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George C. Marshall Space Flight Center (MSFC)
Office of Strategic Analysis and Communications (OSAC)

Fiscal Year 2024

Dual Use Technology Development at Marshall Space Flight Center Fiscal Year (FY) 2024

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A. Program Description

A.1 Background

NASA's Marshall Space Flight Center (MSFC), located in Huntsville, Alabama is one of NASA's largest and most diversified installations. For nearly six decades, NASA and its government and commercial partners have solved spaceflight's most complex, technical problems here. Marshall engineers, scientists, and technologists have enabled or enriched nearly every facet of the nation's ongoing space mission. Just as it did during the Apollo era, Marshall is playing a vital role in Artemis, developing the Space Launch System (SLS), the backbone of NASA's exploration plans; leading the Human Landing System (HLS) that will ferry human and robotic expeditions from lunar orbit to the surface; delivering the hardware necessary to land crew and cargo on the Moon; and developing life support systems to keep crews healthy throughout their missions.

Marshall's largest organization, the Engineering Directorate, provides cutting-edge design, test, analysis and operations support to Artemis, SLS, crew and cargo lander systems, and the diverse suite of NASA space and science missions. Marshall engineers and their external partners are developing advanced technologies and sustainable solutions to benefit NASA, industry, academia and government. Marshall's application and refinement of innovative design tools such as additive manufacturing, or 3D printing, define the agency's leadership in engineering the systems, hardware, and techniques needed to return to the Moon.

To achieve Artemis' mission, create a thriving space infrastructure, and enable future Mars missions, Marshall is combining its legacy of leadership -- in engineering and propulsion technologies; large, integrated space systems; and life-enriching scientific research -- with mutually rewarding commercial and international partnerships. These joint endeavors will combine resources, unify space programs and nations around the globe and create new economic opportunities for all participants.

For more information about Marshall Space Flight Center, visit:

<http://www.nasa.gov/marshall>

For more information on the technology programs and capabilities at MSFC, visit:

<http://www.nasa.gov/centers/marshall/capabilities/index.html>

To learn more about Artemis, SLS and NASA's Moon and Mars goals, visit:

<https://www.nasa.gov/specials/moon2mars/>

A.2 Purpose

The Marshall Associate Director, Technical, oversees and directs Center-wide technology development efforts. A goal of Marshall's technology efforts is to provide technology for programs and projects through leveraged technology investments and development partnerships with industry, academia, government agencies, and national laboratories.

At Marshall, this includes providing technology development capabilities in specific engineering disciplines, developing advanced technologies that leverage MSFC's expertise in propulsion systems, space transportation, space systems, and scientific research, and providing technology solutions to address commercial space challenges as well as Center and Agency-level technology needs through joint partnerships, addressing multiple stakeholder needs.

The purpose of this CAN is to identify candidate technology partnerships with U.S. industry and academic/non-profit organizations that complement the technology development interests of MSFC, benefitting a wide range of users, ensuring the nation realizes the full economic value and societal benefit of these innovations. The goal is to support collaborative, resource-sharing projects where the NASA partner is developing a technology primarily for its own public purposes, and NASA can provide financial support or other assistance.

This CAN utilizes assistance listing [43.012 Space Technology](#), focusing on supporting entrepreneur, researcher, and innovator ideas to advance the commercial space sector and benefit future NASA missions. Awards are authorized by The National Aeronautics and Space Act of 1958, 51 U.S.C. § 20113(e), as amended, which includes "the preservation of the role of the United States as a leader in aeronautical and space science and technology and in the application thereof to the conduct of peaceful activities within and outside the atmosphere."

A.3 Scope

This notice is seeking responses from potential U.S. industry, academic, and/or non-profit organization partners interested in entering into a cost-sharing or matching cooperative agreement with NASA for the joint development of technologies to meet partner needs as well as those of MSFC. These MSFC technology development projects are sponsored by the Marshall Associate Director, Technical, and this CAN solicitation is programmatically managed at the George C. Marshall Space Flight Center, located in Huntsville, Alabama. However, any cooperative agreement(s) resulting from this CAN will be issued and administered through the NASA Shared Services Center (NSSC) Grants and Cooperative Agreements Office located at the Stennis Space Center (SSC), Mississippi. More information regarding the Cooperative Agreements services provided by the NSSC Grants and Cooperative Agreements Office can be found at this link: [Grants | NASA](#)

To minimize unnecessary proposal efforts on the part of Applicants, the CAN partnership selection is a two-step process that consists of the submission of an initial Step-1 Package, proposing a new technology development concept related to one or more of MSFC's Technology Focus Areas as identified within this announcement. The Marshall Associate Director, Technical will then assess whether the proposed technology development concept effectively complements the technology interests and needs of MSFC. Applicants whose Step-1 Package technology concepts are selected by the Marshall Associate Director, Technical will be invited by the MSFC Agreement Officer to submit a Step-2 Project Proposal.

All Step-1 Packages and Step-2 Proposals shall be submitted in accordance with the instructions in this announcement and shall meet the project requirements identified. Proposals will be selected for NASA Cooperative Agreement project awards based on the criteria described in the following sections of this announcement and consideration of available NASA resources at the time of the selection decision. NASA reserves the right to reject any proposal which it determines does not meet the stated requirements.

Under this notice, NASA will award cost-sharing cooperative agreements to U.S. industry, academia, and/or non-profit entities in accordance with the regulations under 2 CFR 200 and 2 CFR 1800 respectively, and as further implemented within the guidance of the Grant and Cooperative Agreement Manual (GCAM). The NASA Grants and Policy Compliance Team website provides these documents and other references at: [Grants Policy and Compliance Team - NASA](#).

A.4 MSFC Technology Focus Areas

MSFC's strategic direction and activities are summed up into the 4 L's: Launch, Land, Live, and Learn. We will launch cargo and astronauts to the Moon and beyond with advanced space transportation technology and return the first soil samples from another planet. We will land and live on the Moon, developing new technologies that will enable our exploration of Mars. We will learn how to best protect our home planet, how to better understand our Sun and Solar System, and how to begin to decipher the myriad mysteries of our ever-changing universe. In order to achieve these goals MSFC has several Technology Focus Areas including Advanced Space Transportation Systems, Habitation Systems, In-Space & Surface Mission Operations, Lander Systems, Science, Space Launch System (SLS), and Surface Technologies & Systems.

The following sections describe the technology development activities necessary for MSFC to achieve its goals. Most of the technologies fall within specific focus areas; however, there is also a section devoted to cross-cutting technologies that directly support multiple focus areas.

A.4.1 Advanced Space Transportation Systems

Advanced Space Transportation Systems applies to crewed and uncrewed space vehicles involved with orbital maneuvers and traveling between planetary destinations as well as their associated subsystems. Technologies supporting this focus area would directly support vehicles such as Mars Transit Vehicle, Propellant Depots / Tankers, In-Space Tugs / Transfer Stages, or spacecraft buses.

A.4.1.1 In-Space Transportation Systems

In-Space Transportation Systems encompasses technology development and modeling of vehicle subsystems such as Avionics & Communications, Guidance Navigation & Control, Thermal Management, etc. Example technologies in this area include but are not limited to:

- Radiation hardened high end electronics for deep space environments
- High data transfer rate through deep space communications systems
- Unsettled propellant mass gauging including hypergolics, cryogenics and xenon as well as pressurant gasses such as helium
- Unsettled propellant and pressurant gas transfer including cryogenics, xenon, and hypergolic propellants

A.4.1.2 In-Space Propulsion Systems

In-Space Propulsion Systems encompasses the development of hardware and modelling related to

thrust generation, propellant storage, and propellant acquisition for space transport vehicles. MSFC is actively investing in several areas of propulsion such as chemical, nuclear, propellant-less systems, integrated CubeSat propulsion systems as well as associated components and hardware. Since chemical propulsion also applies to Lander Systems it is in Cross-Cutting Technologies, see section A.4.8.1 Advanced Chemical Propulsion.

A.4.1.2.1 Nuclear Thermal Propulsion (NTP)

Nuclear Thermal Propulsion (NTP) encompasses hardware development and modeling of nuclear reactors optimized for heat generation on a spacecraft, radiation and neutron shielding as well as heat rejection. Example technologies needed for NTP include but are not limited to:

- Comparable reactor structural materials / hydrogen compatible
- Fuels > 900 sec ISP
- Moderator - 1000k Capable Metal Hydride
- Processes for producing high temperature materials containing fissile material

A.4.1.2.2 Propellant-less Propulsion Systems

Propellant-less propulsion systems encompass hardware development, testing, and modeling of Solar Sails and Electrostatic Solar Wind Sails (E-Sails) that generate thrust from the space environment. Example technologies needed for propellant-less propulsion systems include but are not limited to:

- Deployment mechanisms and systems for solar sails and km scale tethers
- Scalable plasma testing techniques
- Design of high voltage switching and transient suppression for tethers
- Solar Sail or km scale tether dynamics, GN&C, thrust and torque control analysis, and modeling techniques after sail or tether deployment
- Embedded and scalable sail technologies for attitude control, power generation, and light-weight communications with robustness to different sail attitudes

A.4.2 Habitation Systems

Habitation Systems is a broad focus area that encompasses the development of all systems needed to support a human crew in a pressurized environment for the duration of a space mission. Habitats (and supporting habitation systems) may be deployed in an orbit or on a planetary surface (Moon or Mars). Habitation can also provide a means for crew to transit through space between destinations. Sub-areas of habitation systems include Crew Health and Performance (CHP), Environmental Control and Life Support Systems (ECLSS), Human Factors Engineering, Habitat Outfitting, and features supporting minimal functionality loss after periods of dormancy. Special considerations also need to be made regarding the operating environment, as different habitats will be operating in microgravity, Lunar gravity, and Mars gravity with habitat atmospheres ranging from 8.2 psi to 14.7 psi. Specific focus areas of interest for technology development are detailed below. See section A.4.8 Cross-Cutting Technologies for more details about Advanced Materials, Structures & Manufacturing, Autonomous Systems & Robotics, Dust Mitigation, and Power & Energy Systems.

A.4.2.1 Environmental Control and Life-Support Systems (ECLSS)

ECLSS encompasses all hardware development, modeling, and testing related to the various

subsystems that make up the ECLSS architecture, including environmental monitoring, pressure control systems, temperature & humidity control systems, atmosphere revitalization systems (including O₂ generation and CO₂ removal), waste management systems, and water recovery. Example ECLSS technologies include but are not limited to:

- Biomimetics, advanced electrocatalysts or microwave generation for CO₂ removal, oxygen recovery / generation, and air or water filtration and purification
- Sorbent materials for CO₂ removal and trace contaminant control that demonstrate benefits in heat transfer, separation efficiency, and durability when compared to packed bed sorbents
 - Novel form factors
 - Advanced manufacturing methods
- Novel cabin particle filtration, such as ionic liquids processes, that demonstrate high throughput filtration and separation capable of handling surface dust
- Processes to remove Dimethylsilanediol (DMSD) and dimethyl sulfone from wastewater that exceed the state-of-the-art multifiltration (MF) technology used aboard the ISS
- Crew safe materials or processes to prevent or mitigate microbial growth in water and on surfaces

A.4.2.2 Habitat Elements, Systems & Outfitting

Habitat Elements, Systems & Outfitting is a broad area which encompasses technology development, modeling, and simulation related to constructed habitats and habitat outfitting. Outfitting means transforming a habitat, shelter, landing pad, etc. into a functional structure through integration of components or subsystems that were not included in the original structure; examples include pressure vessel penetration management of pipes, electrical conduits, hatches, or windows into tanks, habitats, etc. or furnishings (workbenches, tables, chairs, etc.). Habitat outfitting is a larger and more complex task for habitats which: a) are constructed on the surface of a planetary body using local resources or b) inflatable softgoods habitats which are launched in a deflated state and outfitted at the point of use. Example technologies for this focus area include but are not limited to:

- Construction technologies for external habitat structures and surface infrastructure
- Technologies and processes for internal outfitting, including inflatable habitats
 - Includes on-demand manufacturing to support outfitting
 - Internal deployable structures
- Commodity tracking and distribution including transfer, distribution, and management of fluids, propellants, power, and communication
- Radiation mitigation and protection systems and Galactic Cosmic Radiation protection
- Long term instrumentation and monitoring of habitat structures and systems for both crewed and uncrewed scenarios

A.4.3 In-Space & Surface Payload & Mission Operations

Marshall Space Flight Center is the leader in conducting end-to-end mission operations for science payloads in Low Earth Orbit, in cislunar space, on the Lunar surface and beyond. This focus area encompasses all aspects of payload and mission operations including ground systems, mission execution & training, and science utilization. Example technologies that fall into this focus area include but are not limited to:

- Control Center of Tomorrow technologies and concepts capable of autonomous mission operations and engineering support including distributed ground systems architectures
- Intelligent Agent Systems that perform operation functions such as automated generation of mission operations sequencing or software capable of managing multiple missions
- Training systems such as Virtual, Augmented, or Mixed Reality to optimize development of autonomous utilization, science, and associated accommodations
- Modulated approach to simulation / emulation of integrated spacecraft subsystems and orbital environment used for Plan, Train and Fly concepts
- Learning Management System (LMS) that will provide low-cost high-quality training across a variety of mission support needs

A.4.4 Lander Systems

Lander Systems applies to all manner of crewed and uncrewed landers as well as ascent vehicles. It includes technology development, processes, procedures, or modelling related to crewed and cargo variants of Lunar and Mars ascent and descent vehicles. For more information on Advanced Chemical Propulsion or Autonomous Systems & Robotics see section A.4.8 Cross-Cutting Technologies. Technologies that fall into this focus area include but are not limited to:

- Navigation Technologies for lander accuracy and hazard avoidance
- Reusable landing systems
- Aerodynamic and aerothermal control systems
- De-orbit, precision landing, automated rendezvous and capture, and proximity operations

A.4.5 Science

Marshall Space Flight Center advances ground-breaking scientific discoveries that improve our understanding of Earth, the solar system, and the universe, while enabling the next generation of human exploration missions through developmental research. Science is a broad technology focus area that encompasses several areas of science and the development of advanced sensors and instrumentation.

A.4.5.1 Astrophysics

Astrophysics encompasses the area of astronomy related to energetic events, such as gamma ray bursts, with energies ranging from the Far UV to keV X-rays. Example technologies in this focus area include but are not limited to:

- X-ray optics with low mass, high angular resolution, good Quantum Efficiency, low-noise, fast readout, photon counting ability, vacuum compatible
- Gamma-ray detector technology (includes novel scintillators and active detectors)
- Detector technology development to support gravitational wave detections
- Optical coatings (low-stress Infra-red (IR) coatings, stress-compensation, multilayers)
- Passive and active shielding schemes for ISS and free-flyer payloads
- Ultra-smooth mirrors and ultra-lightweight aerogel mirrors
- Optical sensors and elements including multi-spectral gratings, opto-mechanical elements and tolerancing, sub-arc second optics
- Advanced neutron detection techniques: Capability for detecting a broader range of energies: Thermal to 100MeV (current capability is 20 MeV)

- Telescope/Instrument Design, Fabrication, Error Budgeting, and Performance Modeling and Characterization.

A.4.5.2 Data & Applications Science

Cross-cutting technologies within Data Science can benefit all technology focus areas. Example technologies in this focus area include but are not limited to:

- Advanced data processing and analysis algorithms for data fusion and compression
- Instrument/Measurement data processing (algorithms, coding, archive)
- AI/ML for data processing, pattern detection, and categorization
- Data tagging and process automation on large data files in the terabyte range.
- Data mining, analysis and forecasting tools and models to support R- to-A, and A-to-R

A.4.5.3 Earth Science

Earth Science encompasses all areas related to the study of our home world including surface mapping, atmosphere and weather studies, and magnetosphere studies. Example technologies in this focus area include but are not limited to:

- High resolution multispectral thermal imagery of surface energy balance and urban heat islands
- Observations of surface features in 400-2500 nm range for land cover mapping and monitoring disaster detection and response
- Electronically scanned antenna systems for atmospheric and surface remote sensing
- Wide Field of View ultra-narrow bandpass filters in Ultra-Violet (UV) to near infrared regions
- Lightweight thermal and optical sensors for airborne or CubeSat platforms

A.4.5.4 Heliophysics

Heliophysics encompasses all areas related to the study of our sun including solar coronal heating, the generation and behavior of solar magnetic fields, solar flares and activity, and the solar wind & space weather. Example Heliophysics related technologies include but are not limited to:

- Pointing mechanisms to maintain solar tracking with drift less than 10 arcseconds over 60 minutes
- Components of science-quality low-noise digital cameras that are radiation tolerant or radiation hardened. Components include:
 - CCD or CMOS sensors with pixel sizes < 5 microns, suitable for operation in vacuum, and efficient for EUV or Soft X-ray Research (SXR) detection
 - Field-Programmable Gate Arrays (FPGAs), and analog chain components
- Instrumentation to measure core inner magnetospheric plasma and ionospheric irregularities, instabilities, and initiators
- Optics and spectro-polarimetry for Extreme Ultraviolet (EUV), Far Ultraviolet (FUV), or X-rays
- Radio science instrumentation and sensors

- Optical sensors and elements including multi-spectral gratings, opto-mechanical elements and tolerancing, sub-arc second optics
- Passive microwave remote sensor components that include low-noise multi-frequency antennas, on board signal processing, and geophysical variable retrieval algorithms

A.4.5.5 Planetary Science

Planetary Science encompasses the study of other planets, moons, and asteroids such as the Moon and Mars. Technologies related to Planetary Science include but are not limited to:

- Geophysical and geochemical measurements of planetary surfaces and interiors such as neutron detection, electron microscopy, x-ray spectrometry, LiDAR, and seismometry
- Characterization of properties and processes of regolith and dust on the Moon and Mars
- Advanced remote sensing technologies for studying the Moon, planets, or small bodies, which enable improved understanding of surface composition or geomorphology
- Thermal solutions for long-lived survival of instruments through the lunar night

A.4.6 Space Launch System / Exploration Production & Operations Contract (SLS/EPOC)

Marshall Space Flight Center manages the Space Launch System, an integrated super heavy lift launch platform enabling a new era of science and human exploration beyond Earth orbit. This focus area encompasses technologies, processes, procedures, or modelling related to terrestrially based launch vehicles and ground support equipment. Technology development activities in this focus area include cross program vehicle & mission analysis, exploration class launch vehicle usage, and launch vehicle to expand Moon to Mars Architecture.

A.4.7 Surface Technologies & Systems

Marshall Space Flight Center builds innovative solutions through technology development demonstrations and risk reduction activities to enable humans to live and work on the moon and Mars.

A.4.7.1 Extreme Environments

Extreme Environments encompasses technologies related to the survival of crewed and robotic systems in all environments on the Lunar and Martian Surfaces such as permanently shadowed regions (PSRs), high radiation environments, and extremely cold nights. Technologies in this focus area will enable vehicles and systems to operate or survive in these environments.

A.4.7.2 In-Situ Resource Utilization (ISRU)

In-Situ Resource Utilization (ISRU) encompasses all technologies and processes related to gathering extraterrestrial resources and processing them into useable building materials, industrial gases, propellants, potable water, etc. In addition to the technology development considerations need to be made for how scalable the processes are. Example ISRU related technologies include but are not limited to:

- Instrumentation for geotechnical data acquisition for resource prospecting
- Excavation techniques for regolith, mineral, or ice deposits in the Lunar, Mars, or asteroid environments
- Extraction techniques, such as ionic liquids, molten regolith electrolysis, carbothermal reduction, etc., to separate desired elements or compounds from regolith, rock, ice, or atmosphere

- Processing techniques, such as smelting or alloying, to turn raw metallic ore or lunar regolith into useable stock or refinement techniques to ensure purity of water or propellants
- Biological processes and technologies to extract, process, or refine commodities such as water, propellants, feedstocks, etc. from in-situ resources
- In-situ measurements and validation & verification for process monitoring and closed loop control

A.4.7.3 In-Space Assembly & Manufacturing (ISAM)

In-Space Assembly & Manufacturing (ISAM) is a broad technology focus area that encompasses all technologies and processes related to manufacturing, assembling, and maintaining parts, components, spacecraft or structures in orbit or on planetary surfaces. In addition to the technology development considerations need to be made for how scalable the processes are as well as designing new spacecraft systems to be maintainable. Example technologies include but are not limited to:

- On-demand manufacturing of spare parts, replacement units, and specialty tools
- Autonomous construction and manufacturing technologies for Lunar surface applications
- Assembly of large on-orbit structures and platforms including:
 - Welding, bonding, and mechanical joining
 - Spacecraft GN&C during assembly
 - Berthing, docking, grappling mechanisms, and positioning sensing accuracy
- Assessments of the impact of 15–20-year exposure to in-space and extraterrestrial surface environments on the material, structures, welds, etc.
- Biomanufacturing processes and technologies for deep space exploration

A.4.7.4 Surface Mobility

Surface mobility encompasses the technologies and systems related to crewed and robotic rovers including drive train, power systems, and sensors for autonomous or remote operations. Example technologies in this focus area include but are not limited to:

LIDAR or other sensors for science, navigation, surface mapping, and situational awareness

Local Area GPS network or a navigation system that can operate without GPS

Mechanical solutions and robotic end effectors and manipulators to enable mobility

A.4.8 Cross-Cutting Technologies

The following technologies are cross-cutting in that they directly support multiple technology focus areas.

A.4.8.1 Advanced Chemical Propulsion

Advanced chemical propulsion encompasses advances in conventional liquid propulsion systems including hypergolic and cryogenic propellants, solid rocket motors, and hybrid motors. Example technologies needed for advanced chemical propulsion systems include but are not limited to:

- Novel rocket engines or propellant combinations for Mars transit vehicle stages, Mars descent or ascent vehicles. Thrust classes between 20 - 200 kN
- Low leak valves and longer lifetime of wetted seats and seals
- Pump-fed hypergolic engines including electric pumps and related battery technology

- Rotating Detonation Rocket Engines (RDRE)
- Materials development, testing, and advanced manufacturing techniques supporting hypersonic propulsion systems

A.4.8.2 Advanced Materials, Structures & Manufacturing (AMSM)

This focus area encompasses advances in materials science and advanced manufacturing methods, processes, technologies, test capabilities, and modeling, including metallics, composites, softgoods, plastics, additive manufacturing, welding, etc. AMSM directly supports several Business Units including Advanced Transportation Systems, Habitation Systems, Lander Systems, and Surface Technologies & Systems. Example technologies that fall into this focus area include but are not limited to:

- Inflatable softgoods materials and softgoods/metallics interfaces for space habitats
- Modeling and simulation of structural materials for habitation applications
- Additive Manufacturing such as Powder Bed Fusion (PBF), Directed Energy Deposition (DED), or other processes for alloys such as: copper, aluminum, nickel, titanium, hydrogen resistant alloys, or refractory alloys or AM of electro-mechanical devices
- Additive Manufacturing post-processing and cleaning technologies and processes
- Application of Artificial Intelligence (AI) and Machine Learning (ML) for manufacturing
- Manufacturing of nuclear fuels for nuclear propulsion or power
- Insulation material that can withstand launch environments or capable of handling micrometeoroid and orbital debris (MMOD) space environments

A.4.8.3 Autonomous Systems & Robotics (ASR)

Autonomous Systems & Robotics is a broad focus area with applications to several areas including manufacturing, orbital transfer vehicles, planetary exploration systems, and habitation systems. ASR encompasses hardware and software development and testing that enables spacecraft, rover, and subsystems to operate independently with little to no human intervention. ASR directly supports almost every other technology focus area. Example ASR technologies include but are not limited to:

- Avionics Modeling and Simulation for System Design and Evaluation
- Modeling and simulation of sensors, communications, and situational awareness
- Trusted autonomy for inspection, refueling, maintenance, and operations such as rendezvous & docking
- Systems that operate in low-light environments and remote areas without GPS and can handle off-nominal conditions, fail to operational mode(s), and enables replanning
- Localization, hazard detection, & path planning software for surface rovers and landers
- Real-time multi-asset system-of-systems objective replanning and resource management schemes
- Verification and validation for embedded Autonomy and AI control methodologies

A.4.8.4 Cryogenic Fluid Management (CFM)

Cryogenic fluid management technologies enable the long-term storage of cryogenic propellants such as liquid hydrogen (LH2), liquid oxygen (LOX, LO2), and liquid methane (LCH4). CFM technologies encompass active cooling (such as with cryocoolers), passive cooling (such as with

multi-layer insulation), as well as hardware and modeling related to storing, transferring and conditioning cryogenic fluids. Example CFM technologies include but are not limited to:

- Integrated CFM systems and propellant ISRU plants (liquefaction, storage, transfer, etc)
- Propellant Management Devices or Liquid Acquisition Devices optimized for cryogenics
- Low leak cryo-rated valves, cryo-couplers, and related transfer technologies
- Active Cooling technologies
 - Cryocoolers (20K and 90K) and related chilldown of propellant tanks and lines
 - Thermodynamic Vent Systems (TVS) and vapor cooling systems
- Passive Cooling technologies
 - CFM structural disconnect studies and low conductivity structures
 - Advanced cryogenic thermal coatings and insulations for hard and soft vacuums

A.4.8.5 Dust Mitigation

Dust mitigation is a cross cutting technology focus area that benefits Habitation Systems and Surface Technologies & Systems technology focus areas. Dust mitigation includes technologies related to the development of dust tolerant materials, mechanisms, and electronic systems as well as technologies, processes, and procedures related to the mitigation of the transfer of Lunar and Martian regolith dust from planetary surfaces into surface and orbital habitats. Example technologies include but are not limited to:

- Tribological studies of material interaction with regolith dust
- Dust tolerant mechanisms such as: bearings, seals, quick disconnects, etc.
- Dust tolerant electronics such as communications and navigation systems
- Mitigation of dust build up on systems such as displays, controls, solar arrays, and radiators

A.4.8.6 Model Based Systems Engineering (MBSE)

Model Based Engineering (MBE) involves a variety of digital models. Linking digital models produced by a variety of applications produces digital threads. Digital twins are models that represent a physical object or system. Example technologies for MBSE include but are not limited to:

- Product Lifecycle Management (PLM) “digital thread” of data from design, analysis, manufacturing, test, operations, and maintenance
- Integration of physics and discipline engineering tools across multiple PLMs
- MBE-based documentation tools for Risk Management, Configuration and Data Management, System Requirements, Specifications, Interface Requirements, Engineering Release Process, and Interface Control
- Demonstration of MBSE capabilities to conduct engineering reviews, such as Preliminary Design Review (PDR), Critical Design Review (CDR), Systems Requirements Review (SRR) etc.
- Integrated Safety and Mission Assurance (S&MA) models into MBSE environments such as Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL)
- Natural Language Processing Agents for information retrieval, knowledge representation, automated reasoning, machine learning, and open domain question answering

A.4.8.7 Power & Energy Systems

Power & Energy Systems is a cross-cutting area that encompasses power generation, distribution, and management systems, subsystems, and components. Power & Energy systems are found in spacecraft, habitats, and surface exploration systems and directly support several other technology focus areas including Advanced Space Transportation Systems, Habitation Systems, and Surface Technologies & Systems. Example power related technologies include but are not limited to:

- Long Distance (>100 meters) Surface Power Distribution
- Power management, storage, and distribution systems such as LiPo batteries, fuel cells, deployable and stowable solar arrays
- Novel systems such as electromagnetic energy harvesting, Capacitive or hybrid technologies
- Technologies capable of surviving extreme (high and low) thermal environments
- Miniaturized low-power subsystems for small satellites

A.4.8.8 Space Domain Awareness

Space Domain Awareness is a technology area that directly benefits every other technology focus area. It encompasses orbital debris tracking and mitigation as well as asset tracking and conjunction analysis. Orbits of interest extend to Lunar, Mars, and Solar orbits in addition to Earth orbits. Example technologies for Space Domain Awareness include but are not limited to:

- Scalable tracking of debris (<10cm dia.) from a few to thousands of objects
- Object tracking systems with a capability to generate state vectors
- Hi-fidelity dynamic star field sim, space weather
- Improved monitoring of potential space-based threats such as Near-Earth Objects
- Real-time visualization Space Asset Management Database (SAM-D)
- Orbital debris mitigation and remediation

A.4.8.9 Testing, Modeling & Simulation

Testing, Modeling & Simulation is a cross-cutting technology focus area that directly supports all of the other focus areas. This focus area encompasses all facets of modeling and simulation of hardware as well as physically testing prototypes. Example technologies include but are not limited to:

- Real time strain measurement techniques such as Dynamic Photogrammetry
- Materials testing of aerospace metals, composites, and additively manufactured metals in relevant deep space, Lunar, or Mars environments
 - High temperature and cryogenic testing
 - Material permeability testing
 - Standard and non-standard ASTM Testing (Tensile, compression, fracture and fatigue)
- Computational Fluid Dynamics (CFD) simulations and testing
- Impact testing facility for MMOD and plume-surface interaction
- Non-destructive evaluation (NDE) of high atomic number elements/alloys where x-ray NDE methods are not practical

- Verification instruments and techniques for structures constructed from Lunar or Mars regolith

B. Federal Award Information

B.1 Available Funding for the NOFO

The total amount of funds expected to be awarded is approximately \$1,000,000; however, awards are heavily dependent on available budget.

B.2 Projected Number of Awards

Multiple awards are anticipated pending acceptable Proposals, available funding and other NASA resources; however, MSFC reserves the right to select all, some, or none of the proposals for award. MSFC anticipates approximately 10-20 cooperative agreements as a result of this announcement.

B.3 Maximum Award Amount

No maximum. The majority of the individual MSFC awards provided by this CAN are expected to range between \$30,000 and \$100,000 in value and shall be matched or exceeded by Applicant resource contribution value to the awarded project. MSFC contributions to the Applicant can be direct cash assistance, in-kind (non-cash) resources, or a combination of each.

B.4 Anticipated Period of Performance

The projected period of performance is up to twelve (12) months from date of award.

B.5 Projected Period of Performance Start Date(s)

Anticipated award and project start dates are approximately 35 calendar days after notification of proposal selection. See Section D.4 for additional information.

B.6 Projected Period of Performance End Date(s)

Anticipated award/project periods of performance are dependent on proposals. However, all projects are anticipated to end within twelve (12) months from date of award. See Section D.4 for additional timeline information.

B.7 Funding Instrument Type

Cooperative Agreement

The distinguishing factor between a grant and a cooperative agreement is the degree of Federal participation or involvement during the performance of award activities. Under these cooperative agreements, NASA will have substantial involvement in, and contribution to, the technical aspects of the project effort. Substantial involvement pertains to programmatic involvement rather than administrative oversight, which is present in all Federal financial assistance instruments. This type of notice also allows any potential Applicants to make contact with relevant subject matter experts at Marshall Space Flight Center during the CAN open period prior to Step-1 Package submission and during the development of invited Step-2 Proposals. Potential Applicants are encouraged to reach out to the CAN Program Manager and Assistant Program Manager, contact information provided in Section G.1, to identify appropriate subject matter experts for the Applicant's technology focus area.

Only cost-sharing or cost-matching cooperative agreements will be awarded as a result of this CAN announcement. Neither Grants nor procurement contracts will be issued as a result of this announcement.

Generally, award recipients holding previous awards selected through any of the Dual Use Technology Development Cooperative Agreement Notices are welcome to submit “successor” proposals that seek to continue a previously funded line of research. However, to ensure equitable treatment of all submitted proposals, NASA does not extend any special consideration to such successor proposals in terms of preferential handling, review, or priority for selection. Therefore, all proposals in response to this announcement are considered new, in that they will be reviewed on an equal basis with all other proposals submitted in response to this announcement.

Proposals that were submitted but not selected for any previous announcement may be submitted either in a revised or original form but must conform to the requirements of this announcement. Such submissions will be treated as new proposals and will be subjected to a full peer review.

Funds provided through cooperative agreements awarded under this solicitation cannot be applied as contributions to Space Act Agreements or other NASA awards.

C. Eligibility Information

C.1 Eligible Applicants

Participation in this program is open to United States (U.S.) organizations only, including the entities listed below (hereinafter “Applicants,” “Partners” or “Partner Organizations”). Other Government agencies, Federally Funded Research and Development Centers (FFRDCs), and NASA Centers (or their employees) may not propose to this announcement directly but may participate as a result of an existing partnership with the Applicant or with NASA MSFC. However, no portion of the Applicant’s contribution (cash or in-kind) may be paid for by the Federal government under another federal award.

Eligible entities for this funding opportunity include the following. Further information defining the individual types of organizations are available on Grants.gov and 2 CFR Part 200.1:

Education Organizations

- Independent school districts
- Public and state-controlled institutions of higher education
- Private institutions of higher education

Nonprofit Organizations

- Nonprofits having a 501(c)(3) status with the Internal Revenue Service (IRS), other than institutions of higher education
- Nonprofits that do not have a 501(c)(3) status with the IRS, other than institutions of higher education

For-Profit Organizations

- Organizations other than small businesses

Small Businesses

- Small business grants may be awarded to companies meeting the size standards established by the U.S. Small Business Administration (SBA) for most industries in the economy.

An applicant's failure to meet an eligibility criterion by the time of an application deadline will preclude the NASA from making a Federal award.

NASA's Commitment to Diversity and Inclusion

NASA recognizes and supports the benefits of having diverse and inclusive scientific, engineering, and technology communities and fully expects the reflection of such values in the composition of all panels and teams, including peer review panels, proposal teams, science definition teams, and mission and instrument teams. Per Federal statutes and NASA policy, no eligible applicant shall experience exclusion from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from NASA on the grounds of their race, color, creed, age, sex, national origin, or disability. NASA welcomes proposals from all qualified and eligible sources, and strongly encourages proposals from Historically Black Colleges and Universities (HBCUs), Minority Serving Institutions (MSIs), small, disadvantaged businesses (SDBs), veteran-owned small businesses, service-disabled veteran-owned small businesses (SDVOSB), HUBZone small businesses, and women-owned small businesses (WOSBs), as eligibility requirements apply.

C.2 Cost Sharing or Matching

Cost sharing is required. In-kind contributions are allowable as part of the cost-share requirement.

For this CAN, the partner is expected to contribute at least 50 percent of the total combined partner and NASA resources required to accomplish the objectives of the project. NASA will consider requests by both commercial and non-commercial partners to contribute less than 50 percent. However, any such request will require separate justification by the partner and additional approvals by NASA prior to formal submission of the invited Step-2 Proposal.

NASA contributions to the project may be cash, in-kind resources (non-cash contributions such as labor, project use of testing or lab facilities, materials or supplies, etc.) or a combination of cash and in-kind resources. Partner contributions to the project may be in-kind (non-cash) resource contributions such as partner labor, project use of partner testing or lab facilities, partner-provided materials or supplies, etc.

Cooperative agreements awarded under this notice which include a cash contribution from NASA to the partner (i.e., commercial businesses, colleges and universities, and non-profit institutions) will include obligation of the NASA cash contribution on the cooperative agreement award; however, awardees will draw down funds as needed to coincide with immediate cash requirements, resulting in a draw down of funds as close to the expenditure as possible.

In accordance with 2 CFR 200.305, the default payment method will be advanced payments, and recipients may request advanced payments electronically. Additional payment information is detailed in the GCAM Section 7.2 Payments and GCAM Appendix D, Section D8 Financial Management.

C.3 Other Eligibility Criteria

C.3.1 Limitation on Number of Step-1 Package Submissions per Organization

There is no restriction on the number of Step-1 Package submissions that an organization may submit in response to this announcement. Each submission, however, must be a separate, standalone, complete document for evaluation purposes.

C.3.2 Rejection Rights and Late Submissions

NASA reserves the right to reject a submission without review for the following reasons:

- The submission is clearly nonresponsive to the objectives and/or provisions of the announcement.
- The submission does not meet the requirements for format, content, and organization.
- The submission is not submitted by the submission due date/time.

However, the Agreement Officer reserves the right to consider any submission if deemed in the best interest of the Government.

NASA may review applications that are received after the deadline or consider these late applications for funding. NASA may, however, extend the application deadline on request for any applicant who can demonstrate that good cause exists to justify extending the deadline. Good cause for an extension may include technical problems outside of the applicant's control that prevent submission of the application by the deadline, other exigent or emergency circumstances, or statutory requirements for NASA to make an award.

Applicants experiencing technical problems outside of their control must notify NASA as soon as possible and before the application deadline. Failure to timely notify NASA of the issue that prevented the timely filing of the application may preclude consideration of the award.

C.3.3 Restriction on the use of Classified Material

It is NASA policy that all Step-1 Package submissions and subsequent invited proposals should not contain security-classified material. However, should the proposed approach require access to classified information, or should the result of the project generate such material, the Applicant shall comply with all Government security regulations.

C.3.4 Ineligibility of Proposals That Include Participation of China or Chinese-Owned Companies

Proposals involving bilateral participation, collaboration, or coordination in any way with China or any Chinese-owned company, whether funded or performed under a no-exchange-of-funds basis, shall be ineligible for award.

D. Application and Submission Information

D.1 Address to Request Application Package

This Cooperative Agreement Notice (CAN) 80MSFC24M0001 is posted on the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) website <http://nspires.nasaprs.com/> under the Solicitations link. The 80MSFC24M0001 NSPIRES page will also be linked on Grants.gov, the U.S. Government System for Grant and Cooperative Agreement Opportunities (<https://grants.gov/search-grants>).

All information needed to respond to the are contained within this solicitation and associated Appendices. Updates to programmatic information for this CAN may be made available before the stated due date(s). If so, such information will be added as a formal amendment to this CAN and posted at the CAN's specific homepage on NSPIRES <http://nspires.nasaprs.com>. Each prospective Applicant has the responsibility to regularly check this CAN's NSPIRES

homepage for any and all updates prior to any submission.

D.2 Content and Form of Application Submission

Content and form of application submission (Step-1 Package, and Step-2 Proposal) is described in two sections below:

D.2.1 Step-1 Package

Applicants shall submit a Step-1 Package using the templates provided with the announcement. Subject Matter Experts at NASA will review the Step-1 Package in accordance with the evaluation criteria set forth within this announcement. All Applicants will be notified with the result of this assessment regarding that organization's Step-1 Package submission.

Applicants with Step-1 Packages that align to a MSFC technology need and are selected by NASA for a potential project will receive a letter from a warranted NASA MSFC Agreement Officer formally requesting submission of a full Project Proposal.

Applicants shall submit their Step-1 Packages via email to the following address on or before the deadlines provided in Section D.4: msfc-dualusetechdevca@mail.nasa.gov. Mailed hard copies will not be accepted. **Step-1 Packages submitted via NSPIRES will not be accepted for evaluation.** The Applicant organization and the CAN solicitation number shall be referenced in the subject line of the e-mail submitting the Step-1 Package.

Files described in the following subsections are included in a WinZip archive, henceforth referred to as a package. Step-1 Packages shall be developed using the templates provided with the announcement as detailed below:

D.2.1.1 80MSFC24M0001 Step-1 Paper Template (Word document) – Applicants shall complete the 80MSFC24M0001 Step-1 Paper Template first-page form and may complete additional subsections on subsequent pages. Data from the first-page form will be extracted to auto-populate fields within a NASA internal SharePoint library. If an Applicant prefers to submit the additional subsections of the form as a separate document, then those subsections may be submitted in a searchable Portable Data Format (PDF) document. With the exception of the first-page form, Step-1 Papers shall be single-spaced, 12-point font, 8½" x 11" with 1" margins on all sides. Paragraphs D.2.1.1.1 through D.2.1.1.6 provide guidance on some form fields and additional required information. The 80MSFC24M0001 Step-1 Paper Template also includes guidance instructions for content. Step-1 Packages, including all sections and any attachments unless otherwise noted in this solicitation, shall be limited to seven pages or less and shall provide the information listed in the following sections:

D.2.1.1.1 Project Title (included on first-page form)

The Project Title shall provide the initial indication of the technology proposed to be developed to meet a specific NASA technical need in the areas described within Section A.4 *MSFC Technology Focus Areas*. The Step-1 Paper will include a reference header with: This Step-1 Paper is in response to CAN No. 80MSFC24M0001. Please keep the title brief.

D.2.1.1.2 Duration of Step-1 Paper Validity (included on first-page form)

In some instances, the Applicant may be notified that the Step-1 Paper submission meets the Proposal selection criteria but the invitation to submit a Project Proposal may be delayed for administrative and/or funding availability reasons. The Applicant shall indicate in the Step-1 Paper whether a delay of this nature is acceptable, and the length of time the Step-1 Paper will be valid after submission.

D.2.1.1.3 Lead Individual and Key Personnel (summarized on first-page form, detailed in additional sections)

The Step-1 Paper shall identify the Applicant's lead individual and other key personnel that will work on the project with a brief description of their main qualifications. Contact information of the lead individual such as work e-mail, physical mailing address, and phone number shall be included in the Step-1 Paper. A statement identifying the foreign national status of the lead individual and/or other key personnel shall be included if other than a U.S. citizen or U.S. permanent resident.

D.2.1.1.4 Relevant NASA Personnel and Facilities (summarized in first-page form, detailed in additional sections)

Any specific NASA personnel, expertise and/or facilities desired by the Applicant for the collaborative technology development shall be identified. It shall be indicated whether these NASA facilities and/or personnel would be required for completion of the project.

D.2.1.1.5 Detailed Project Description (detailed in additional sections)

The Project Description shall be an overview of the proposed project and technical approach. It shall provide a clear statement of the project goal and primary objectives. It shall provide a summary-level description of the technology to be developed. It shall specify how this technology will address and be applied to meet a specific need for U.S. industry and for NASA/MSFC to include specific programs and projects, if known. It shall provide a description of the technology development approach to include the anticipated collaboration roles and major task activities of the Applicant and of MSFC and the anticipated deliverables for the project. It shall address the potential technical issues and challenges of the project. It shall include a brief explanation of how far this project is expected to advance the maturity of the technology given a successful project conclusion. It shall briefly describe anticipated next steps by the Applicant for the technology development following this project, including existing or desired partnerships with specific commercial, academic or government organizations for desired follow-on activities and/or competitive solicitations targeted by the Applicant that are directly associated with this technology development.

D.2.1.1.6 Project Cost Estimate (summarized in first-page form, detailed in additional sections)

The Step-1 Paper shall provide a preliminary estimate of the total project cost. The cost estimate shall include a summary-level projected breakdown of the total in-kind (non-cash) resource contributions provided by the Applicant and the total resource contributions to be provided by NASA. For the desired NASA resource contribution, the breakdown will clearly distinguish between the direct cash assistance to the Applicant provided by NASA and any NASA in-kind contributions (non-cash resource support such as cost of

NASA labor, materials, facility and equipment use, etc.) to be provided for the project.

The Step-1 Paper budget summary table format should be consistent with the example in Appendix A. See Section D.2.1.3 for instructions related to budget summary worksheet. Additional summary-level explanatory narrative for major cost/resource contribution items from each party is highly desired. Copy and paste the project cost summary table from the supplemental Excel workbook.

If the requested resource contribution from NASA is cash-only with no significant costs anticipated for additional NASA in-kind (non-cash) support, the Applicant shall describe the expected involvement of MSFC in the proposed effort in the Project Description section (refer to Section B.2, *Funding Instrument Type*).

D.2.1.2 80MSFC24M0001 Step-1 Quad Chart and Backup Slide Template (PowerPoint file) – Applicants shall complete the 80MSFC24M0001 Quad Chart and Backup Slide Template (PowerPoint file) first slide. The first slide is a quad-chart template including completion instructions for each section. The lower right quadrant of the quad-chart presents summary budget data, which can be copied from the supplemental Excel project cost summary spreadsheet. The second slide in the PowerPoint file is optional. This second slide offers the opportunity to present pictures or diagrams that provide additional information about the proposed technology development effort. The two-slide 80MSFC24M0001 Quad Chart and Backup Slide Template PowerPoint file is **not** included in the seven-page limit for a Step-1 Package.

D.2.1.3 80MSFC24M0001 Step-1 Budget Summary Worksheet (Excel workbook) – Applicants shall use the 80MSFC24M0001 Step-1 Budget Summary Worksheet to develop budget information for the 80MSFC24M0001 Step-1 Paper Template and 80MSFC24M0001 Quad Chart and Backup Slide Template. This workbook includes a worksheet that matches the example project cost summary table on page A-1 of this solicitation. Instructions within the Excel workbook explain how to enter data into the spreadsheet. Below the project cost summary table are fields that display the percentages of contributions from the Applicant and NASA. Note that the Applicant’s contribution must meet or exceed 50%. After completing the project cost summary spreadsheet, Applicant’s should copy and paste the calculated values for the total project cost, the Applicant’s total in-kind contribution value, NASA’s contributions including the cash-to-partner, Other Direct Cost (ODC), labor value, and FTE into the 80MSFC24M0001 Quad Chart and Backup Slide Template cost summary quadrant; also, Applicant’s should copy and paste that data into the appropriate fields of the 80MSFC24M0001 Step-1 Paper Template first-page form.

D.2.2

Step-2 Proposal

Step-2 Proposal submissions are by direct invitation from the NASA Agreement Officer of this solicitation. All invited Step-2 Proposals shall be submitted electronically via NSPIRES (<http://nspires.nasaprs.com>) by the due date provided by the NASA Agreement Officer on the invitation notification letter.

Upon notification by the NASA Agreement Officer that an Applicant has been selected for

submission of a full Project Proposal, the Applicant PI shall prepare the Project Proposal in accordance with the instructions in this section and any additional instructions and the submission due date provided in the Step-2 invitation notification letter. The Step-2 invitation notification letter submission instructions will take precedent in the event of a conflict between the Step-2 invitation notification letter and the content of this section.

Please note carefully the following requirements for submission of an electronic proposal via NSPIRES:

The organization/institution submitting the Proposal must be registered in NSPIRES. Registration for NSPIRES must be performed by an organization's Authorized Organizational Representative (AOR). Typically, the AOR is a point of contact from the Sponsored Research Office (SRO) or the Electronic Business Point of Contact (E-Biz POC).

In general, the process to register an organization in NSPIRES requires the following steps:

1. An Employer Identification Number (EIN) for the organization. The EIN number is also commonly called the Tax Identification Number (TIN). The TIN/EIN can be obtained from the IRS website.
2. Unique Entity Identifier (UEI) (for additional information related to the Unique Entity Identifier, visit: <https://sam.gov/content/duns-uei>)
3. A valid login.gov account: Information regarding login.gov may be found at <https://login.gov/>
4. A valid registration with the SAM: Information regarding SAM may be found at <https://www.sam.gov/SAM/>. As part of SAM registration, U.S. organizations will receive a Commercial and Government Entity (CAGE) code.

The Step-2 Proposal Principal Investigator (PI) named on the proposal's NSPIRES cover page is also required to be individually registered in NSPIRES and to specify his/her organizational affiliation. The organizational affiliation specified on the NSPIRES cover page at proposal submission must be the organization through which the PI would work and receive funding while participating in the proposed effort. Other key individual team members (e.g., co-investigators and other key individual participants of the project) are also required to be individually named on the proposal's NSPIRES cover page and individually registered in NSPIRES. **NOTE: In order to allow NASA partners access for technical review, Applicants should not list NASA partners as team members in the NSPIRES system.**

Invited Step-2 proposers are strongly urged to familiarize themselves with NSPIRES and to initiate submission of the required proposal materials well in advance of the proposal submission deadline.

The Proposal submission in NSPIRES requires the coordinated participation of both the proposal PI and the AOR of the PI's submitting organization. First, the PI must complete all NSPIRES required electronic forms, and upload the required PDF file(s). Second, the AOR must submit the electronic proposal on behalf of the PI. Coordination between the PI and the AOR on the final editing and submission of the proposal materials is facilitated through their respective accounts in NSPIRES. Proposers should be sure to allow adequate time for coordination between the PI and AOR. Depending on the organization and its internal review

process, this can take several days. The PIs are encouraged to begin this coordination at the outset of the proposal preparation. (Note: if one individual is acting in both the PI and AOR roles and are identified within NSPIRES as both a PI and AOR, that individual must ensure that all steps in the process are taken, including the AOR submitting the proposal from the organization.)

Also, while every effort is made to ensure the reliability and accessibility of the NSPIRES website and to maintain the NSPIRES help center via e-mail and telephone, unexpected submission difficulty may arise at any point, including with the internet or with the user's own equipment. Difficulty in registering with or using NSPIRES is not, in and of itself, a sufficient reason for NASA to consider a proposal that is submitted after the proposal due date. The NSPIRES homepage provides users with on-line help support and Help Desk e-mail and phone support: [NSPIRES Help Desk support](#)

D.2.2.1 Step-2 Proposal Detailed Content and Format

NSPIRES accepts fully electronic proposals through a combination of data-based information (e.g., the NSPIRES electronic Cover Page and its associated forms) and uploaded portable document format (PDF) file(s) that contain the body of the proposal. The website will provide a list of all elements that make up an electronic proposal, and the system will conduct an element check to identify any item(s) that is (are) apparently missing or incomplete. Again, proposers are particularly encouraged to begin their submission process early to allow time to accommodate potential submission issues.

All electronic Proposals uploaded into NSPIRES shall follow the Proposal Sections outline below, within the page limitations provided. Pages that exceed the page count limits for any section will be removed and not evaluated. Proposals shall be single-spaced, 12-point font, with 1" margins on all sides. Pages larger than 8½" x 11" will count as 2 pages. Charts, tables and graphs may utilize 8- point or larger font size and spacing, and all graphics will count toward the page limitations. All pages minus the Title Page shall be numbered, and Proposal sections including Appendices shall be clearly separated.

It is essential that all PDF files generated and submitted meet NASA requirements. At a minimum, it is the responsibility of the proposer to

- 1) submit the Proposal and all Proposal appendix content as a single, unlocked, searchable PDF file; and
- 2) ensure that all fonts are embedded in the PDF file and that only Type 1 or TrueType fonts are used. In addition, any proposer who creates files using TeX or LaTeX is required to first create a DVI file and then convert the DVI file to Postscript and then to PDF; and
- 3) maintain the recommended 20 MB size limit for proposals. Larger file sizes can affect the performance of the NSPIRES system.

See https://nspires.nasaprs.com/tutorials/PDF_Guidelines.pdf for more information on creating PDF documents that comply with NSPIRES.

Proposal Sections

Max Page Count

NSPIRES Proposal Cover Page

NSPIRES direct input

(includes Summary form and Budget form inputs)

Title Page	1
Executive Summary (Can duplicate the NSPIRES Summary form content. Also include the duration of Proposal validity statement)	1
Technical Merit and Feasibility	
• Technical Approach	5
• Personnel and Facilities	2
• Technical Schedule	2
• Reporting Requirements	1
Business/Commercialization Plan	2
Cost Plan	
• Budget Summary and Co-funding Plan (consistent with NSPIRES Budget form inputs)	2
Collaboration Statement (see Appendix B for template/example)	2
Data Management Plan	<u>1</u>
Maximum Total Page Count	19

Proposal Appendix (Appendix materials do not count against the maximum 19-page proposal limit):

- | | |
|--|---|
| 1. Professional Resume of the Proposal Lead Individual | 2 Page Limit |
| 2. Letter(s) of Intent (provided by the relevant MSFC support organization and/or other parties directly supporting the Applicant's proposed effort) | No Page Limit |
| 3. Supplemental budget information and justifications and detailed cost-basis explanations for the cost plan line items (as noted in Section D.2.2.1.5 and Appendix A) | No Page Limit |
| Include a copy of standard University Rates and Agreements documentation, if applicable. | |
| 4. Other required NSPIRES forms and certifications | NSPIRES direct input at Proposal submission |

D.2.2.1.1 Executive Summary

The Proposal Executive Summary shall include a summary description of the project to include a brief introduction of the technology need being addressed, the project objective, project technical approach and the anticipated benefit(s) of the project outcome. The Executive Summary content can duplicate the content of the NSPIRES required proposal

Summary form

D.2.2.1.2 Duration of Proposal Validity

In some instances, a Proposal submission may meet the selection criteria, but a Proposal award cannot be made by the target CAN Proposal selection and award notification period due to a lack of available funds. The possibility exists that additional award funding may become available at a date beyond the target dates that will enable an additional award selection(s).

In the Executive Summary the Applicant shall indicate of the Proposal whether a selection date and/or award and project start date beyond the target periods/dates listed in the CAN is acceptable, and the length of time the Proposal will be valid after submission, greater than the required minimum length of 120 days.

D.2.2.1.3 Technical Merit and Feasibility

This section shall contain the following four subsections described below:

a) Technical Approach

The project Proposal shall include a clear and succinct statement of the technology development goal of the project and any primary corresponding objectives. The Proposal shall present a technically innovative approach that addresses a specific NASA technology need in the areas described in Section A.4 *MSFC Technology Focus Areas*.

The Proposal shall contain a clear and succinct description of the specific technology development proposed. The Proposal shall include a brief explanation of how this innovative approach is relevant and important to meeting the identified technology need compared to current state-of-the-art. The Proposal shall explain how far this project is expected to advance the maturity of the technology given a successful project conclusion. NASA Technology Readiness Levels (TRL) are a type of measurement system used to assess the maturity level of a particular technology, and the use of TRLs to describe the technology maturity goal of the project is recommended. NASA TRL descriptions can be found at:

https://www.nasa.gov/directorates/heo/scan/engineering/technology/txt_accordion1.html.

A work or task plan shall be included that indicates what development effort will be performed and who will perform the work (e.g., the partner or NASA MSFC). The methods planned to achieve each objective or task shall be discussed in appropriate detail. The task descriptions shall be linked to the milestones defined for the technical schedule.

Any reliance on NASA in-kind contributions, such as NASA-provided technical expertise and/or Government Furnished Equipment or Facilities, in the technical effort shall be clearly described. If the requested resource contribution from NASA is cash-only with no significant in-kind support contribution expenses by NASA anticipated, the work plan shall describe the expected involvement of MSFC in the proposed effort

(refer to Section B.7, *Funding Instrument Type*).

Expected accomplishments and the deliverables for the project shall be clearly stated. All projects shall include a Final Project Technical Report among the project deliverable items

The Applicant's view of the risks involved in proposed innovation shall be provided.

Proprietary Data: Proprietary Data means copyrighted material developed at private expense, or recorded information, regardless of form, the media on which it is recorded, or the method of recording, embodying trade secrets developed at private expense. All Proprietary Data the Applicant intends to use in carrying out its responsibilities under any Agreement pursuant to this CAN (or to complete the project) shall be identified in the Technical Merit and Feasibility portion of the proposal submission. The Applicant shall describe the general nature of all Proprietary Data and any restrictions on their use and dissemination.

b) Personnel and Facilities

The Applicant's key personnel involved in the development activities will be identified in this section. Key personnel are the principal investigator and other individuals whose expertise and functions are essential to the success of the project. The Applicant shall provide a brief biographic information summary for all key personnel, including directly related education and relevant professional experience. **In addition, a separate 1-2 page professional resume of the principal investigator / lead individual shall be provided in the Proposal Appendix (reference Section D.2.2.1).** If the lead individual and/or other key personnel are not U.S. citizens or U.S. permanent residents, a statement identifying the foreign national status of the individual shall be provided.

The Applicant must also describe in detail any consortia as recipient, subcontracting, consultant, or other business arrangements.

Key NASA technical personnel or co-investigators expected to be involved in the project shall also be identified. Biographic information of key NASA personal is not required.

The Applicant shall identify and describe the relevant facilities and equipment currently available, and if applicable, those to be purchased to support the proposed activities. NASA strongly discourages funding the acquisition of durable equipment, instrumentation, or facilities. The necessary facilities required shall be shown to be adequate, including any reliance on external sources, such as NASA provided Government Furnished Equipment or Facilities.

c) Technical Schedule/Milestones

The schedule section will define the project development schedule with key milestones clearly identified on the schedule. Definitions of the key milestones shall be included with task descriptions and assignments, resource allocations, and planned

accomplishments in the Proposal. The due dates for any identified deliverables, including the final project report and project closeout meeting, by either party of the agreement will be shown on the schedule.

d) Reporting Requirements

All Proposals shall contain provisions for reporting the progress and results of the Dual Use Technology project to the MSFC Associate Director, Technical (DA01) or designated representative and to the MSFC Technical Monitor for the project. The actual points of contact will be contained in the final negotiated agreement. The content and frequency of the reports shall be identified in the Proposal. Progress reports can be made in conjunction with technical milestone completions.

A final project Technical Report is a required deliverable within 120 days of the end of the project period of performance. If information in the final closeout report is classified, sensitive, or subject to export control restrictions, as delineated in the Export Administration Regulations (EAR) and the International Traffic in Arms Regulations (ITAR) restrictions, a second publicly releasable alternative report shall also be prepared. The publicly releasable version of the final closeout report shall include:

- A project overview, major activities; significant results, major findings, developments, or conclusions (both positive and negative); and key outcomes or other achievements. Include a discussion of stated goals not met.
- Description of how the results been disseminated: For example, a list of publications that have appeared or are anticipated as a result of the award. Of course, all publications should acknowledge NASA support, including the name of the program, and the grant number(s).

For university and industry projects which employ the direct participation of university students at any academic level, the final project closeout report technical should identify the number and academic level of the students involved along with a description of the student(s) participation in the project. Individual students who were significant contributors to the project results should be identified by name in the final project closeout report.

In addition, the reporting clauses in a Cooperative Agreement require that any technologies (e.g., devices, processes, and software) created or enhanced as a result of projects funded by this CAN must be reported using NASA's e-NTR page, <https://invention.nasa.gov/>

NASA requires that the last technical schedule milestone include a project closeout meeting between NASA and all parties involved. Submission of all final reports is required within 120 days of the end of the project period of performance.

D.2.2.1.4 Business/Commercialization Plan

For commercial Applicants, this section shall describe the Applicant's plans for commercialization by identifying the proposed or eventual commercial product and/or service and describing the corresponding commercial venture and the unique competitive advantage resulting from this technology development effort. This description shall also include the anticipated next steps by the Applicant immediately following the project conclusion for related, follow-on technology development efforts. Describe existing or desired partnerships with specific commercial or academic or government organizations for follow-on activities and/or specific competitive solicitations targeted by the company and directly associated with this technology development.

Describe the strategic relevance to the Applicant of the project with the proposed technology in terms of the Applicant's current business segments, overall business plan, and relative position with respect to its competitors. Describe market feasibility by identifying the specific target market and/or target customer companies for the eventual technology product/service and showing the distinction between U.S. Government and other markets.

It is optional but encouraged to describe the amounts and sources of the Applicant's financial resources already expended and committed to date with respect to the technology development project and business development of the targeted commercial venture.

For academic Applicants, this section shall describe the strategic relevance to the University of the technology development described in the paper. Describe the relevance and potential importance of the proposed technology development to eventual product or service applications by U.S. commercial and government endeavors, and the competitive advantage that may result from the technology. Describe the general target market and the distinction between U.S. government & other markets for the technology. This section shall also describe the anticipated next steps by the Applicant for additional follow-on technology development following the project conclusion. Describe existing or desired partnerships with specific commercial partners or government organizations for follow-on activities and/or specific competitive solicitations targeted by the university and directly associated with this technology development.

D.2.2.1.5 Cost Plan

This section shall contain the following two subsections described below:

Budget and Co-funding Plan:

The Cost Plan shall contain a budget table and co-funding plan that contains clear identification of any requirements for NASA cash contributions to the partner, as well as the value of partner and NASA in-kind resource contributions dedicated to accomplishing the project in accordance with Section C.2.

NASA contributions to the project may be cash, in-kind resources (non-cash NASA contributions such as labor, project use of testing or lab facilities, materials or supplies, etc.) or a combination of each. Partner contributions to the project may be in-kind (non-cash) resource contributions such as labor, project use of testing or lab

facilities, materials or supplies, etc.

The total budget shall be sufficient and reasonable to accomplish the project. It shall identify the costs for the milestones and final deliverables. It shall also contain a clear co-funding plan for the use of NASA resources.

The Cost Plan shall be prepared in accordance with the following guidelines and completed for each agreement year, if applicable. The plan shall include the resources (cash and/or in-kind) requested from NASA and the resources provided by the Applicant.

The total costs for the project, and the shared funding requirements of the Cost Plan shall be reflected in a Budget Summary table consistent to that shown in Appendix A. The cost categories in the table shall be based on the descriptions in the following sections and will be shown in detail in the Budget Summary per Appendix A.

Provide budget / cost amounts in whole dollars.

The Budget and Co-funding Plan shall be described in sufficient detail and/or be accompanied by computations of estimates as required to fully explain the proposed cost line items in each cost category and the cost basis for each item.

Detailed line item cost descriptions, cost estimate computations and/or basis of cost estimates can be provided within the Budget Summary table, provided as additional narrative paragraphs in the Cost Plan section (2-page limit). Additional budget explanation and cost justifications information can be provided as a supplemental budget information section in the Proposal appendix (no page limit). Refer to Appendix A, page A-2.

Universities should include a copy of their current Standard University Rates and Agreements document as a part of the budget supplemental information in the Proposal appendix.

For Proposals requesting a direct cash contribution from NASA to the Partner Company or University:

The proposal Budget Summary cost table and any supplemental narrative explanation shall clearly describe the purpose and amount of Company/University project costs covered by the requested NASA cash contribution. Clearly differentiate Company/University project cost items and amounts covered by the requested NASA cash contribution from any other NASA in-kind (non-cash) contributions and also any project cost items and amounts the Company/University will provide as their own in-kind co-funding resource contribution.

In addition, the Applicant will complete a separate NSPIRES Budget form provided as a part of the NSPIRES Step-2 submission process. The NSPIRES Budget form addresses only the Company/University project costs covered by the requested NASA cash contribution award to the recipient.

The line items, cost values, subtotals and total award amount for the NASA cash contribution entered in the NSPIRES Budget form shall be fully consistent with the line items, cost values, subtotals and total award amount for the NASA cash contribution provided in the corresponding Proposal Budget Summary table (reference Appendix A) and supplemental budget information relevant to the NASA cash contribution

Direct Labor:

Salaries and Wages: The names of the principal investigator and other senior associates shall be listed along with the estimated amount of direct labor for which NASA funding is requested or cost sharing will be provided. For other professionals and associates, each position shall be listed, with the number of full time equivalent (FTE) person months and rate of pay (hourly, monthly, or annual).

For the NASA in-kind contributions of direct labor, include the only direct Civil Service full-time-equivalent (FTE) labor amounts and cost value. Identify any NASA in-kind engineering support contractor or technician contactor (WYE) labor amount and cost value as a line item within the NASA Other Direct Cost category.

For clerical, secretarial, supporting staff, etc., only the total numbers of persons and total amount of salaries per year in each category are required. Salaries requested shall be consistent with the company's/institution's approved practices.

Fringe Benefits: Provide the company/institution labor fringe benefit rate of each applicable individual. If the company's/institution's accepted accounting practice is to include other fringe benefit contributions to employee labor (social security, retirement, etc.) in direct labor costs, provide this clarification in the Proposal.

Other Direct Costs:

Equipment, Materials, Supplies: Durable equipment purchases are discouraged, especially computing equipment. Equipment or materials costing \$1,000 or more shall be listed individually by description and estimated cost and adequately justified.

Allowable equipment and apparatus items for direct NASA funding (if requested) will be limited to those that are not already available for the conduct of the work. General purpose office equipment will not be considered eligible for support.

Subcontractors and Consultants: Describe the work to be subcontracted, estimated amount, Applicant (if known), and the reason for subcontracting. Identify consultants to be used, why they are necessary, the time they will spend on the project, and rates of pay.

Other Direct Costs (Travel): Mode of travel, destination, number of calendar days, per diem, and relevance to the proposed activities shall be specified. In order to qualify for support, attendance at meeting or conferences shall directly contribute to specific project objectives. Allowance for air travel will be in accordance with Federal Travel

Regulations.

Indirect Costs:

Facility & Administrative and Other Applicable Costs: If not taken into account within direct labor or other direct costs, the basis and rate for all indirect fees and costs, including overhead and general facility and administrative expenses, shall be within generally acceptable levels, conform to typical Federal grant and cooperative agreement guidelines, and be clearly specified in the Proposal. A copy of any current indirect rate agreement in place (e.g. with the Department of Naval Research - DNR, or Health and Human Services - HHS) shall be submitted with the Proposal.

Profit/Fee: Profit/fee is considered an unallowable cost. In addition, profit/fee is inconsistent with the spirit of the Dual Use Technology cooperative development program, which is intended to enable an entity to further a technology/research by using resources that may not otherwise be available to them and to potentially expand an industrial base for NASA. It is not intended to be a profit generating venture.

D.2.2.1.6 Additional Proposal Requirements

In addition, the Proposal shall also include:

1. A Taxpayer Identification Number (TIN) shall be included with the address listed on the Proposal title page.
2. Data Management Plan (DMP): All proposals submitted under this Funding Announcement are required to submit a Data Management Plan (DMP), in accordance with the NASA Plan for Increasing Access to the Results of Scientific Research. (http://www.nasa.gov/sites/default/files/files/NASA_Data_Plan.pdf).

That plan must include:

- Type of data to be produced, data formats and (where relevant) standards:
- Data dissemination, including (where relevant) publication:
- Data storage/archiving location and preservation of data access:
- Responsibilities of each party; or
- A statement that a DMP is not required because of the nature of the activity (e.g., no data or proprietary or personally identifiable data are expected).

See NASA's Scientific and Technical Information Program's DMP FAQ at <https://sti.nasa.gov/faq/> and the Science Mission Directorate's DMP FAQ at <http://science.nasa.gov/researchers/sara/faqs/dmp-faq-roses/> for more information.

3. Collaboration Statement: The Cooperative Agreement Collaboration Statement is a mutually agreed-upon list which summarizes the project responsibilities, tasks, and contributions of both parties. The Applicant is expected to provide the description of the NASA responsibilities and contributions as well as their own. The Collaboration Statement will be included as a part of the final Cooperative

Agreement content. A template/example is provided in Appendix B.

4. Letter(s) of Intent: A Letter of Intent is provided by the relevant MSFC support organization and/or other key parties directly supporting the Applicant's proposed effort. Letters of Intent shall be included in the Proposal Appendix.

D.3 Unique Entity Identifier (UEI) and System for Award Management (SAM)

Each applicant for NASA funding (unless the applicant is an individual or is excluded per 2 CFR 25.110) is required to:

- Be registered in SAM before submitting an application
- Maintain an active SAM registration with current information, including information on a recipient's immediate and highest-level owner and subsidiaries, as well as on all predecessors that have been awarded a Federal contract or grant within the last three years, if applicable, for all times during which it has an active Federal award or an application or plan under consideration by NASA; and
- Provide its UEI in each application or plan it submits to NASA. UEIs may be obtained by registering in SAM.gov

NASA may not issue an award or financial modification to an existing award to an applicant or recipient entity until the entity has complied with the requirements to provide a valid UEI and maintain an active SAM registration with current information. At the time of issuing an award, if the intended recipient has not complied with the UEI or SAM requirements, NASA may determine that the applicant is not qualified to receive an award and use that determination as a basis for making an award to another applicant.

D.4 Submission Method, Dates and Times

Submission Method

Step-1 Packages shall be submitted electronically to the following email address on or before the deadline provided in Section D: msfc-dualusetechdevca@mail.nasa.gov

Invited Step-2 proposals shall be submitted electronically through NSPIRES.

Application Submission Deadline

Application Materials	Required or Encouraged	Due Date and Time
Step-1 Package	Required	March 13, 2024, 11:59 PM ET
Step-2 Invited Project Proposal	Required if Invited	To Be Provided in Invitation Letter

This announcement will follow a 2-step process for proposal submissions. Step-1 of the process is submission of a Step-1 Package by the Applicant. The Applicant may submit a Step-1 Package at any time prior to the due date of Step-1 Package open period. In Step-2 of the process, NASA will assess each Step-1 Package submitted and invite selected Applicants to submit a full project Proposal. Refer to Section C.3.2 *Rejection Rights and Late Submissions*.

Step-1 Package due date: March 13, 2024, 11:59 PM ET

Step-1 Package selection letters sent: within 80 calendar days of the applicable Step-1 Package due date

Step-2 Invited Project Proposal due:	approximately 30 - 45 calendar days after Invitation to Propose is sent to invited Applicants. The specific Proposal submission instructions and due date will be provided in the Step-2 Proposal invitation letter
Proposal selection:	approximately 60 calendar days after the Step-2 Proposal due date provided in the invitation letter
Cooperative Agreement award and project start:	approximately 35 calendar days (target) after notification of Proposal selection

Step-1 Package Non-Selection Notification, Step-2 Invitation for a Project Proposal, and Proposal Selection/Non-selection Notification letters will be issued to the respective Applicant(s) by a warranted NASA MSFC Agreement Officer in writing via email.

If an Applicant is invited to provide a full Step-2 proposal, the Step-1 Package selection letter will provide specific Step-2 proposal submission instructions and submission deadline.

All applications **must** be received by the established deadline. The Step-1 Package deadline provided in this section and any deadline provided in letter invitation for Step-2 proposals is the date and time by which the submission must be electronically time stamped. See section C.3.2 regarding late submissions.

D.5 Funding Restrictions

All costs charged to awards covered by this NOFO must comply with the Uniform Administrative Requirements in 2 C.F.R. 200 and 1800, unless otherwise indicated in the NOFO, the terms and conditions of the award, and the [Grants and Cooperative Agreement Manual \(GCAM\)](#).

- All proposed funds must be allowable, allocable, and reasonable. Funds may only be used for the project. All activities charged under indirect cost must be allowed under 2 CFR 200 cost principles.
- Grants and cooperative agreements shall not provide for the payment of fee or profit to the recipient.
- Unless otherwise directed in 2 CFR 200, for changes to the negotiated indirect cost rate that occur throughout the project period, the recipient must apply the rate negotiated for that year, whether higher or lower than at the time the budget and application was awarded.
- Proposals must not include bilateral participation, collaboration, or coordination with China or any Chinese-owned company or entity, whether funded or performed under a no-exchange-of-funds basis.
- Any funds used for match or cost sharing must be allowable under 2 CFR 200.

- The non-Federal entity must use one of the methods of procurement as prescribed in 2 CFR 200.320, Methods of procurement to be followed.

Direct Costs Limitations

See Section D.2.2.1.5 for Direct Cost guidance.

Pre-Award Costs

Per 2 CFR §1800.210, NASA waives the requirement for applicants to obtain prior approval for pre-award costs incurred 90 days or less before an award's period of performance start date. Pre-award costs in excess of 90 days before an award's period of performance start date are not allowable under this NOFO. Any costs that the applicant incurs in anticipation of a grant or cooperative agreement award is at the risk of the applicant and will be subject to the rules described in 2 CFR §1800.210, Pre-award costs and the "Pre-award Costs" section of the GCAM, currently section 5.14.1.

Indirect Facilities & Administrative (F&A) Costs

See Section D.2.2.1.5 for F&A Cost guidance.

D.6 Other Submission Requirements

Collection of Demographic Information

NASA is implementing a process to collect demographic data from grant applicants for the purpose of analyzing demographic differences associated with its award processes. Information collected will include name, gender, race, ethnicity, and disability status. Submission of the information is voluntary and is not a precondition of award.

E. Application Review Information

E.1 Application Evaluation Criteria

NASA will pre-screen all Step-1 Package and Step-2 Proposal submissions for compliance with requirements of this solicitation and relevant Appendices.

E.1.1 Selection of Step-1 Packages

The following selection criteria shall be considered in the assessment and selection of the Step-1 Packages.

- 1) Relevance/alignment and potential of the project to meet a specified MSFC and NASA need or interest, as delineated in this Cooperative Agreement Notice.
- 2) The technical quality of the proposed project, including the clarity of the project goal and primary objectives, the technical approach and the anticipated accomplishments and deliverables, and the level of technical challenges versus projected benefit.
- 3) The reasonableness and suitability of the cost projections and the proposed shared resource contributions from NASA and from the Applicant.

The three factors are of equal importance for purposes of evaluating invitation selections to provide a full Step-2 Project Proposal.

Applicants will be notified whether or not they have been selected for a Step-2 Project Proposal submission within the Step-1 Package selection notification period specified in this CAN.

E.1.2 Evaluation of Project Proposals

The full Proposals will be evaluated on the following factors. These factors will be weighted as follows:

<u>Factor</u>	<u>Weight (%)</u>
Technical Merit and Feasibility	40
Business/Commercialization Plan	20
Cost Plan	<u>40</u>
Total	100

The Proposals will be selected in accordance with evaluation results and available funding levels.

E.1.2.1 Factor: Technical Merit and Feasibility

The proposed project will be evaluated on whether it offers a feasible technical approach to a NASA problem or need. The evaluation sub-factors for Technical Merit and Feasibility include:

a) Technical Approach

The relevance and merit of the proposed technology development to a NASA need compared to state-of-the-art technologies, including the risks involved in the proposed innovation, will be evaluated. The clarity, feasibility and reasonableness of the work plan, including the project goals and objectives and the project tasks and methods to achieve them, and the expected project accomplishments and deliverables will be evaluated. The merit and feasibility of the requested MSFC contributions (cash, NASA technical expertise, and/or Government Furnished Equipment or Facilities) as identified in the description of the technical effort will be evaluated.

b) Personnel and Facilities

The directly related education and relevant experience of the Applicant's key personnel identified as the principal investigator and other individuals whose expertise and functions are essential to the success of the project will be evaluated. The appropriateness and clarity of the description of any consortia identified as Applicants, subcontracting, consultant, or other business arrangements will be evaluated.

The adequacy and availability of relevant Applicant facilities and equipment, and if applicable, those to be purchased to support the proposed activities, including any reliance on external sources, such as NASA provided Government Furnished Equipment or Facilities, will be evaluated.

c) Technical Schedule/Milestones

The clarity, completeness, and reasonableness of the development schedule including key milestones, definitions of the key milestones, task descriptions and assignments, resource allocations, and planned accomplishments and due dates for any identified deliverables by

either party of the agreement as described in the Technical Approach will be evaluated.

Under Technical Merit and Feasibility, sub-factor “a” is more important than sub-factor “c”, which is more important than sub-factor “b”.

E.1.2.2 Factor: Business Commercialization Plan

The commercialization plan will be evaluated on the strength of the anticipated commercial potential of the technology. This includes the Applicant's ability to identify a specific, well-defined commercial product or service based on the proposed technology and the potential for a realistic target market of sufficient size for this product or service.

For commercial Applicants, the evaluation will consider the capability of the Applicant to provide necessary private financial, physical, personnel, and other resources to propose in a timely manner to achieve commercial application of the technology.

In applying these commercial criteria, NASA will assess Proposal information in terms of credibility, objectivity, reasonableness of key assumptions, independent corroborating evidence, internal consistency, demonstrated awareness of key risk areas and critical business vulnerabilities, and other indicators of sound business analysis and judgment.

E.1.2.3 Factor: Cost Plan

The Cost Plan will be evaluated for completeness, clarity, and reasonableness. The evaluation sub-factors for the Cost Plan include:

a) Budget Summary

The overall Cost Plan, including the Budget Summary, will be evaluated to ensure the cost elements and the cost rationale of the proposed project budget are clearly described, complete and reasonable to cover the intent and necessary scope of the cooperative agreement project. The evaluation will assess the clear identification of the type (cash and/or in-kind labor, equipment use, facility use, materials, etc.), the value and the cost estimate rationale of the resource contribution required for each element and from each party to accomplish the project.

b) Resource Contributions

The evaluation will assess whether the overall resource contributions of NASA and the Applicant are appropriate per the CAN guidelines of Section B and Section C.2 *Cost Sharing or Matching*. The evaluation will assess whether the amount of MSFC and Applicant resource contributions shown for each budget element are appropriate and sufficient for the scope of work shown in the Proposal. The evaluation will assess whether the total value of the resource contributions (cash and/or in-kind) from MSFC and from the Applicant are sufficient to accomplish the cooperative agreement for the scope of work shown in the Proposal.

Under Cost Plan, sub-factor a) and sub-factor b) are of equal importance.

E.2 Review and Selection Process

E.2.1 Risk Analysis

NASA Grant Officers will conduct a pre-award review of risk associated with the proposer as

required by 2 CFR 200.206, Federal awarding agency review of risk posed by applicants. For all proposals selected for award, the Grant Officer will review the submitting organization's information available through multiple government-wide repositories such as the System for Award Management (SAM.gov), the Contractor Performance and Assessment Reporting System (CPARS), the Federal Audit Clearinghouse (FAC), USAspending.gov, and GrantSolutions Recipient Insight.

E.2.2 Risk Review

For any Federal award, if NASA anticipates that the total Federal share will be greater than the simplified acquisition threshold (currently \$250,000) over the period of performance:

- i. Prior to making a Federal award with a total amount of Federal share greater than the simplified acquisition threshold, NASA is required to review and consider any information about the applicant that is in the designated integrity and performance system accessible through SAM (see 41 U.S.C. §2313);
- ii. An applicant, at its option, may review information in the designated integrity and performance systems accessible through SAM and comment on any information about itself that a Federal awarding agency previously entered and is currently in the designated integrity and performance system accessible through SAM;
- iii. NASA will consider any comments by the applicant, in addition to the other information in the designated integrity and performance system, in making a judgment about the applicant's integrity, business ethics, and record of performance under Federal awards when completing the review of risk posed by applicants as described in 200.206, Federal awarding agency review of risk posed by applicants.

F. Federal Award Administration Information

F.1 Notice of Award

The Selection Official for this Notice is the Marshall Space Flight Center, Associate Center Director, Technical.

After reviewing Phase 1 Step-1 Packages and receipt of direction from the Selection Official, the NASA MSFC Agreement Officer will applicants via email using the Step-1 Package Non-Selection Notification or the Step-2 Invitation for a Project Proposal.

Those selected to submit full proposals in the NSPIRES system will be notified and should follow the steps in Section D.2.2 of this NOFO. Once the Proposal reviews are complete, and upon receipt of direction from the Selection Official, applicants will be notified via email using Proposal Selection or Non-selection notifications. Notification letters do not constitute authorization to begin performance.

NASA will notify successful grant recipients of funding via a Notice of Award (NASA Form 1687) signed by the Grant Officer. This Notice of Award is the authorizing document and will be sent to the Principal Investigator via electronic delivery. All expenses incurred on grant activities prior to the period of performance start date listed on the Notice of Award are at the risk of the non-Federal entity until the Notice of Award is received and period of performance commences.

F.2 Administrative and National Policy Requirements

In addition to the requirements in this section and in this NOFO, NASA may place specific terms and conditions on individual awards in accordance with 2 C.F.R. Part 200. Recipients of NASA grant funding shall adhere to requirements set forth in 2 CFR 200, 2 CFR 1800, 2 CFR 170, 2 CFR 175, 2 CFR 182, and 2 CFR 183.

Throughout the year, NASA may issue policies or guidance by way of a Grant Information Circular (GIC). GICs supplement, clarify, augment, remove, and/or alter information included in NASA grant policies and/or provide other important updates. NASA distributes GICs on the NASA website on the Grants Policy and Compliance [Regulations and Guidance section](#) under Active GICs. Expired GICs are stored on the [GICs Archive webpage](#). GICs supersede the policy document referenced in the circular. As such, NASA grant applicants and recipients should ensure they stay informed by checking NASA's [Grant Regulations and Guidance](#) page for the most up-to-date policies and requirements.

General Terms and Conditions are shown in the GCAM Appendix D, which can be accessed via the following link: https://www.nasa.gov/offices/procurement/gpc/regulations_and_guidance.

Research Terms and Conditions

Awards from this funding announcement that are issued under 2 CFR 1800 are subject to the Federal Research Terms and Conditions (RTC) located at <http://www.nsf.gov/awards/managing/rtc.jsp>. In addition to the RTC and NASA-specific guidance, three companion resources can also be found on the website: Appendix A—Prior Approval Matrix, Appendix B—Subaward Requirements Matrix, and Appendix C—National Policy Requirements Matrix.

Environmental Statement

Awards of proposals related to this NOFO must comply with the National Environmental Policy Act (NEPA); thus, proposers are encouraged to plan and budget for any anticipated environmental impacts. While most research awards will not trigger action-specific NEPA review, some activities (including international actions) will.

The majority of grant-related activities are categorically excluded as research and development (R&D) projects that do not pose any adverse environmental impact. A blanket NASA Grants Record of Environmental Consideration (REC) provides NEPA coverage for these anticipated activities. The NSPIRES award application cover page includes questions to determine whether a specific proposal falls within the Grants REC and must be completed as part of the proposal submission process. Activities outside of the bounding conditions of the Grants REC will require additional NEPA analysis. Examples of actions that will likely require NEPA analysis include but are not limited to suborbital-class flights not conducted by a NASA Program Office, activities involving ground-breaking construction/fieldwork, and certain payload activities such as the use of dropsondes.

Questions concerning environmental compliance may be addressed to the NASA NEPA Manager via the NASA program official listed in this NOFO.

F.3 Reporting

F.3.1 Federal Financial Reporting

Recipients of NASA funding must submit quarterly financial reports. Financial reports must be submitted via the Payment Management System (PMS):

- Quarterly Federal Financial Reports (FFR), Standard Form (SF) 425, are due no later than 30 days past the reporting period end date
- Final Financial Status Reports/Final Federal Financial Report (FSR/FFR) are due no later than 120 days after the end of the period of performance

F.3.2 Performance Reporting

The awards resulting from this CAN are anticipated to have a period of performance of twelve (12) months or less. Accordingly, NASA award recipients must submit final performance reports. Descriptions of final reporting requirements are below:

Final Performance Report – Used as part of the grant closeout process to submit project outcomes in addition to the information submitted on the annual Performance Report.

Due: within 120 days after the end of the award’s period of performance

Recipients shall electronically submit a final performance report deliverable to the NASA Grants Officer at the NSSC on the results pertaining to this award provided within 120 days after the end date for the period of performance in accordance with terms and conditions as contained within any subsequent award.

Recipients shall also provide electronic copies of the final performance report to the following MSFC CAN contacts:

- The assigned MSFC Technical Officer for the project
- The MSFC CAN Program Manager Dan O’Neil, (daniel.a.oneil@nasa.gov)
- The MSFC CAN Assistant Program Manager Quincy Bean (quincy.a.bean@nasa.gov)
- The MSFC CAN Programmatic POC, Lisa Watkins (lisa.s.watkins@nasa.gov)

For all NASA awards, recipients must utilize the Research Performance Progress Report (RPPR) format. The RPPR is not a template or form but rather a set of standard data elements against which award recipients will report, and it is not available as a template or form from NASA. All performance reports must contain the mandatory data elements and reporting category required for RPPRs.

All reports **shall** include the following data elements on the report’s cover page:

- Federal agency (i.e., NASA) and program office to which the report is submitted.
- Award number.
- Project title
- Principal Investigator name, title, and contact information (e-mail address and phone number).
- Name of submitting official, title, and contact information (e-mail address and phone number), if other than PI.

- Submission date.
- Unique Entity Identifier (UEI) number and EIN number.
- Recipient organization name and address.
- Recipient identifying number or account number, if any.
- Period of performance start and end date.
- Reporting period end date.
- Report term or frequency (annual, semi-annual, quarterly, other).
- Final Report? Indicate “Yes” or “No”
- Signature of submitting official (either handwritten or electronic)

In addition to the data elements above, all NASA performance reports **shall** report on one mandatory reporting category, “accomplishments.”

Accomplishments data element:

1. What were the major goals and objectives of this project?
2. What was accomplished under these goals?
3. What opportunities for training and professional development has the project provided?
4. How were the results disseminated to communities of interest?
5. What do you plan to do during the next reporting period to accomplish the goals and objectives?

For further details on reporting project performance, please refer to the Post-Award Phase Section of the GCAM.

Access to Research

Awards issued under this NOFO must comply with the provision set forth in the NASA Plan for Increasing Access to the Results of Scientific Research (http://www.nasa.gov/sites/default/files/files/NASA_Data_Plan.pdf) including the responsibility for:

1. Submitting as-accepted peer-reviewed manuscripts and metadata to a designated repository and
2. Reporting publications with the annual and final performance reports.

Recipient Integrity and Performance Matters

Awards under this solicitation that are \$500,000 or more may be subject to the post award reporting requirements reflected in [2 CFR 200 Appendix XII](#).

FFATA Reporting Requirements

Per 2 CFR 170, Reporting Subaward and Executive Compensation Information, award recipients that issue first-tier subawards above \$30,000 shall report those subawards in the Federal Award Accountability and Transparency Act (FFATA) Subaward Reporting System (FSRS). 2 CFR 170 provides detailed guidance as to what information needs to be reported in these systems and the deadlines for submitting this information. Recipient information that is reported to FSRS is ultimately transferred to USAspending.gov for public display.

Suspension and Debarment Disclosure

This reporting requirement pertains to disclosing information related to government-wide suspension and debarment requirements. Before a recipient enters into a grant award with NASA, the recipient must notify NASA if it knows if it or any of the recipient's principals under the award fall under one or more of the four criteria listed at 2 CFR Part 180.335:

- i. Are presently excluded or disqualified;
- ii. Have been convicted within the preceding three years of any of the offenses listed in 2 C.F.R. § 180.800(a) or had a civil judgment rendered against it or any of the recipient's principals for one of those offenses within that time period;
- iii. Are presently indicted for or otherwise criminally or civilly charged by a governmental entity (federal, state or local) with commission of any of the offenses listed in 2 C.F.R. § 180.800(a); or
- iv. Have had one or more public transactions (federal, state, or local) terminated within the preceding three years for cause or default.

At any time after accepting the award, if the recipient learns that it or any of its principals falls under one or more of the criteria listed at 2 C.F.R. § 180.335, the recipient must provide immediate written notice to NASA in accordance with 2 C.F.R. § 180.350.

Additional Reporting Requirements

NASA recipients must conform to all reporting requirements outlined in the Required Publications and Reports section of the GCAM, currently Appendix F.

G. NASA Contact Information

G.1 Contact and Resource Information

All general questions about this notice shall be submitted, by e-mail only, to the NASA MSFC Agreement Officer, Wade Amis (wade.s.amis@nasa.gov).

Questions regarding potential technical project collaboration with MSFC civil servant partners can be submitted to the MSFC Dual Use Technology Development CAN Program Manager, Dan O'Neil (daniel.a.oneil@nasa.gov), and Assistant Program Manager Quincy Bean (quincy.a.bean@nasa.gov).

After final Proposal selection notifications made within this notice are provided to the Applicants by the MSFC Agreement Officer (refer to Section F.1.), the NASA Shared Service Center (NSSC) Grant Distribution (nssc-contactcenter@mail.nasa.gov or 877-677-2123) is then responsible for the execution of the individual Cooperative Agreement awards and retains the procurement administration responsibility for the Cooperative Agreement through project closeout.

NASA MSFC, via the assigned MSFC Technical Lead/Officer for the awarded project, will retain technical management activities including safety, budgeting, funding, costing, property management, patents, and technology transfer.

G.2 Systems Information

NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES)

NSPIRES is the NASA Solicitation and Proposal Integrated Review and Evaluation System.

This web-based system supports the entire lifecycle of NASA research solicitation and selection,

from the release of solicitation announcements through proposal submission, the peer review and the decision process. Applicants may search for and apply for funding opportunities available at NASA through NSPIRES. For technical assistance with NSPIRES, please contact the NSPIRES Help Desk at nspires-help@nasaprs.com or (202) 479-9376, Monday through Friday, 8:00 AM – 6:00 PM ET.

H. Other Information

This section provides a variety of information about access to facilities and information. Subsections include access to facilities and systems, limited release of confidential business information, personal identify verification cards, a contracting prohibition, disclosure of invention, intellectual property, safety, and a prohibition against us of certain technologies.

H.1 Access to NASA Facilities/Systems

All recipients shall work with NASA project/program staff to ensure proper credentialing for any individuals who need access to NASA facilities and/or systems. Such individuals include U.S. citizens, lawful permanent residents (“green card” holders), and foreign nationals (those who are neither U.S. citizens nor permanent residents).

H.2 Limited Release of Proposers’ Confidential Business Information

- (a) For proposal evaluation and other administrative processing, NASA may find it necessary to release information submitted by the proposer to individuals not employed by NASA. Business information that would ordinarily be entitled to confidential treatment may be included in the information released to these individuals. Accordingly, by submission of this proposal the proposer hereby consents to a limited release of its confidential business information (CBI).
- (b) Except where otherwise provided by law, NASA will permit the limited release of CBI only pursuant to non-disclosure agreements signed by the assisting contractor or subcontractor, and their individual employees who may require access to the CBI to perform the assisting contract.

H.3 PIV Card Issuance

Personal Identify Verification (PIV) Card Issuance Procedures will be processed on a limited, as needed basis in accordance with FAR Clause 52.204-9, Personal Identity Verification of Contractor Personnel (Jan. 2011)

Personal Identity Verification of Contractor Personnel (Jan 2011)

- (a) The Contractor shall comply with agency personal identity verification procedures identified in the contract that implement Homeland Security Presidential Directive-12 (HSPD-12), Office of Management and Budget (OMB) guidance M-05-24 and Federal Information Processing Standards Publication (FIPS PUB) Number 201.
- (b) The Contractor shall account for all forms of Government-provided identification issued to the Contractor employees in connection with performance under this contract. The Contractor shall return such identification to the issuing agency at the earliest of any of the following, unless otherwise determined by the Government:

- (1) When no longer needed for contract performance.
- (2) Upon completion of the Contractor employee's employment.
- (3) Upon contract completion or termination.

(c) The Contracting Officer may delay final payment under a contract if the Contractor fails to comply with these requirements.

(d) The Contractor shall insert the substance of this clause, including this paragraph (d), in all subcontracts when the subcontractor's employees are required to have routine physical access to a Federally-controlled facility and/or routine access to a Federally-controlled information system. It shall be the responsibility of the prime Contractor to return such identification to the issuing agency in accordance with the terms set forth in paragraph (b) of this section, unless otherwise approved in writing by the Contracting Officer.

End of Provision

See Appendix C for the procedure and process for PIV.

H.4 Prohibition on Contracting by Kaspersky Lab and Other Covered Entities

The following will be incorporated into any resultant agreements:

52.204-23-Prohibition on Contracting for Hardware, Software, and Services Developed or Provided by Kaspersky Lab and Other Covered Entities (Nov 2021)

(a) Definitions. As used in this clause— Covered article means any hardware, software, or service that— (1) Is developed or provided by a covered entity; (2) Includes any hardware, software, or service developed or provided in whole or in part by a covered entity; or (3) Contains components using any hardware or software developed in whole or in part by a covered entity.

Covered entity means— (1) Kaspersky Lab; (2) Any successor entity to Kaspersky Lab; (3) Any entity that controls, is controlled by, or is under common control with Kaspersky Lab; or (4) Any entity of which Kaspersky Lab has a majority ownership.

(b) Prohibition. Section 1634 of Division A of the National Defense Authorization Act for Fiscal Year 2018 (Pub. L. 115–91) prohibits Government use of any covered article. The Contractor is prohibited from—

- (1) Providing any covered article that the Government will use on or after October 1, 2018; and
- (2) Using any covered article on or after October 1, 2018, in the development of data or deliverables first produced in the performance of the contract.

(c) Reporting requirement.

(1) In the event the Contractor identifies a covered article provided to the Government during contract performance, or the Contractor is notified of such by a subcontractor at any tier or any other source, the Contractor shall report, in writing, to the Contracting Officer or, in the case of the Department of Defense, to the website at <https://dibnet.dod.mil>. For indefinite

delivery contracts, the Contractor shall report to the Contracting Officer for the indefinite delivery contract and the Contracting Officer(s) for any affected order or, in the case of the Department of Defense, identify both the indefinite delivery contract and any affected orders in the report provided at <https://dibnet.dod.mil>.

(2) The Contractor shall report the following information pursuant to paragraph (c)(1) of this clause:

(i) Within 1 business day from the date of such identification or notification: The contract number; the order number(s), if applicable; supplier name; brand; model number (Original Equipment Manufacturer (OEM) number, manufacturer part number, or wholesaler number); item description; and any readily available information about mitigation actions undertaken or recommended.

(ii) Within 10 business days of submitting the report pursuant to paragraph (c)(1) of this clause: Any further available information about mitigation actions undertaken or recommended. In addition, the Contractor shall describe the efforts it undertook to prevent use or submission of a covered article, any reasons that led to the use or submission of the covered article, and any additional efforts that will be incorporated to prevent future use or submission of covered articles.

(d) Subcontracts. The Contractor shall insert the substance of this clause, including this paragraph (d), in all subcontracts including subcontracts for the acquisition of commercial products or commercial services.

H.5 Use and Disclosure of Research Resulting from Awards

As a Federal Agency, NASA requires prompt public disclosure of the results of its sponsored research to general knowledge that benefits the Nation. Thus, it is NASA's intent that all knowledge developed under awards resulting from this solicitation be shared broadly. In certain Science and Technology Mission Directorate (STMD) programs, award recipients will be expected to publish their work in peer-reviewed, open literature publications to the greatest extent practical.

NASA recognizes that there are cases when data cannot be disclosed to the public (e.g., export-controlled data). Even in these cases, proposers are expected to publish data to the greatest extent possible (e.g., use normalized data or at least discuss new methodologies used with clean "test cases"). NASA also understands that proposers may have legitimate proprietary interests in the technology or data they have produced at their own expense. If results must include proprietary or restricted information, that information should be appropriately marked and segregated into a separate Appendix that will not be publicly disseminated. A publicly releasable version of the final report and other deliverables shall be otherwise complete and comprehensive.

Further, NASA encourages the widest practicable dissemination of research results at any time during the course of the investigation.

(1) All information disseminated as a result of the award shall contain a statement which acknowledges NASA's support and identifies the award by number (e.g., "the material is based upon work supported by NASA under award No(s) XXXXX (as shown on the award notice).)

- (2) Except for articles or papers published in scientific, technical, or professional journals, the exposition of results from NASA supported research should also include the following disclaimer - “Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration.”
- (3) As a courtesy, any release of a NASA photograph or illustration should list NASA first on the credit line followed by the name of the Principal Investigator's Institution. As an example - “Photograph or illustration, figure, etc. courtesy of NASA or NASA Center managing the mission or program and the Principal Investigator's institution.”

H.6 Intellectual Property

Intellectual property provisions are subject to the terms and conditions in terms and conditions in 2 CFR 200, 2 CFR 1800, and the NASA GCAM, as applicable. For all recipients, the patent rights provision in a resulting award will require the disclosure to NASA of all subject inventions made under the cooperative agreement. NASA considers the reporting of inventions an important metric that will be used to measure whether new technologies are being developed. Reporting of inventions also protects a recipient’s ownership to such inventions since NASA has the right to obtain title in unreported inventions.

H.7 NASA Safety Statement

Safety is the freedom from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment. NASA's safety priority is to protect: (1) the public, (2) astronauts and pilots, (3) the NASA workforce (including employees working under NASA award instruments), and (4) high-value equipment and property.

H.8 Prohibition on Certain Telecommunications and Video Surveillance Services and Equipment

(a) Grant and cooperative agreement recipients and subrecipients are prohibited from obligating or expending grant funds to:

- (1) Procure or obtain,
- (2) Extend or renew a contract to procure or obtain; or
- (3) Enter into contract (or extend or renew contract) to procure or obtain equipment, services, or systems that use covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Pub. L. 115-232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).
 - i. For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera

Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).

- ii. Telecommunications or video surveillance services provided by such entities or using such equipment.
- iii. Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise, connected to the government of a covered foreign country.

Appendix A: Budget Summary



BUDGET SUMMARY EXAMPLE

FROM _____ TO _____ (Performance Period)

Proposed Project Cost

See instructions on page A-2	A Company/University In-kind Contributions	B NASA direct Cash Contribution covering Company/University items (if any)	C NASA internal In-kind Contributions (if any)	D Total Project Costs
<p>1) Direct labor contributions Company/University: (describe hours/rates for individual PI & other individual participant salaries, wages, fringe benefits, etc., included in direct labor costs)</p> <p>NASA Civil Service: (Note: For the NASA In-Kind Contribution column C include the only direct Civil Service full-time-equivalent (FTE) labor amounts and cost value (if any) in this block 1C. Include any NASA contactor engineering support or technician labor (WYE) in block 2C below).</p>	<p>\$5,000</p> <p>a) \$3,000 b) \$2,000 c) \$0</p>	<p>\$3,000</p> <p>a) \$0 b) \$2,000 c) \$1,000</p>	<p>\$3,000</p> <p>d) \$3,000</p>	<p>\$11,000</p> <p>a) \$3,000 b) \$4,000 c) \$1,000 d.) \$300</p>
<p>2) Direct Cost Items (provide a brief line-item description & cost rationale of Company/University partner and NASA direct cost items for columns A, B & C)</p> <p>Examples of direct cost items:</p> <p>a. Direct non-labor costs of equipment use b. Direct costs of facility use c. Student tuition d. Student stipend expenses e. Materials/supplies/consumables (describe) f. NASA contactor direct engineering support or technician labor (WYE) amounts and cost value (if any) g. Partner travel h. NASA travel i. Subcontracts (describe) j. Other direct project applicable costs (add & describe as needed)</p>	<p>\$4,000</p> <p>a) \$300 b) \$100 c) \$1,000 e) \$1,000 g) \$600 i) \$1000</p>	<p>\$1,700</p> <p>a) \$200 c.) \$1,000 e) \$100 g) \$400</p>	<p>\$1,300</p> <p>a) \$100 e) \$500 f) \$400 g. \$300</p>	<p>\$7,000</p> <p>a) \$600 b) \$100 c) \$2,000 d) e) \$1,600 f) \$400 g) \$1,000 h) \$300 i) \$1,000</p>
3) Facilities & Administrative Overhead Costs:	\$2,000	\$1,000	N/A	\$3,000
Subtotals for column A,B,C, D.:	\$11,000	\$5,700	\$4,300	\$21,000
TOTAL PROJECT BUDGET	\$11,000		\$10,000	\$21,000

A. Instructions

1. For the Step-1 Package, provide a completed budget summary for the project performance period for the Step-1 Package and for the Proposal, per the example table provided on Page A-1 and in the Excel budget summary worksheet. Provide payment and total amounts in whole dollars.
2. Column A shall reflect the cost amount of the project resources to be contributed by the company/university.

Column B shall reflect the cost amount of the company/project resources to be covered by NASA as a direct cash contribution to the recipient.

Note: Do not include any Partner in-kind contribution items or NASA in-kind contribution items in column B.

Column C shall reflect the cost amount of the project resources to be contributed by NASA as an in-kind (non-cash) contribution to the recipient. NASA in-kind contribution examples include the value of NASA direct civil service labor, NASA contractor support labor, NASA materials and supplies, NASA facilities and equipment use, etc., provided to support the project.

Note: NASA direct labor is the amount and dollar value of **civil-service** labor (noted as FTE) charged to the project.

For a generic estimate of NASA/MSFC civil service (FTE) labor value, 1 full-year of NASA MSFC FTE labor = \$195,000.

(E.g., a project anticipating 0.2 FTE (approximately 400 hours) of NASA MSFC civil service labor support = \$39,000 in-kind contribution value for 0.2 NASA FTE labor.)

The amount and dollar value of any NASA contractor support (non-civil service) labor (noted as WYE) needed for the project will be included as a separate line item in Other Direct Costs.

The NASA MSFC FYE labor rate estimate provided can also be used as an estimate for NASA MSFC WYE labor values, if more accurate WYE rate information is not available.

Column D shall reflect the Recipient's estimated total costs for the project

The Budget Summary for a Step-1 Package can be at a summary line-item level, although more detailed line item descriptions and associated cost estimate rationale for each are welcome.

3. **For the Step-2 Proposal only, cost item descriptions and computations of estimates in each cost category shall be provided to fully explain the proposed cost line item and the basis of the cost estimate amount.** Additional pages for supplemental budget /cost plan detailed explanations can be provided in the Proposal appendix and are not included in the Proposal total page count.

Any supplemental cost item descriptions, cost totals, and computations of estimates provided outside of the Budget Summary table, should be consistent with the content of the Budget Summary table and clearly delineate between those line items to be covered by the recipient's own in-kind contribution, the recipient's line items covered by the NASA cash contribution to the recipient, and line items covered by NASA's in-kind (non-cash) contribution.

NOTICE: INFORMATION CONTAINED ON THIS FORM IS NOT TO BE RELEASED OUTSIDE OF THE GOVERNMENT WITHOUT THE EXPRESS WRITTEN CONSENT OF THE RECIPIENT.

B. Specific Costs

For the Proposal, provide details and attachments as necessary to support each element listed below:

- 1) Direct Labor (salaries, wages, and fringe benefits): List number and titles of personnel, amounts of time to be devoted to the cooperative agreement, and rates of pay.

Note: For NASA, direct labor is the amount and dollar value of **civil-service labor** (noted as FTE) charged to the project.

Assistance in determining the appropriate specific cost value of NASA/MSFC civil service (FTE) labor for the proposed project can be provided by the assigned NSAS MSFC Technical POC identified in the Step-2 invitation notification letter

For a generic estimate of NASA/MSFC civil service (FTE) labor value, 1 full-year of NASA MSFC FTE labor = \$195,000.

(E.g., a project anticipating 0.2 FTE (approximately 400 hours) of NASA MSFC civil service labor support = \$39,000 in-kind contribution value for 0.2 NASA FTE labor).

The amount and dollar value of any NASA contractor support (non-civil service) labor (noted as WYE) needed for the project will be included as a separate line item in Other Direct Costs.

The NASA MSFC FYE labor rate estimate provided can also be used for NASA MSFC WYE labor values, if more accurate WYE rate information is not available.

- 2) Total Cash Contribution from NASA to the Company/University Partner (if any): In column B provide a brief line-item breakdown description and the cost rationale of all Company/University cost items that will be covered by the requested NASA cash contribution to the partner:

Note: Do not include any Partner in-kind contribution items or NASA in-kind contribution items in column B. Only include individual items covered by the NASA cash contribution.

- 3) Facilities and Administrative (F&A) Overhead Costs (Partner only): Identify F&A cost rate(s) and base(s) including the effective period of the rate. If applicable, identify the Cognizant Federal Agency for the partner F&A rates:

- 4) Other Direct Costs / In-kind Contributions of each Partner:

Equipment use: List each equipment separately. Explain the need for items costing more than \$5,000, unless a lower threshold has been established by your institution for classifying such purchases as equipment. Describe the basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the grant officer. Any equipment purchase requested to be made as a direct charge under this grant shall include the equipment description, how it will be used in the conduct of the basic research proposed, why it cannot be purchased with indirect funds, and a statement certifying that the equipment will be used exclusively for research and not for general business or administrative purposes.

- a) Facility use: Describe the basis for the estimated direct costs of specific facility use for the project.

Note: Use the Facilities and Administrative (F&A) Overhead Costs section to account for any indirect or overhead costs for facility use charged to the project.

- b) Graduate student tuition or stipend expenses: For universities, if applicable describe the cost of tuition and stipend expenses for students participating in the project. Student direct labor expenses should be accounted for and described in Block 1. _

- c) Supplies/materials/consumables: Provide the general description of needed supplies or materials, the method of acquisition. Provide the basis for the estimated cost if the line item total exceeds \$5,000.
- d) NASA direct cost engineering support contractor (non-civil service) labor (WYE): Provide estimated NASA WYE labor amounts and the associated direct cost amount
- e) Partner travel: Describe the purpose of the proposed travel in relation to the agreement and provide the basis of the travel cost estimate, including information on destination and number of travelers where known.
- f) NASA travel: Describe the purpose of the proposed travel in relation to the agreement and including information on destination and number of travelers where known.
- g) Subcontracts: Describe the work to be subcontracted, estimated cost amount and cost estimate rationale, the subcontract Applicant (if known), and the reason for subcontracting.
- h) Other Applicable Costs: List and describe any other project direct cost items and provide the estimated cost and cost estimate rationale.

Appendix B: Cooperative Agreement Collaboration Statement

The Cooperative Agreement Collaboration Statement is a mutually agreed-upon list which summarizes the project responsibilities and contributions of both parties. The Applicant is expected to provide the description of the NASA responsibilities and contributions as well as their own. The 1-page Collaboration Statement will be included as a part of the final cooperative agreement content. The Collaboration Statement shall include the following:

Cooperative Agreement Collaboration

Statement Project Title: Project Name.

Project Objective: Provide a concise summary description of the objective(s) of the project.

NASA MSFC shall be responsible for the following contributions to the joint activity:

1. Numerically list NASA/MSFC's significant responsibilities/contributions for the project.
- 2.
- 3.

(Name of Applicant organization) shall be responsible for the following contributions to the joint activity:

1. Numerically list the Applicant organization's significant responsibilities/contributions for the project.
- 2.
- 3.

Where relevant, the tasks listed should include a reference to the corresponding technical schedule/milestone(s).

See Page C-2 for an example of the Collaboration Statement.

Cooperative Agreement Collaboration Statement Example

Project Title: “The Design, Development, and Test of XYZ Prototype”.

Project Objective: The primary object of the project is to design, develop, and test a prototype unit. The performance test results of the developed XYZ prototype will be analyzed against performance objectives, and the analysis’ results and conclusions shall be provided in a final closeout briefing and technical report.

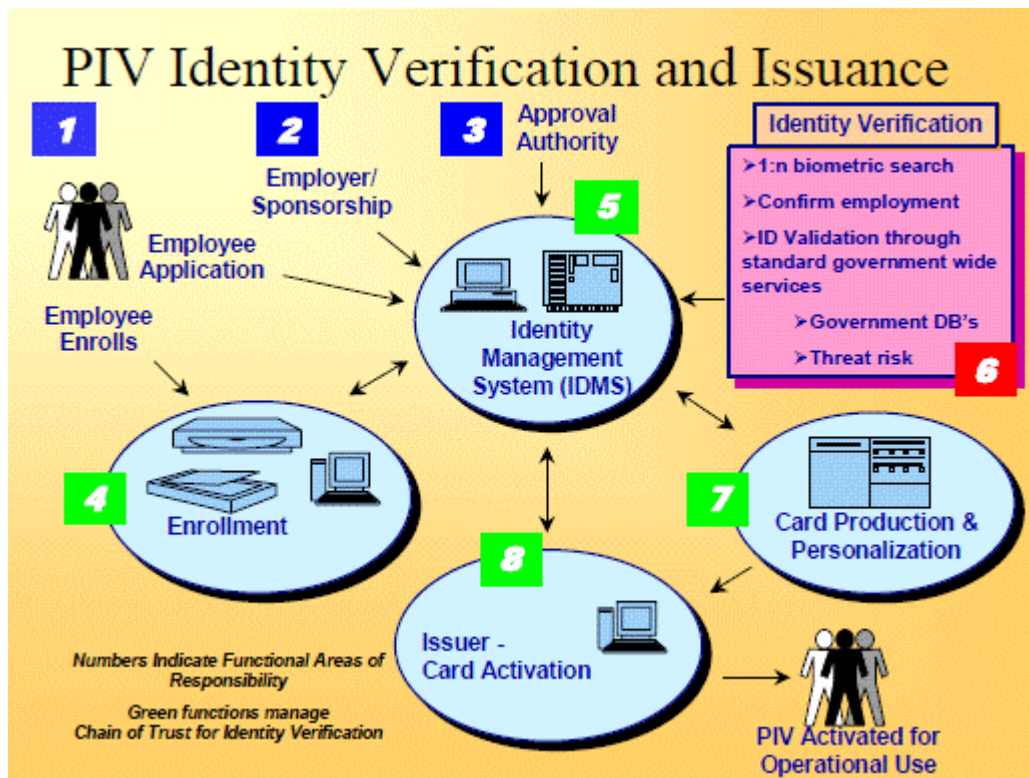
NASA MSFC shall be responsible for the following contributions to the joint activity:

1. MSFC will provide engineering consultation support to (Applicant name) for the development efforts for the XYZ prototype unit.
2. MSFC will provide sample materials to (Applicant name) for prototype development NLT Milestone C of the technical schedule.
3. MSFC will develop the prototype test plans and test procedures 2 weeks prior to the test start date.
4. MSFC will perform the testing of the developed prototype using the MSFC XXXX & YYYY test facilities. Testing will be complete at milestone E.
5. MSFC will...

(Applicant name) shall be responsible for the following contributions to the joint activity:

1. (Applicant name) will design and build the XYZ prototype during technical schedule milestones B-D.
2. (Applicant name) will work with MSFC to develop the prototype test plans and test procedures, and will observe the MSFC testing of the XYZ prototype (milestone E).
3. (Applicant name) will perform the data analysis on the prototype performance test results within 3 weeks after test completion.
4. (Applicant name) will ...
5. (Applicant name) will provide a final technical report detailing the XYZ prototype development and the results of the performance test at milestone G.

Appendix C: PIV Card Issuance Procedures



Step 1:

The grantee or recipient submits a formal letter that provides a list of the names of individuals (applicants) who require access to a federally controlled facility or access to a Federal information system to the cognizant NASA technical officer. In the case of a foreign national applicant, approval through the NASA Foreign National Management System (NFMMS) must be obtained for the visit or assignment before any processing for a PIV credential can take place. Further, if the foreign national is not under a grant or cooperative agreement where a technical officer has been officially designated, the foreign national will provide the information directly to their visit/assignment host, and the host sponsor will fulfill the duties of the technical officer mentioned herein. In each case, the letter shall provide notification of the grant, cooperative agreement, or foreign national's full name (first, middle and last), social security number (SSN) or NASA Foreign National Management System Visitor Number if the foreign national does not have a SSN, and date and place of birth. If the applicant has a current satisfactorily completed National Agency Check with Inquiries (NACI) or an equivalent or higher degree of background investigation, the letter shall indicate the type of investigation, the agency completing the investigation, and date the investigation was completed. Also, the letter must specify the risk/sensitivity level associated with the position in which each applicant will be working (NPR 1600.1, §4.5 is germane). Further, the letter shall also acknowledge that applicants may be denied access to NASA information or information systems based on an unsatisfactory background investigation/adjudication.

After reviewing the letter for completeness and concurring with the risk/sensitivity levels, the technical officer/host must forward the letter to the Center Chief of Security (CCS). The CCS shall review the OPM databases (e.g., DCII, PIP, et al.), and take appropriate steps to validate the applicant's investigation status. Requirements for a NACI or other investigation shall be initiated only if necessary.

Applicants who do not currently possess the required level of background investigation shall be directed to the e-QIP web site to complete the necessary background investigation forms online. The CCS shall provide to the technical officer/host information and instructions on how to access the e- QIP for each grantee, recipient or foreign national employee requiring access.

Step 2:

Upon acceptance of the letter/background information, the applicant will be advised that in order to complete the investigative process, he or she must appear in-person before the authorized PIV registrar and submit two forms of identity source documents in original form. The identity source documents must come from the list of acceptable documents included in Form I-9, Employment Eligibility Verification, one of which must be a [Federal](#)¹ or State issued picture identification. Fingerprints will be taken at this time. The applicant must appear no later than the entry on duty date.

When the applicant appears, the registrar will electronically scan the submitted documents; any document that appears invalid will be rejected by the registrar. The registrar will capture electronically both a facial image and fingerprints of the applicant. The information submitted by the applicant will be used to create or update the applicant identity record in the Identity Management System (IDMS).

Step 3:

Upon the applicant's completion of the investigative document, the CCS reviews the information, and resolves discrepancies with the applicant as necessary. When the applicant has appeared in person and completed fingerprints, the package is electronically submitted to initiate the NACI. The CCS includes a request for feedback on the NAC portion of the NACI at the time the request is submitted.

Step 4:

Prior to authorizing physical access of a grantee or recipient to a federally-controlled facility or access to a Federal information system, the CCS will ensure that a check has been performed with the National Crime Information Center (NCIC) and Interstate Identification Index. In the case of a foreign national, a national check of the Bureau of Immigration and Customs Enforcement (BICE) database will be performed for each applicant. If this process yields negative information, the CCS will immediately notify the technical officer/host of the determination regarding access made by

¹ A non-PIV government identification badge, including the NASA Photo Identification Badge, MAY NOT BE USED for the original issuance of a PIV vetted credential.

the CCS.

Step 5:

Upon receipt of the completed NAC, the CCS will update IDMS from the NAC portion of the NACI and indicate the result of the suitability determination. If an unsatisfactory suitability determination is rendered, the technical officer will advise the grantee or recipient that the applicant is being denied physical access to all federally controlled facilities and Federal information systems.

Based on a favorable NAC and NCIC/III or BICE check, the CCS will authorize the issuance of a PIV federal credential in the Physical Access Control System (PACS) database. The CCS, based on information provided by the technical officer/host, will determine what physical access the applicant should be granted once the PIV issues the credential.

Step 6:

Using the information provided by the applicant during his or her in-person appearance, the PIV card production facility creates and instantiates the approved PIV card for the applicant with an activation date commensurate with the applicant's start date.

Step 7:

The applicant proceeds to the credential issuance facility to begin processing for receipt of his/her federal credential.

The applicant provides to the credential issuing operator proof of identity with documentation that meets the requirements of FIPS 201 (DHSEmployment Eligibility Verification (Form I-9)) documents. These documents **must** be the same documents submitted for registration.

The credential issuing operator will verify that the facial image, and optionally referenced fingerprint, matches the enrollment data used to produce the card. Upon verification of identity, the operator will locate the employee's record in the PACS database and modify the record to indicate the PIV card has been issued. The applicant will select a PIN for use with his or her new PIV card. Although root data is inaccessible to the operator, certain fields (hair color, eye color, etc.) may be modified to more accurately record the employee's information.

The applicant proceeds to a kiosk or other workstation to complete activation of the PIV card using the initial PIN entered at card issuance.

ALTERNATIVE FOR APPLICANTS WHO DO NOT HAVE A COMPLETED AND ADJUDICATED NAC AT THE TIME OF ENTRANCE ON DUTY (EOD)

Steps 1 through 4 shall be accomplished for all applicants in accordance with the process described above. If the applicant is unable to appear in person until the time of entry on duty, or does not, for any other reason, have a completed and adjudicated NAC portion of the NACI at the time of entrance on duty, the following interim procedures shall apply.

1. If the documents required to submit the NACI have not been completed prior to EOD, the applicant will be instructed to complete all remaining requirements for submission of the investigation request. This includes presentation of I-9 documents and completion of fingerprints, if not already accomplished. If the applicant fails to complete these activities as prescribed in NPR 1600.1 (Chapters 3 & 4), it may be considered as failure to meet the conditions required for physical access to a federally controlled facility or access to a Federal information system, and result in denial of such access.
2. Based on favorable results of the NCIC, the applicant shall be issued a temporary NASA identification card for a period not-to-exceed six months. If at the end of the six month period the NAC results have not been returned, the agency will at that time make a determination as to whether an additional extension will be granted for the temporary identification card.
3. Upon return of the completed NAC, the process will continue from Step 5.