.01 Power Generation and Conversion	Science
Focus Area 3: Autonomous Systems for Space Exploration	S5.05 Fault Management Technologies	HEOMD
Focus Area 4: Robotic Systems for Space Exploration	S4.02 Robotic Mobility, Manipulation and Sampling Z5.03 Payload Technologies for Free-Flying Robots	STMD
Focus Area 5: Communications and Navigation	H9.01 Long Range Optical Telecommunications H9.05 Transformational/Over-the-Horizon Communications Technology S3.04 Guidance, Navigation and Control	Science, HEOMD

FY18 Examples



Focus Area	Subtopic	Primary Mission Directorate
Focus Area 6: Life Support and Habitation Systems	H6.01 Integrated System Health Management for Sustainable Habitats	HEOMD
Focus Area 7: Human Research and Health Maintenance	H12.03 Crew Worn Accelerometers in Spaceflight Environment	HEOMD
Focus Area 9: Sensors, Detectors and Instruments	S1.01 Lidar Remote Sensing Technologies S1.02 Technologies for Active Microwave Remote Sensing S1.03 Technologies for Passive Microwave Remote Sensing S1.04 Sensor and Detector Technology for Visible, IR, Far IR and Submillimeter S1.07 In Situ Instruments/Technologies for Planetary Science T8.02 Photonic Integrated Circuits	Science

FY18 Examples



Focus Area	Subtopic	Primary Mission Directorate
Focus Area 11: Spacecraft and Platform Subsystems	S3.05 Terrestrial Balloons and Planetary Aerial Vehicles S3.08 Command, Data Handling, and Electronics S4.04 Extreme Environments Technology	Science
Focus Area 12: Entry, Descent, and Landing Systems	Z7.01 Entry Descent & Landing Sensors for Environment Characterization, Vehicle Performance, and Guidance, Navigation and Control	STMD
Focus Area 19: Integrated Flight Systems	A2.01 Flight Test and Measurement Technologies A2.02 Unmanned Aircraft Systems (UAS) Technologies	ARMD
Focus Area 21: Small Spacecraft Technologies	Z8.02 Communications for Distributed Small Spacecraft Beyond LEO Z8.03 Low Cost Radiation Hardened Integrated Circuit Technology	STMD