MSFC Small Business Innovation Research

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Small Business Innovation Research (SBIR) program objectives established by law include stimulating technological innovation in the private sector, strengthening the roles of small-business concerns in meeting federal research and development needs, increasing the commercial application of federally supported research results, and fostering and encouraging participation by socially and economically disadvantaged persons and women-owned small businesses in technological innovation.

There are three phases in the Small Business Innovation Research program. The purpose of phase I is to determine the technical feasibility of the proposed innovation and the quality of the performance of the small-business concern with a relatively small NASA investment before consideration of further federal support. The performance period is 6 months, with funding up to $70,000. To be eligible for phase I selection, a proposal must be based on an innovation having high technical or scientific merit that is responsive to a NASA need.

The objective of phase II is to continue development of selected innovations shown feasible in phase I that have the highest potential value to NASA and the U.S. economy. Phase II awards may not necessarily complete the research and development required to satisfy commercial and federal needs beyond the Small Business Innovation Research program, but completion of the research and development as well as commercializing the results should be pursued in phase III. Phase II lasts 2 years, with funding up to $600,000.

Phase III is pursuit by Small Business Innovation Research contractors of commercial application of their project results using private-sector funds. This is in support of the government's policy to stimulate technological innovation and provide for return on investment from government-funded research/research and development that is in aid of the national economy. Phase III may also be follow-on, non-Small Business Innovation Research-funded contracts with the government for Small Business Innovation Research-derived products or processes for use by the federal government.

Small Business Technology Transfer is a pilot program with similar objectives to Small Business Innovation Research. This program is a cooperative research and development effort conducted by a small business concern and a research institution. The phase I performance period is 1 year, with funding up to $100,000. Phase II lasts up to 2 years, with funding up to $500,000.

Contact the MSFC Small Business Innovation Research/Small Business Technology Transfer program manager for more information about a particular program. A representation of completed contracts with the phase II results and commercialization of the end products/processes is provided as follows:

Company Name: Accurate Automation Corporation
Contract Number: NAS–8–38967
Project Title: Advanced Telerobotic Control Using Neural Networks

The phase II end product of this endeavor was a new hybrid neural/adaptive robot system with a controller that is unique in that it can be readily adapted from one robot to another without modifying the control software.

By updating the training of the underlying neural network each time the robot arm is moved, the controller automatically learns to improve its performance each time it is used. The system was designed around a unique neural-network coprocessor developed by Accurate Automation Corporation in support of this and other related Small Business Innovation Research programs. The neural-network coprocessor has since been commercialized and is presently being marketed. It has licensees in both PC and Versa Module Eurocard form factors.

Follow-on applications of the technology include aircraft actuator control and the control of a four-motor electric car. Silicon Graphics has provided Accurate Automation Corporation with a considerable amount of equipment as a result of this contract. Unisys, who developed the dual Digital Signal Processor board for the Neural Network Processor, has also invested heavily in the board. This has resulted in sales to Phillips Laboratory, Texas Instruments, Lockheed Martin, Pratt & Whitney, and others for the Versa Module Eurocard board.

The target application arena for this technology includes use in environments dangerous for humans, including underwater ship cleaning and inspection and assembly applications.

Company Name: Engineering Sciences, Inc.
Contract Number: NAS–8–40175
Project Title: A Fast Algorithm for Transient All-Speed Flows and Finite-Rate Chemistry

The phase II end product of this effort was a highly efficient algorithm that can be incorporated into any computational fluid dynamics code for a more efficient and reliable analysis of multiphase flow fluid dynamics and thermodynamics inside liquid-propellant rocket engine combustion devices.

With the technology developed during the first two phases of this effort, Engineering Systems, Inc., has modeled spray-coating processes in an effort to understand the physics of the thermal protection layer coating of the shuttle program's solid rocket boosters. United Space Boosters, Inc., is funding this activity. During 1994 and 1995, Pratt & Whitney employed Engineering Systems' technology to enhance the computational efficiency of the NASTAR code, and last year Engineering Systems utilized the technology to model steam-sterilization processes for Baxter Healthcare Corporation.

NASA has now provided further funding for the development of a code that will address combustion issues relevant to the performance of tripropellant engine preburners/injectors. The technology initiated under the auspices of the Small Business Innovation Research program are now aimed at the development of next-generation launch vehicle propulsion.

Company Name: Plasma Processes, Inc.
Contract Number: NAS–8–40585
Project Title: Innovative Plasma Nozzle Techniques for Eliminating Overspray

This project's phase II end product was a bell-contoured plasma nozzle configuration that reduces overspray, optimizing material-deposition efficiency and quality of vacuum- and air-plasma spray coatings and structures.

Plasma Processes, Inc., designed bell-contoured vacuum plasma spray nozzles that have reduced overspray by 50 percent when spraying copper and copper alloys. The company has also reduced tungsten overspray, producing denser, less-porous coatings than previously achievable. As a result, nozzles have been used to successfully spray-form tungsten crystal-growth furnace cartridge tubes which will be used to process materials in microgravity.

Bell-contoured vacuum plasma spray nozzles have been designed for the Department of Energy to spray gradient materials on plasma-facing components of a nuclear-fusion reactor. In addition, a leading thermal spray equipment and consumables manufacturer has committed to test the nozzles at its own cost to evaluate the nozzles' potential for use in its equipment, and the world's largest producer of plasma spray equipment has issued a letter of intent to purchase a specified number of the nozzles. Plasma Processes, Inc., is currently employing bell-contoured nozzles in a phase II contract to fabricate crystal-growth furnace cartridge tubes for NASA. They will also be used to spray toxic materials (e.g., beryllium) for Department of Energy projects and to fabricate "smart materials" that function as proximity sensors.

Company Name: SECA, Inc.
Contract Number: NAS–8–40583
Project Title: Propulsion Chemistry for Computational Fluid Dynamics Applications

During the phase II portion of this effort, predictive methodology was developed to determine the effect of using real-fluid thermodynamics and physical properties in computational fluid dynamics codes when analyzing propulsion system performance and operational characteristics.

Utilizing Small Business Innovation Research funding, SECA has developed real-fluid thermodynamic and caloric equations of state, transport properties, surface tension, and mixture rules to describe multicomponent fluids at an extreme range of states for propellant and exhaust components. These properties are described in subroutines for use with computational fluid dynamic codes for improving RP–1 injector-element and hybrid-propellant combustion efficiencies considering soot formation, fuel pyrolosis, and burn rate.

These new thermodynamic codes are being used by SECA for Lockheed Martin to analyze and design hybrid rocket motors for the Integrated Hybrid Propulsion Development

Program. SECA's effort in this work will continue through 1997.
The new property subroutines are also being used to predict spray combustion behavior of RP–1 when used alone and with a tripropellant system for the reusable launch vehicle designs of the X–33 and X–34. These tripropellant computational fluid design codes are being developed under a NASA/MSFC phase III Small Business Innovation Research study.

Sponsor: Office of Space Access and Technology; Small Business Innovation Research Program