Project ID	NASA Center	ESMD related area	Project Title	Project Description
ARC2-06-SD	ARC	Ground Operations	Prognostics for Complex Systems - Damage Propagation Modeling	The Prognostics Center of Excellence at NASA Ames Research Center is conducting research in systems health management. This involves the early assessment of abnormal conditions and damage as well as the estimation of "remaining life" of a component or subsystem. The goal is to research damage propagation mechanisms and to model damage using a physics-based approach for select application domains (e.g., power semiconductors, electro-mechanical actuators, composite structures, batteries, ?)
ARC2-07-SD	ARC	Ground Operations	Prognostics for Complex Systems	The Prognostics Center of Excellence at NASA Ames Research Center is conducting research in systems health management. This involves the early assessment of abnormal conditions and damage as well as the estimation of "remaining life" of a component or subsystem. The goal is to contribute towards the state of the art in uncertainty management which is a critical component of prognostics.
GSFC1-11-SD	GSFC	Lunar & Planetary Surface Systems	Development of Very Low Frequency Radar to Enable Reflection/Transmission Tomography to Image Interior of Asteroids/Comets/NEOs.	This project has a goal to develop two identical low frequency radar nodes that will enable to image interior of asteriods/comets/Near Earth Objects using reflection/transmission tomography principles. One of the radars will be installed on a landing probe to land on the asteriod's surface while the second radar will be installed on a spacecraft orbiting asteriod. The low frequency (5-15 MHz) operation will enable to achievce high depth of penetration and wideband opearation of 10 MHz will allow to achieve resolution of 10-15 meters. The radar consists of 3 basic subsystems: (1) Base band signal generation and base band I & Q data processing, (2) Analog RF front end, and (3) Antenna. Using either Xlinx/Altera FPGA board and Analog Devices' DDS chips entire base band operation will be programmed and implemented. The analog RF front end will be assembled from commercially available RF components. The data acquisition and processing will be implemented through the FPGA. Development of data processing algorithm to form a 2-D image of interior portion of a target will also be part of this project.
JSC1-15-SD	JSC	Lunar and Planetary Surface Systems	Design of a Wireless Sensor Scavenging Network	Design a wireless sensor energy scavenging network that provides communications to a base station (mobile or stationary) from an array of intelligent sensors nodes comprised of various transducers , sensors ,RF transmitters/receivers and controllers with their own power source that does not require batteries to operate. The wireless network sensors obtain power from the environment (power harvesting) and would respond to an interrogation command from the base station to send their data acquisition data to the base station. The wireless sensor scavenging network is programmable for sending data on demand or periodically. In addition, the sensor network can be reconfigured to acquire different types of data from each sensor by the base station. This has applicability for the lunar and beyond outposts. Design includes what trades were made to arrive at the design and concept of operations.
JSC4-35-SD	JSC	Spacecraft	Telemetry in Audio Compression CODEC	The Constellation Vehicle Orion will utilize the Internet Protocol (IP) for voice and data communications via the radio frequency links to the Mission Control Center (MCC) routing through Tracking and Data Relay Satellite (TDRSS). For redundancy and safety a 'dissimilar' audio link will communicate simultaneously with the ground via line-of-sight, during critical mission phases, i.e
JSC4-36-SD	JSC	Spacecraft	Implement Codecs on FPGAs	This project will be to implement ITU standard G.729 (CS-ACELP) and G.722.2 (AMR-WB) speech compression codecs on FPGA target. These codecs are typically implemented on Digital Signal Processors (DSP). Constellation wants to implement the codecs on an FPGA so that redundant data-bus audio packet management, speech signal extraction and compression can happen on a single chip, minimizing mass, power and size requirements.

JSC4-48-SD	JSC	Spacecraft	Reusable electronic structures for reduced power usage and reduced electronics footprints	Many electronic circuits have common sub-circuits and sub-elements that are not utilized full time. It is theorized that common sub-circuit elements could be reutilized or loaned to other circuits while they are not being used. With the advent of Field Programmable Gate Arrays (FPGA) or Field Programmable Analog Arrays (FPAA) the reality of sub-circuit reutilization and loaning could be a reality. The logistics of sub-circuit allocation now becomes more of a circuit management and availability issue. The availability and scheduling could be performed by an integrated or remote microprocessor. This project's goals are to define the common sub-circuit elements, develop scheduling and management tools and algorithms that facilitate effective circuit reutilization, borrowing and loaning, that effectively reduce total circuit power, footprint and overall costs.
JSC1-49-SD	JSC	Lunar and Planetary Surface Systems	Interoperability of Multiple 802.xx Data Protocols and High Bandwidth Data Transmission	Lunar surface operations will require interoperability of multiple wireless networks using standard data protocols and frequencies. Specifically of interest is the interoperability of multiple 802.11, 802.15.x, and 802.16 having some or all of their working frequencies in the 2.4 GHz range and the management of these frequencies. Also investigations are needed for the transmission of multiple streams of High Definition Video on these networks. Simulations of the Lunar Surface networks with focus on finding methods of managing the transmissions as to maximize the effective bandwidth of each channel.
KSC1-05-SD	KSC	Lunar and Planetary Surface Systems	Lunar Regolith Excavation O2 Prod/Outpost Emplace	The feedstock required for O2 production on the moon is Lunar Regolith (soil). 100 metric tonnes (MT) of Lunar Regolith will be required each year for Oxygen Production of 1 MT. In addition up to 2,000 MT of regolith excavation will be required per year in the initial stages of Outpost construction. This project will investigate concepts for Lunar Regolith excavation equipment and propose solutions in the form of completed designs and prototypes.
KSC1-06-SD	KSC	Lunar and Planetary Surface Systems	Lunar Operations Cryogenics Consumables Transfer	Oxygen that is produced on the moon must be transferred to the end user. In addition there will be residual propellants on the descent stage that can be scavenged and re-used as valuable commodities. This project will identify methods for cryogenics consumables transfer and appropriate dust tolerant interfaces.
KSC1-07-SD	KSC	Lunar and Planetary Surface Systems	Umbilicals and Quick Disconnect Couplings for Lunar Cryogenics Consumables Transfer	A Quick Disconnect (QD) Fluid Coupling that is dust tolerant and does not leak is required for transferring cryogenic and other liquid consumables on the moon.
LARC1-17-SD	LARC	Lunar and Planetary Surface Systems	Design, Modeling, and Performance Simulation of Lidar Systems for Sensing Trace Gases	Lidars for sensing water vapor, ice, and several atmospheric trace gases are being investigated. Students will develop computer models for evaluating the merits of several lidar techniques for optimum system development. There could be some test experiments, provided students have requisite training in using lasers that includes laser safety training and eye exams.
LARC1-18-SD	LARC	Lunar and Planetary Surface Systems	Development of Mid-IR Laser-Based Differential Absorption Lidar (DIAL) for Water Vapor Detection	Students will be involved in developing the capability (modeling and simulation) of sensing water vapor on Mars and in other planetary atmospheres using lidars. (There could be some test experiments provided students have requisite training in using lasers that include laser safety training and eye exams.)

LARC1-25-SD	LARC	Lunar and Planetary Surface Systems	Lidar performance modeling and simulation for ACTIVE SENSING OF CO2 EMISSIONS OVER NIGHTS, DAYS, AND SEASONS (ASCENDS) program.	Tasks include direct detection lidar performance simulation, instrumentation modeling, investigation of modulation techniques to support CO2 and O2 lidars.
MSFC1-07-SD	MSFC	Lunar and Planetary Surface Systems	Radiation Effects on Electronics Modeling	Develop advanced models of the natural radiation environment to diagnose and predict the effects of Single Event Effects (SEEs) on modern electronic architectures.
MSFC1-08-SD	MSFC	Lunar and Planetary Surface Systems	Reconfigurable Computers	Provide reconfigurable computing capability, resulting in reduction of flight spares and risk reduction for limited circuit lifetimes.
MSFC2-28-SD	MSFC	Ground Operations	Simulation of Propellant loading in Launch Vehicle	MSFC has developed a Generalized Fluid System Simulation Program (GFSSP) for modeling and simulation of propulsion systems. GFSSP is a finite volume based network flow analysis code that can model cryogenic propulsion systems. MSFC is currently working on a project to develop numerical modeling techniques for simulating propellant loading of Ares I Launch Vehicle. The objective of this computational project is to develop a methodology to estimate the time required to chilldown the ground system, amount of propellant used to chilldown and to ensure that during loading operation, the propulsion system does not violate any design criterion.
MSFC1-22-SD	MSFC	Lunar and Planetary Surface Systems	Development, characterization and Evaluation of Lunar Regolith and Simulants	MSFC is developing a method to create lunar regolith simulants that will match the properties of the lunar surface. This process requires preparation of silicate mineral separates from inneous rocks. Design, testing and cost analysis of a system able to produce batches of separates between 1 and 100 tons is needed. A successful method will be an important step in an overall effort involving a dynamic national and international team.
MSFC1-20-SD	MSFC	Lunar and Planetary Surface Systems	NASA X-TOOLSS (eXploration Toolset for Optimization Of Launch and Space Systems)	Description: Use of the NASA X-TOOLSS software for design optimization of conceptual space systems. NASA X-TOOLSS is based on genetic and evolutionary algorithms, which have proven successful for global optimization of complex systems, and for applications where unique and innovative designs are sought. An advantage of NASA X-TOOLSS and genetic/evolutionary optimization is that the design space is not limited to existing designs and approaches. Example applications of interest for NASA X-TOOLSS include habitats for the Moon and Mars, lunar surface mobility and power systems, lunar descent module and lander concepts, and thermal/structural design of small satellites and other spaceflight hardware.
SSC3-05-SD	SSC	Propulsion	Cryogenic Pipe Stress	At NASA Stennis Space Center the use of cryogenics is very important to the testing of rocket engines used for space exploration. It is important to know the characteristics of piping that carry cryogenic fluid to the testing stands. For this project we need to be able to evaluate piping surface temperature and stress as a function of flow condition (full LN flow, trickle LN flow and no flow) and environment for a pipe containing Liquid Nitrogen (LN). For example, if the pipe is chilled with LN we should be able to measure the surface temperature and pipe stress for the different flow conditions. Next we should be able to expose the top of the pipe to sunlight and rain to see how that affects the pipe outer temperatures and stresses along with the varied flow conditions. The collected data should be compared with a model of the system in ANSYS or equivalent software.