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| National Aeronautics and Space Administration | Nasa Logo |

***[Project Title]***

**SBIR/STTR Civilian Commercial Readiness Pilot Program (CCRPP)**

**CCRPP Application**

**Page Limit: 30 Pages**

**Date:** **MM/DD/YYYY**

**This form is only one of several parts required for a CCRPP Application. All parts of the CCRPP Applications are available at, and must be submitted through, the NASA SBIR/STTR Proposal Submissions and Awards Management System (ProSAMS) at:**

[https:](NULL)//prosams.nasa.gov/

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# Notice to Applicant

This document should describe the rationale, strategy, actions, roles and responsibilities of participants to mature the identified SBIR/STTR technology product and/or service for the specified application and customer, which could be a NASA sponsor program or mission or a non-NASA customer for which the application strongly aligns with and furthers NASA interests. Firms must follow the “CCRPP Application” template below to ensure compliance with application requirements.

A letter of commitment from an investor is a required entrance criterion for this application. This is an agreement between the applicant and the investor that the SBIR/STTR project has demonstrated sufficient results and that expansion and acceleration of project efforts in line with NASA interests are justified. The acceleration of the project should be clearly tied to a strong customer pull at the completion of the project.

Information provided by the submitter in the CCRPP application will be considered procurement sensitive and protected by the government in accordance with all applicable laws, regulations and policies.

# 1.0 Customer Objectives

## 1.1. Overview of Customer and Investor

Provide a brief description of the primary and or target customer(s) (a NASA Program/Project and/or non-NASA customer(s) whose application of the technology are justified as being strongly aligned with NASA goals, missions, and/or interests) that is to receive the technology or capability as a result of this CCRPP project.  The acceleration of the project should be clearly tied to a strong customer pull at the completion of the project.

This description should provide more detail than the summary in the Application Summary. Include the following:

1. Describe your customer for this CCRPP project. If there are multiple end customers, please describe.
2. Generally describe the customer’s plan (including justification of timing) to acquire this technology.
3. Is the customer the same as the investor that is providing matching funds for this project?
4. If the investor is not the same as the customer, please describe the investor, and describe what relationship there is, if any, between the customer and the investor.

## 1.2 Program/Project/Customer Alignment

Describe how the CCRPP project matures the SBIR/STTR technology and fits into the customer’s technology needs, goals, and activities.

### 1.2.1 Expected Impacts and Benefits

Describe what the *maturation and transition efforts* **from this CCRPP project** will accomplish in terms of the technology. Indicate and describe any of the below expected impacts and benefits to the customers(s) associated with this technology. This should include, but not be limited to the following:

* Mission Enabling technologies
* Instrument or component technologies
* New capabilities
* Performance improvements
* Reliability improvements
* Cost savings
* Other.

### 1.2.2 Need Date(s) for the Technology

[Specify when (Quarter and FY) the technology must be ready.]

Table 1 - Need Dates

|  |  |
| --- | --- |
| **Customer Need** | **D****ATE [Qtr. & FY]** |
|  |  |

# 2.0 Additional Commercialization Information

NASA Phase II contractors develop a commercialization plan as a deliverable for the completion of their Phase II. If a previous NASA Phase II contractor, please provide the updated commercialization plan with any applicable changes or provide a new commercialization strategy if applying to NASA from another federal agency’s Phase II award.

A streamlined version of this plan, in addition to the other information already provided in this application, would include:

1. **Market Feasibility and Competition Strategy:** Describe (a) the target market(s) of the innovation and the associated product or service; (b) the competitive advantage(s) of the product or service; (c) key potential customers and applications, including NASA mission programs, prime contractors, and non-NASA commercial customers as applicable; (d) projected market size (NASA, other Government and/or non-Government); (e) the projected time to market and estimated market share within five years from market-entry; and (f) anticipated competition from alternative technologies, products and services and/or competing domestic or foreign entities.
2. **Commercialization Strategy:** Present the commercialization strategy for the innovation and associated product or service and its relationship to the Small Business Concern’s (SBC’s) business plans for the next five years. Describe experience and record in technology commercialization, and any existing and projected commitments (e.g. Government Phase III funding, Industry Investment, etc.) other than proposed for this CCRPP.
3. **Key Management, Technical Personnel and Organizational Structure:** Describe: (a) the skills and experiences of key management and technical personnel in technology commercialization; (b) current organizational structure; and (c) plans and timelines for obtaining expertise and personnel necessary for commercialization.
4. **Financial Strategy:** Delineate private financial resources committed to the development and transition of the innovation into market-ready product or service. Describe current investment, sales, licensing, and other indicators of commercial potential and feasibility. Describe the projected financial requirements and the expected or committed capital and funding sources necessary to support the planned commercialization of the innovation. Provide evidence of current financial condition (e.g., standard financial statements including a current cash flow statement). Describe how this CCRPP projects fits into a broader financial planning strategy towards commercialization.
5. **Intellectual Property:** Describe plans and current status of efforts to secure intellectual property rights (e.g., patents, copyrights, trade secrets) necessary to obtain investment, attain at least a temporary competitive advantage, and achieve planned commercialization.

# 3.0 Implementation Approach

## Maturation Strategy

Describe the approach to maturing the technology, summarizing the statement(s) of work. Depending on the complexity of the effort, multiple sub-sections may be appropriate; in this case, identify each major sub-system or component separately as needed.

For this effort, provide the following as a minimum:

1. Discuss the current status of the technology including a summary of the results of the prior Phase II effort and any other pertinent parallel/following efforts that advanced the technology. Justify how the current status and plan supports accelerated maturation at this time to support the near-term need(s).
2. Identify technology maturation tasks with a brief description for each. Describe the approach to transition the technology to the user from the maturation stage, such that an initial capability is achieved, and how the information in this CCRPP Application explains the technology transition.
3. This section should describe the required steps/activities to be accomplished to integrate, test, and certify (if applicable) the SBIR/STTR technology in the target program/project or operational application.
4. Identify other support or research efforts/programs required for successful maturation of this technology. Clearly describe how this technology supports or is supported by other NASA programs or projects, if applicable.
5. Describe how each source of funds will be applied and how financial contingencies will be addressed.

### 3.1.1 Schedule

* Tentative detailed schedule (e.g., Gantt chart) and Milestone Table

*[Provide separate schedules and tables if multiple sub-systems or components are required. Note this should be consistent with the milestones provided in the Application Budget.]*

***[Insert Gantt chart images as required]***

## Procurement Strategy

Describe all applicable procurements and subcontract relationships related to the proposed effort as separate line items in this section.

## Technical Strategy

Consider appropriate technical factors to make the products transition-ready through the course of the technology commercialization or integration. The following factors should be considered:

1. Implementation funding requests
2. Technology issues, risks, and mitigations
3. Integration issues, risks, and mitigations
4. Test and evaluation concept and implementation
5. Environmental, safety, and occupational health (if required).

## Logistics Strategy (as needed)

Consider appropriate logistics factors to make the products transition-ready through the course of the technology integration. The following factors should be considered on an as-needed basis:

1. Design interface
2. System reliability requirements
3. Technical data
4. Maintenance planning
5. Computer resources support
6. Manpower and personnel
7. Describe all applicable procurements and subcontract relationships.
8. Supply support
9. Support equipment requirements
10. Facilities
11. Asset Management
12. Environmental Issues
13. Training and training support.

## Manufacturing Strategy (if applicable)

Address manufacturing issues that must be demonstrated or addressed to allow technology production, including:

1. Demonstration of production readiness
2. Sources of product production/supply
3. Lean manufacturing and manufacturing development initiatives
4. Industrial capabilities.

## Key Personnel

Identify all key personnel involved in CCRPP activities whose expertise and functions are essential to the success of the project. Provide biographical information, including directly related education and experience. Where the resume/vitae is extensive, summaries that focus on the most relevant experience or publications are desired and may be necessary to meet the application size limitation.

## Readiness Levels

Provide Technology and Manufacturing Readiness Levels (TRL and MRL, respectively; refer to Appendix A and B) as applicable in Table 2 below.

At a minimum, TRL increases must be described. MRL may not be relevant depending on the customer. If MRL does not apply, it is left blank at the discretion of the applicant.

Definitions

Technology Development Level: State of technology, at a given point in time, e.g., is the technology reliable and mature enough to be integrated into a product and be used?

Integration Readiness Level: State of the progress of the technology towards inclusion into a system or product for actual use, e.g., how well are issues related to interaction with other components, technologies, or systems addressed?

Table 2 – Readiness Level Indicators

|  |  |  |
| --- | --- | --- |
| **Initial Technology Development Level** | **TRL: #** | Provide explanation/justification for this level and an "As of Date.” |
| **MRL: #** |
| **Projected Final Technology Development Level** | **TRL: #** | Provide rationale to support the ability of this technology project to achieve the projected level, based on customer needs. |
| **MRL: #** |
| **Identify Minimum Acceptable Integration Readiness Levels** | **TRL: #** | Provided by customer. This should match the investor letter. |
| **MRL: #** |
| **Projected Final Integration Readiness Levels** | **TRL: #** | Provide rationale to support the ability of this technology project to achieve the projected level, based on customer needs. |
| **MRL: #** |

Additional information and guidelines are available at the NASA SBIR/STTR website:

<http://sbir.nasa.gov/content/post-phase-ii-initiatives#CCRPP>

- End of CCRPP Technical Application -

# Appendix A: Manufacturing Readiness Levels

**Definition of Manufacturability**: 1. Extent to which a good can be manufactured with relative ease at minimum cost and maximum reliability. 2. The general engineering art of designing products in such a way that they are easy to manufacture.

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| --- | --- | --- | --- |
| **Phase (as specified by DoDI 5000.02**[[7]](http://en.wikipedia.org/wiki/Manufacturing_Readiness_Level#cite_note-7) | **MRL** | **Definition** | **Description** |
| **Material Solutions Analysis** | 1 | Basic manufacturing implications identified | Basic research expands scientific principles that may have manufacturing implications. The focus is on a high level assessment of manufacturing opportunities. The research is unfettered. |
| 2 | Manufacturing concepts identified | Invention begins. Manufacturing science and/or concept described in application context. Identification of material and process approaches are limited to paper studies and analysis. Initial manufacturing feasibility and issues are emerging. |
| 3 | Manufacturing proof of concept developed | Conduct analytical or laboratory experiments to validate paper studies. Experimental hardware or processes have been created, but are not yet integrated or representative. Materials and/or processes have been characterized for manufacturability and availability but further evaluation and demonstration is required. |
| 4 | Capability to produce the technology in a laboratory environment. | Required investments, such as manufacturing technology development identified. Processes to ensure manufacturability and quality are in place and are sufficient to produce technology demonstrators. Manufacturing risks identified for prototype build. Manufacturing cost drivers identified. Manufacturability assessments of design concepts have been completed. Key design performance parameters identified. Special needs identified for tooling, facilities, material handling and skills. |
| **Technology Development** | 5 | Capability to produce prototype components in a production relevant environment. | Manufacturing strategy refined and integrated with Risk Management Plan. Identification of enabling/critical technologies and components is complete. Prototype materials, tooling and test equipment, as well as personnel skills, have been demonstrated on components in a production relevant environment, but many manufacturing processes and procedures are still in development. Manufacturing technology development efforts initiated or ongoing. Manufacturability assessments of key technologies and components ongoing. Cost model based upon detailed end-to-end value stream map. |
| 6 | Capability to produce a prototype system or subsystem in a production relevant environment. | Initial manufacturing approach developed. Majority of manufacturing processes have been defined and characterized, but there are still significant engineering/design changes. Preliminary design of critical components completed. Manufacturability assessments of key technologies complete. Prototype materials, tooling and test equipment, as well as personnel skills have been demonstrated on subsystems/ systems in a production relevant environment. Detailed cost analysis includes design trades. Cost targets allocated. Manufacturability considerations shape system development plans. Long lead and key supply chain elements identified. Industrial Capabilities Assessment for Milestone B completed. |
| **Engineering and Manufacturing Development** | 7 | Capability to produce systems, subsystems or components in a production representative environment. | Detailed design is underway. Material specifications are approved. Materials available to meet planned pilot line build schedule. Manufacturing processes and procedures demonstrated in a production representative environment. Detailed manufacturability trade studies and risk assessments underway. Cost models updated with detailed designs, rolled up to system level and tracked against targets. Unit cost reduction efforts underway. Supply chain and supplier Quality Assurance assessed. Long lead procurement plans in place. Production tooling and test equipment design and development initiated. |
| 8 | Pilot line capability demonstrated. Ready to begin low rate production. | Detailed system design essentially complete and sufficiently stable to enter low rate production. All materials are available to meet planned low rate production schedule. Manufacturing and quality processes and procedures proven in a pilot line environment, under control and ready for low rate production. Known manufacturability risks pose no significant risk for low rate production. Engineering cost model driven by detailed design and validated. Supply chain established and stable. Industrial Capabilities Assessment for Milestone C completed. |
| **Production and Deployment** | 9 | Low Rate Production demonstrated. Capability in place to begin Full Rate Production. | Major system design features are stable and proven in test and evaluation. Materials are available to meet planned rate production schedules. Manufacturing processes and procedures are established and controlled to three-sigma or some other appropriate quality level to meet design key characteristic tolerances in a low rate production environment. Production risk monitoring ongoing. [LIRP](http://en.wikipedia.org/wiki/Low_rate_initial_production) cost goals met, learning curve validated. Actual cost model developed for Full Rate Production environment, with impact of Continuous improvement. |
| **Operations and Support** | 10 | Full Rate Production demonstrated and lean production practices in place. | This is the highest level of production readiness. Engineering/design changes are few and generally limited to quality and cost improvements. System, components or items are in rate production and meet all engineering, performance, quality and reliability requirements. All materials, manufacturing processes and procedures, inspection and test equipment are in production and controlled to six-sigma or some other appropriate quality level. Full Rate Production unit cost meets goal, and funding is sufficient for production at required rates. Lean practices well established and continuous process improvements ongoing. |

-End of Appendix A-

# Appendix B: Technology Readiness Level (TRL)

The Technology Readiness Level (TRL) describes the stage of maturity in the development process from observation of basic principles through final product operation. The exit criteria for each level documents that principles, concepts, applications or performance have been satisfactorily demonstrated in the appropriate environment required for that level. A relevant environment is a subset of the operational environment that is expected to have a dominant impact on operational performance. Thus, reduced-gravity may be only one of the operational environments in which the technology must be demonstrated or validated in order to advance to the next TRL.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **TRL** | **Definition** | **Hardware Description** | **Software Description** | **Exit Criteria** |
| **1** | Basic principles observed and reported. | Scientific knowledge generated underpinning hardware technology concepts/ applications. | Scientific knowledge generated underpinning basic properties of software architecture and mathematical formulation. | Peer reviewed publication of research underlying the proposed concept/ application. |
| **2** | Technology concept and/or application formulated. | Invention begins, practical application is identified but is speculative, no experimental proof or detailed analysis is available to support the conjecture. | Practical application is identified but is speculative, no experimental proof or detailed analysis is available to support the conjecture. Basic properties of algorithms, representations and concepts defined. Basic principles coded. Experiments performed with synthetic data. | Documented description of the application/ concept that addresses feasibility and benefit. |
| **3** | Analytical and experimental critical function and/or characteristic proof of concept. | Analytical studies place the technology in an appropriate context and laboratory demonstrations, modeling and simulation validate analytical prediction. | Development of limited functionality to validate critical properties and predictions using non-integrated software components. | Documented analytical/  experimental results validating predictions of key parameters. |
| **4** | Component and/or breadboard validation in laboratory environment. | A low fidelity system/component breadboard is built and operated to demonstrate basic functionality and critical test environments, and associated performance predictions are defined relative to the final operating environment. | Key, functionally critical, software components are integrated, and functionally validated, to establish interoperability and begin architecture development.  Relevant Environments defined and performance in this environment predicted. | Documented test performance demonstrating agreement with analytical predictions.  Documented definition of relevant environment. |
| **5** | Component and/or breadboard validation in relevant environment. | A medium fidelity system/component brassboard is built and operated to demonstrate overall performance in a simulated operational environment with realistic support elements that demonstrates overall performance in critical areas.  Performance predictions are made for subsequent development phases. | End-to-end software elements implemented and interfaced with existing systems/simulations conforming to target environment. End-to-end software system, tested in relevant environment, meeting predicted performance.  Operational environment performance predicted. Prototype implementations developed. | Documented test performance demonstrating agreement with analytical predictions.  Documented definition of scaling requirements. |
| **6** | System/ subsystem or prototype demonstration in a relevant environment. | A high fidelity system/component prototype that adequately addresses all critical scaling issues is built and operated in a relevant environment to demonstrate operations under critical environmental conditions. | Prototype implementations of the software demonstrated on full-scale realistic problems. Partially integrate with existing hardware/software systems. Limited documentation available. Engineering feasibility fully demonstrated. | Documented performance demonstrating agreement with analytical predictions. |

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| **7** | System prototype demonstration in an operational environment. | A high fidelity engineering unit that adequately addresses all critical scaling issues is built and operated in a relevant environment to demonstrate performance in the actual operational environment and platform (ground, airborne, or space). | Prototype software exists having all key functionality available for demonstration and test. Well integrated with operational hardware/software systems demonstrating operational feasibility. Most software bugs removed. Limited documentation available. | Documented test performance demonstrating agreement with analytical predictions. |
| **8** | Actual system completed and "flight qualified" through test and demonstration. | The final product in its final configuration is successfully demonstrated through test and analysis for its intended operational environment and platform (ground, airborne, or space). | All software has been thoroughly debugged and fully integrated with all operational hardware and software systems. All user documentation, training documentation, and maintenance documentation completed. All functionality successfully demonstrated in simulated operational scenarios.  Verification and Validation (V&V) completed. | Documented test performance verifying analytical predictions. |
| **9** | Actual system flight proven through successful mission operations. | The final product is successfully operated in an actual mission. | All software has been thoroughly debugged and fully integrated with all operational hardware/software systems. All documentation has been completed. Sustaining software engineering support is in place.  System has been successfully operated in the operational environment. | Documented mission operational results. |

## Definitions for Appendix B

**Proof of Concept:** Analytical and experimental demonstration of hardware/software concepts that may or may not be incorporated into subsequent development and/or operational units.

**Breadboard:** A low fidelity unit that demonstrates function only, without respect to form or fit in the case of hardware, or platform in the case of software. It often uses commercial and/or ad hoc components and is not intended to provide definitive information regarding operational performance.

**Brassboard:** A medium fidelity functional unit that typically tries to make use of as much operational hardware/software as possible and begins to address scaling issues associated with the operational system. It does not have the engineering pedigree in all aspects, but is structured to be able to operate in simulated operational environments in order to assess performance of critical functions.

**Proto-type Unit:** The prototype unit demonstrates form, fit, and function at a scale deemed to be representative of the final product operating in its operational environment. A subscale test article provides fidelity sufficient to permit validation of analytical models capable of predicting the behavior of full-scale systems in an operational environment

**Engineering Unit:** A high fidelity unit that demonstrates critical aspects of the engineering processes involved in the development of the operational unit. Engineering test units are intended to closely resemble the final product (hardware/software) to the maximum extent possible and are built and tested so as to establish confidence that the design will function in the expected environments. In some cases, the engineering unit will become the final product, assuming proper traceability has been exercised over the components and hardware handling.

**Mission Configuration:** The final architecture/system design of the product that will be used in the operational environment. If the product is a subsystem/component, then it is embedded in the actual system in the actual configuration used in operation.

**Laboratory Environment:** An environment that does not address in any manner the environment to be encountered by the system, subsystem, or component (hardware or software) during its intended operation. Tests in a laboratory environment are solely for the purpose of demonstrating the underlying principles of technical performance (functions), without respect to the impact of environment.

**Relevant Environment:** Not all systems, subsystems, and/or components need to be operated in the operational environment in order to satisfactorily address performance margin requirements. Consequently, the relevant environment is the specific subset of the operational environment that is required to demonstrate critical "at risk" aspects of the final product performance in an operational environment. It is an environment that focuses specifically on "stressing" the technology advance in question.

**Operational Environment:** The environment in which the final product will be operated. In the case of space flight hardware/software, it is space. In the case of ground-based or airborne systems that are not directed toward space flight, it will be the environments defined by the scope of operations. For software, the environment will be defined by the operational platform.

- End of Appendix B -