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Small Business Innovation Research Post-Phase II Opportunity Assessment

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Abstract

This report outlines current Small Business Innovation Research (SBIR) Post-Phase II opportunity contract award results for the SBIR technology program from 2007 to 2011 for NASA's Aeronautics Research Mission Directorate (ARMD), Human Exploration and Operations Mission Directorate (HEOMD), Science Mission Directorate (SMD), and Space Technology Mission Directorate (STMD). The report provides guidelines for incorporating SBIR technology into NASA programs and projects and provides a quantitative overview of the post-Phase II award patterns that correspond with each mission directorate at NASA Glenn Research Center (GRC).

In recent years, one of NASA's goals has been to not only transfer SBIR technologies to commercial industries, but to ensure that NASA mission directorates incorporate SBIR technologies into their program and project activities. Before incorporating technologies into MD programs, it is important to understand each mission directorate structure because each directorate has different objectives and needs. The directorate program structures follow.

Aeronautics Research Mission Directorate (ARMD)

ARMD research focuses on traditional aeronautic disciplines and emerging fields, helping to make the Nation's air transportation system and future air and space vehicles more efficient. ARMD programs and research activities (Fig. 1) follow.

(1) Advanced Air Vehicles Program (AAVP): supports advanced air transport technology, revolutionary vertical-lift technology, commercial supersonic technology, advanced composites, and aeronautics evaluation and testing capabilities

(2) Airspace Operations and Safety Program (AOSP): develops and demonstrates airspace technology, assesses shadow modes using realistic technologies for the National Airspace System (NAS) for safe trajectory-based operations, and operates safe autonomous systems

(3) Integrated Aviation Systems Program (IASP): focuses on environmentally responsible aviation, unmanned aerial system integration into the NAS, and flight demonstrations and capabilities

(4) Transformative Aeronautics Concepts Program (TACP): this seedling program focuses on leading-edge aeronautic research, transformational tools and technologies, and convergent aeronautics solutions

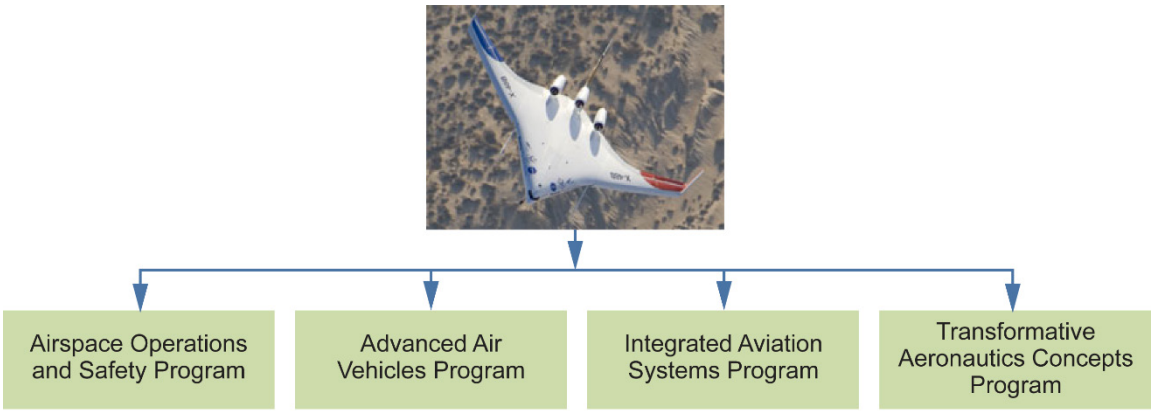

Figure 1.—Aeronautics Research Mission Directorate (ARMD) programs.

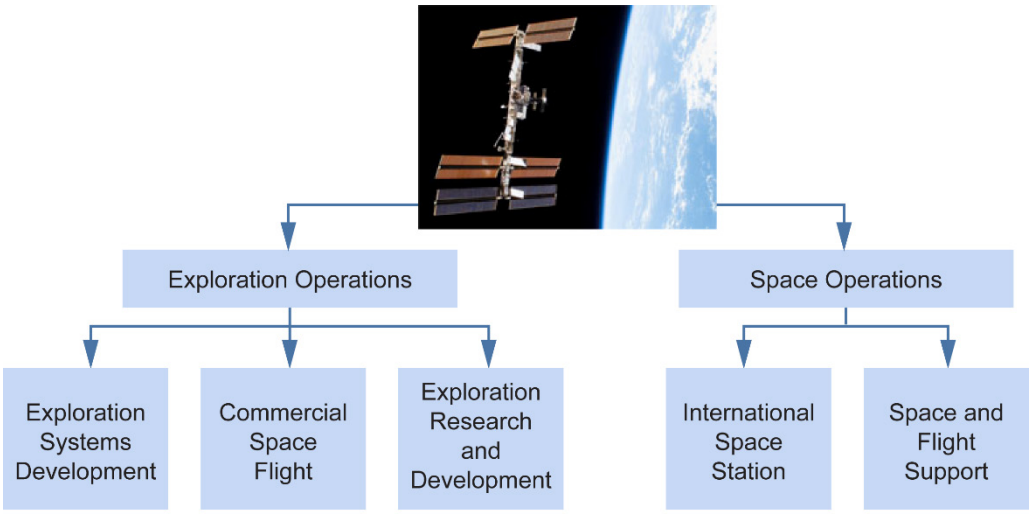

Figure 2.—Human Exploration Operations Mission Directorate (HEOMD) programs.

Human Exploration Operations Mission Directorate (HEOMD)

HEOMD topics and research focuses on advanced research and technology for beyond low Earth orbit (LEO) missions. HEOMD programs provide the Agency with space operations leadership and management related to human exploration in and beyond LEO. HEOMD research activities (Fig. 2) follow:

(1) Exploration Operations: manage commercial space transportation, exploration systems development, human space flight capabilities and advanced exploration systems, and space life sciences research and applications

(2) Space Operations: support space and ground infrastructure, and rocket propulsion testing capabilities; ensure safe, reliable, and affordable access to space; and maintain secure and dependable communications between ground stations and platforms across the solar system

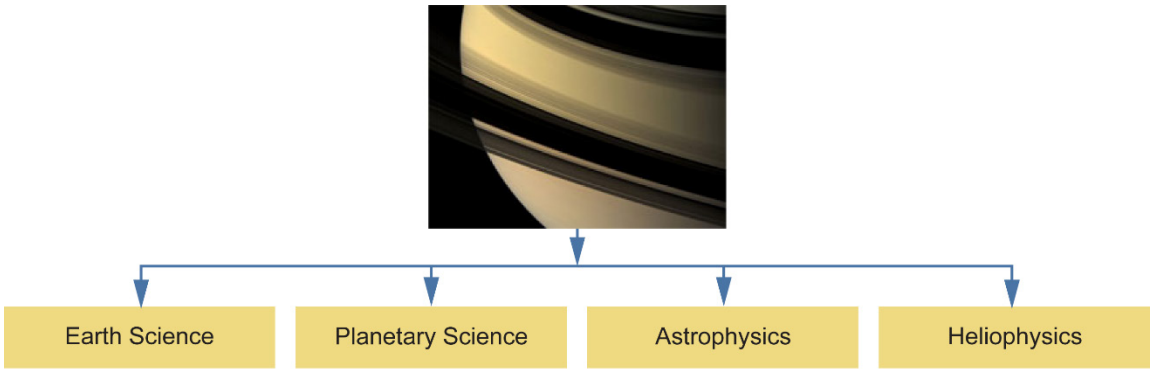

Figure 3.—Science Mission Directorate (SMD) programs.

Science Mission Directorate (SMD)

SMD topics and research focuses on conducting scientific exploration using space observatories and space probes to view the Earth from space, observe and visit other bodies in the solar system, and peer out into our Galaxy and beyond. SMD topics and research activities (Fig. 3) follow:

(1) Earth Science: develop a scientific understanding of Earth systems and Earth's response to natural and human-induced changes to improve prediction of climate, weather, and natural hazards for present and future generations

(2) Planetary Science: advance scientific understanding of the solar system, while pushing the limits of spacecraft and robotic engineering design and operations

(3) Astrophysics: discover how the universe works, explore how it began and evolved, and search for life on planets around other stars

(4) Heliophysics: explore the full system of complex interactions that characterize the relationship of the Sun with the solar system

Space Technology Mission Directorate (STMD)

STMD topics and research focuses on collaborative partnerships with industry to develop and demonstrate high-payoff technologies needed by the Agency to achieve current and future missions. STMD research activities (Fig. 4) follow:

(1) Centennial Challenges: engage the public through competitions to develop advanced technology and solutions that are valuable to NASA and the aerospace community

(2) Center Innovation Fund: provide funds for each NASA center that supports emerging technologies and create initiatives to leverage each center's talent and capabilities

(3) Flight Opportunities: develop and provide flight opportunities to demonstrate and validate space technologies in relevant environments

(4) Game-Changing Development: identify and rapidly mature innovative high-impact capabilities and technologies for use in a various future NASA missions

(5) Innovative Advanced Concepts Program: nurture visionary ideas that could transform future NASA missions by creating breakthroughs—radically better or entirely new aerospace concepts

(6) SBIR/Small Business Technology Transfer (STTR) Program: provides an opportunity for small, high technology companies and research institutions to participate in Government-sponsored research and development in key technology areas

(7) Small Spacecraft Technology Program: develops and demonstrates new capabilities using unique features of small spacecraft for science, exploration, and space operations

(8) Space Technology Research Grants: solicit proposals from accredited U.S. universities from outstanding early-career faculty members who are beginning independent research careers

(9) Technology Demonstration Missions Program: bridges the gap between early proof-of-concept tests and incorporating cost-effective, innovative new technologies into successful NASA, Government, and commercial space missions

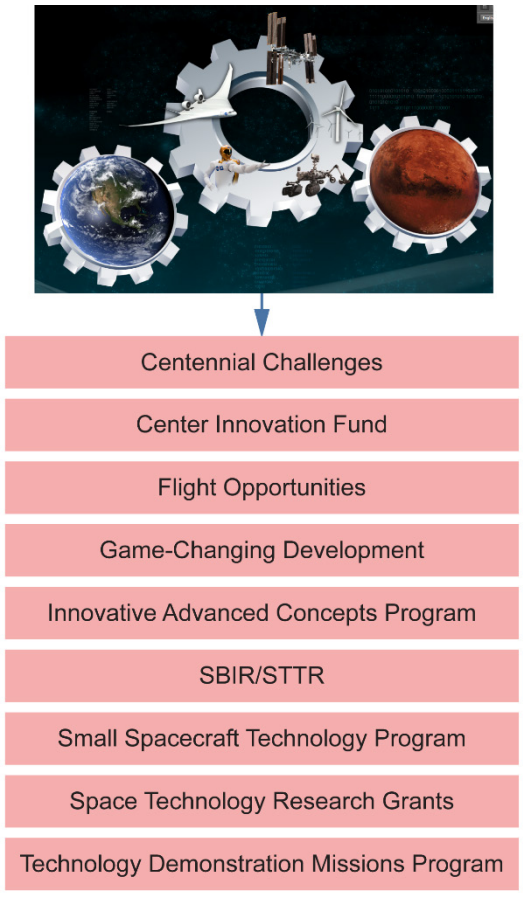

Figure 4.—Space Technology Mission Directorate (STMD) programs.

Incorporating SBIR technologies into practical use by mission directorates is a desirable goal for NASA but is very challenging. Although SBIR technologies are intended to be tools to help program managers meet their program needs, unfortunately a majority of program managers often claim that incorporating SBIR technologies into their programs adds a higher level of risk. Some of the program managers' concerns are

- Technology may not prove to be more cost effective.
- Typically corresponding with early Technology Readiness Levels (TRLs) 3 to 5.
- Inconsistent on-time product delivery caused by limited resources of small companies.
- Phase II funding was not sufficient to develop prototype for acquisition.
- Issues with company qualification and reliability causing significant schedule delays or cost overruns.
- Cannot determine if engineering specifications meet the program requirements.

Post-Phase II Opportunity Contract Awards

Program managers have not traditionally considered SBIR technologies as part of their mainstream activities because they have no incentive unless the SBIR technology is one of a few paths for potential program success. Program managers are more likely to purchase and modify off-the-shelf technology to meet their limited time schedules. To overcome some of the program managers' concerns, the NASA SBIR/STTR program instituted matching fund initiatives. The Phase II Enhancement (Phase II-E), Phase II eXpanded (Phase II-X), and the recently implemented Commercialization Readiness Program (CRP) initiatives can be the key to transition from TRL 4 to 6.

In general, SBIR/STTR projects are structured into four corresponding stages and phases as shown in Figure 5. The post-Phase II portion is essential in bridging the gap between stages 2 and 4 and in providing incentives to program managers to adopt SBIR technology. Because these initiatives provide matching funds, most program managers are eager to partner with small businesses. Initiatives typically last between 6 and 36 months and create more opportunities to mature technologies and therefore reduce the associated risks. In turn, this increases the likelihood of incorporating technologies into mission directorate or other Government or commercial programs. These options are summarized as follows.

- Phase II-E: This option advances Phase II innovations by extending existing Phase II contracts. Under Phase II-E extensions, NASA SBIR will match investments in technology development that small businesses secure from eligible non-NASA SBIR third parties on a dollar-for-dollar basis. The minimum matching investment is $25,000 and the maximum is $150,000, extending projects by 6 to 12 months.
- Phase II-X: This option establishes a strong and direct partnership between the SBIR program and NASA programs and projects undertaking new technology development. Under Phase II-X expansions, NASA SBIR will double the funding that small businesses secure from non-SBIR NASA programs or projects. The minimum investment that NASA SBIR will double is $75,000 and the maximum is $250,000. Expanded projects last between 12 and 24 months.
- CRP: This program accelerates transition of SBIR-developed technologies into NASA applications. Projects that request SBIR funding under the CRP option must (1) involve a technology that entered into either a Phase I or Phase II contract and (2) identify how more SBIR funding would accelerate development in response to NASA program or project needs. The minimum matching investment is $100,000 and the maximum is $1.5 million, extending projects by 24 to 36 months.

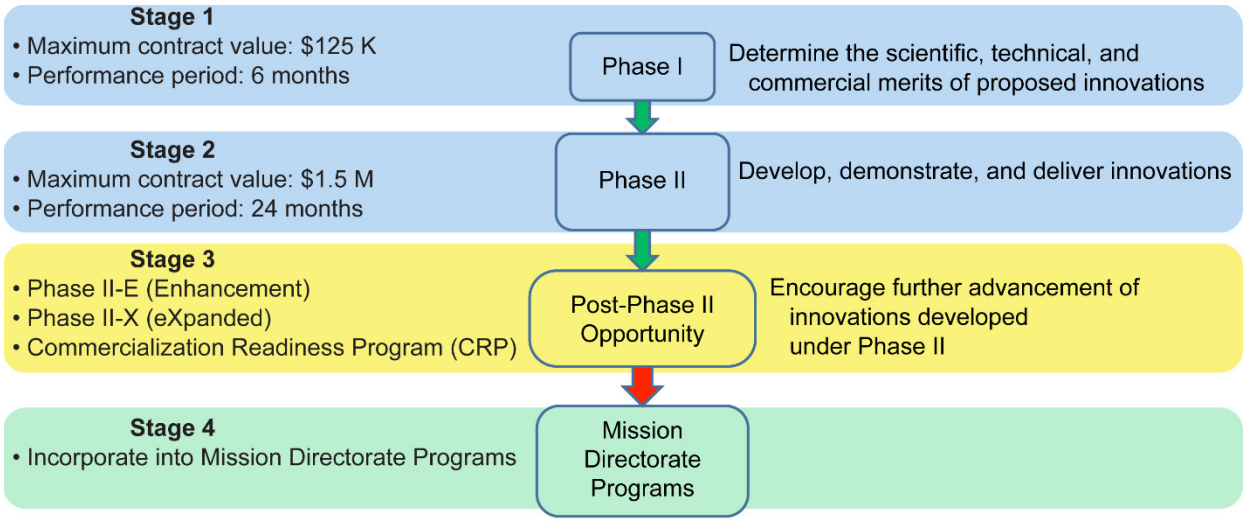

Figure 5.—SBIR development stages.

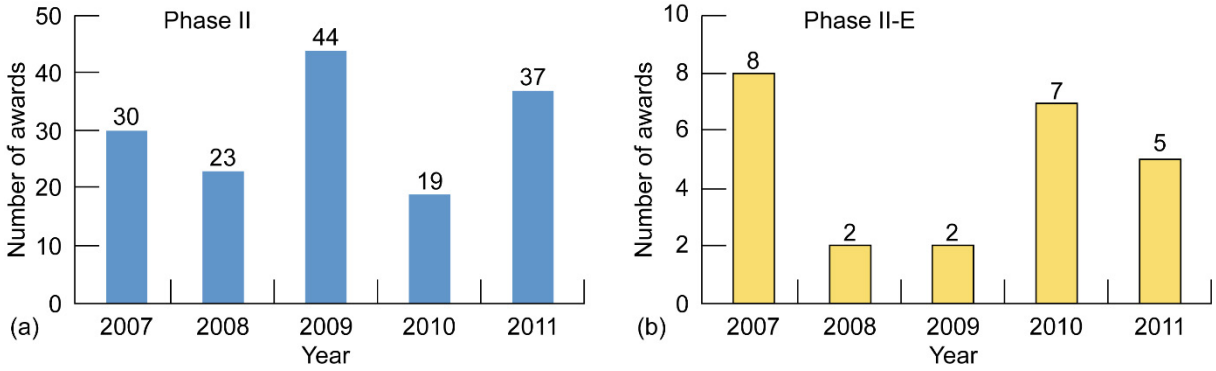

Figure 6.—Contracts awarded to GRC by 2007 to 2011 solicitation year. (a) Phase II. (b) Phase II-E

Quantitative Evaluation of Post-Phase II Contract Awards

When this report was written, no Phase II-X contract award data was available, therefor only data pertaining to Phase II-E and CRP contracts awarded to GRC are discussed in this report.

GRC received a total of 153 Phase II contracts during the 2007 to 2011 solicitation years as shown in Figure 6(a). The number of Phase II awards fell from a peak of 44 in 2009 to 19 in 2010—a 56 percent decline. Overall the number of Phase II awards did not fluctuate dramatically.

As of Phase II-E, GRC received 26 Phase II E contract awards as shown in Figure 6(b).The sharp increase in the number of awards between 2007 and 2010 may have been driven by factors such as programs and projects and SBIR subtopics were more aligned, and earlier planning of Stage 3 activities during Phase II.

Figure 7 shows the number of Phase II-E contracts awarded by mission directorate between 2007 and 2011—7 were awarded by ARMD, 11 by HEOMD, and 6 by SMD. It is worth noting that the discrepancy in the number of awards is that some mission directorates develop technologies for internal use, while others focus on developing technologies for use outside the Agency.

Figure 8(a) shows the Phase II-E contracts awarded by all NASA, Department of Defense (DoD), and external funding sources. Both NASA and external sources awarded a total of 20 contracts between 2007 and 2011, slightly greater than DoD funding sources.

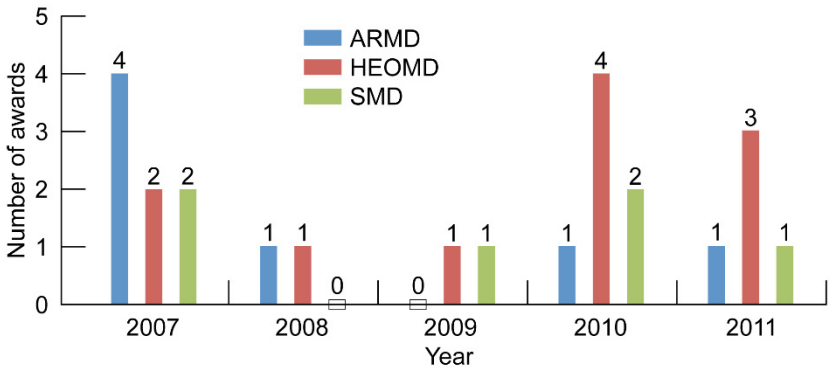

Figure 7.—Phase II-E contract awards by GRC mission directorate, 2007 to 2011.

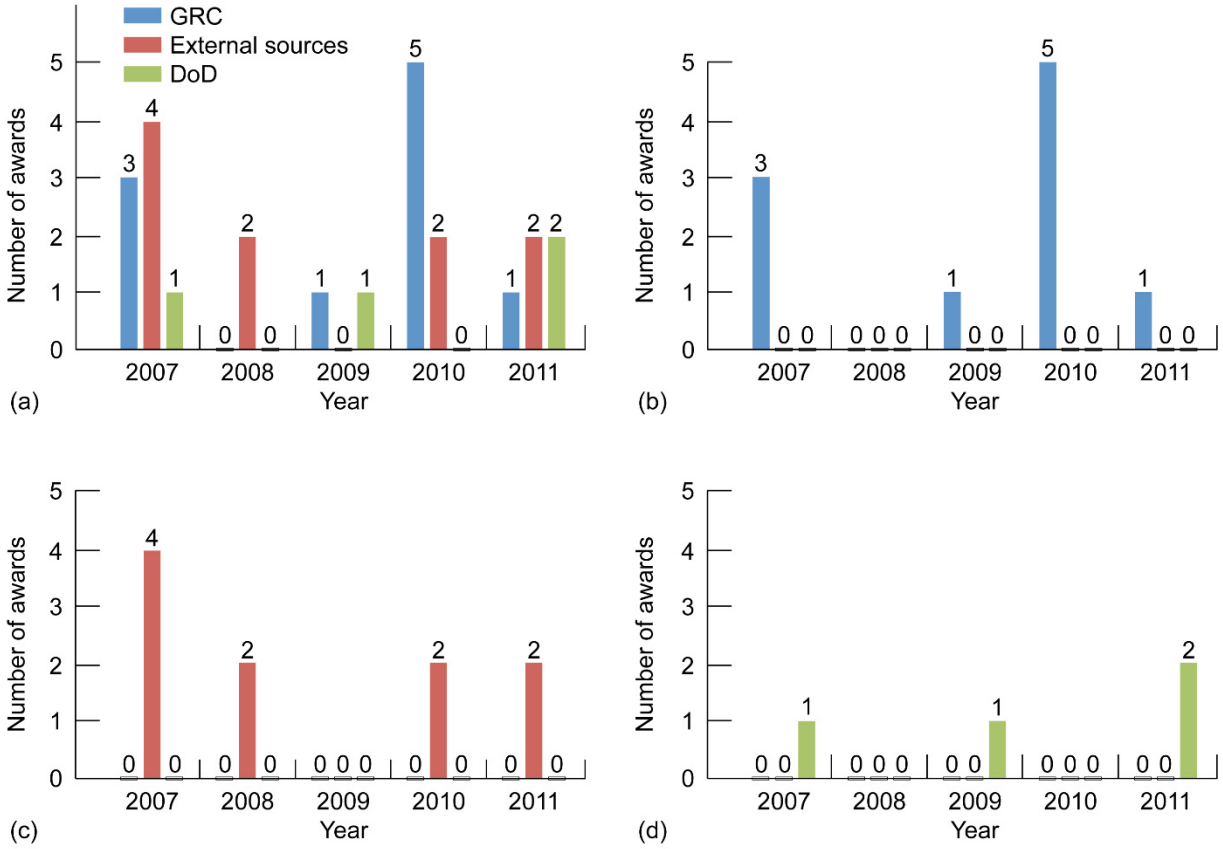

Figure 8.—Phase II-E contract award funding sources, 2007 to 2011. (a) All sources. (b) GRC programs. (c) External sources. (d) Department of Defense (DoD).

Between 2007 and 2011, GRC was awarded 10 Phase II-E contracts as shown in Figure 8(b). In contrast, external sources funded 10 contract awards as shown in Figure 8(c) and DoD awarded 4 contracts as shown in Figure 8(d).

Because CRP funding was initiated in Fiscal Year 2014, only three total SBIR Phase II contracts have been awarded—one each supporting SMD, STMD, and HEOMD as shown in Figure 9.

Infusion Process Guidelines

The SBIR Technology Infusion Manager (TIM) at GRC offers several services to help interested NASA stakeholders incorporate SBIR technology into their programs and projects. Figure 10 illustrates the process.

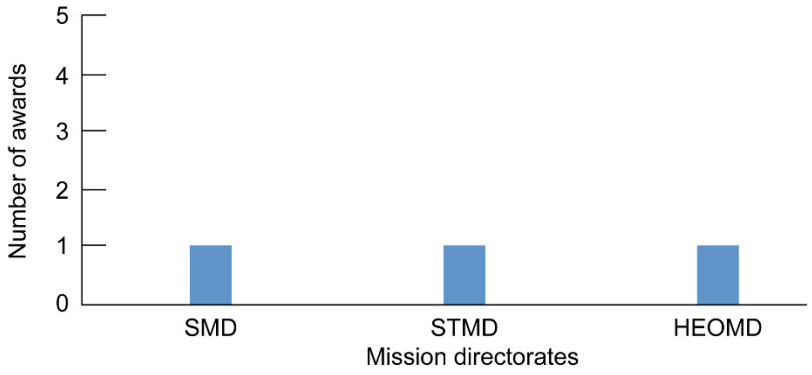

Figure 9.—2014 Commercialization Readiness Program contract awards by GRC mission directorate.

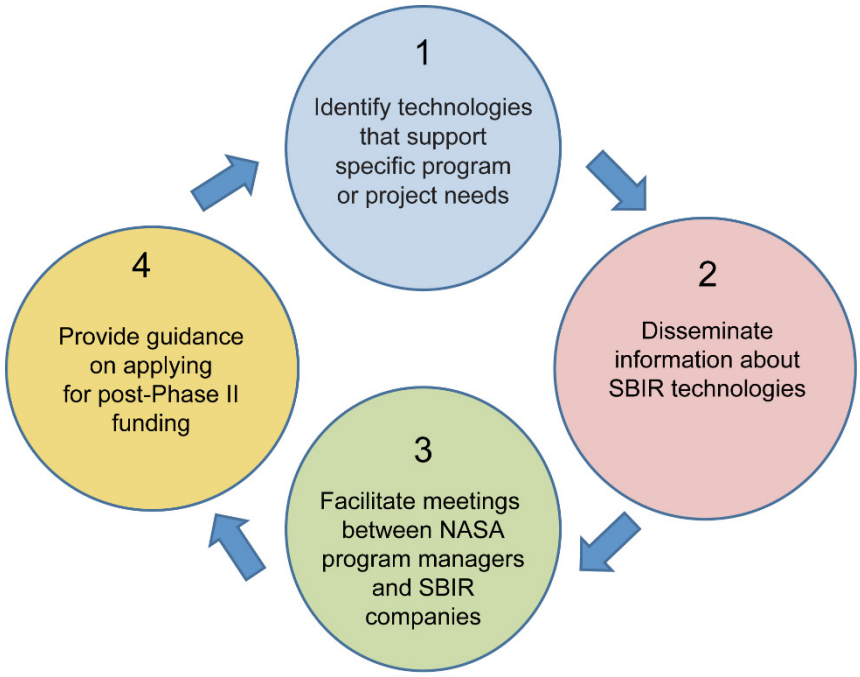

Figure 10.—Process for incorporating for Phase II contract awards into GRC mission directorates.