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Statement of

Douglas A. Comstock
Director, Innovative Partnerships Program Office
National Aeronautics and Space Administration

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Committee on Science and Technology

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Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to appear today to discuss NASA's Small Business Innovation Research (SBIR) Program and the Small Business Technology Transfer (STTR) Program. NASA's SBIR/STTR programs are managed by the Innovative Partnerships Program Office (IPPO) whose primary mission is to provide leveraged technology and capabilities to Agency programs and projects through partnerships with industry, academia, government agencies, and national laboratories.

The SBIR/STTR programs provide an opportunity for small, high technology companies and research institutions to participate in government sponsored research and development efforts on key technology needs. Below, I have addressed the questions posed by this Subcommittee in your invitation to testify.

Changes and Trends since last Reauthorization

Both the SBIR and STTR programs have evolved and matured since they were last authorized, in 2000 and 2001 respectively, and NASA continues to pursue ways to improve program efficiency and effectiveness. Organizationally, the programs have moved in recent years. In 2000, the SBIR/STTR programs were part of Commercial Technology Programs in the Office of Aerospace Technology. Then, in March 2004, the Exploration Systems Mission Directorate was created and SBIR/STTR moved under this new directorate as part of the Innovative Technology Transfer Partnerships Program, which subsequently was renamed the Innovative Partnerships Program Office (IPPO). In August 2005, IPPO (including SBIR/STTR) was established as an agency-wide mission support office reporting to the Office of the Administrator. The 2005 change reflected the desire to emphasize the agency-wide nature of what IPP does rather than

having it located in a single Mission Directorate, and was consistent with recommendations from the November 2004 report of the National Academy of Public Administration, "*Technology Transfer: Bringing Innovation to NASA and the Nation*". In 2000, the SBIR/STTR programs operated largely independently from the other partnership and technology transfer functions of the office they were part of. There is now a focus on managing these activities in an integrated way, to benefit from common technology priorities, outreach activities, and technology transfer and partnership opportunities.

NASA is also seeking to further improve the effectiveness of the SBIR/STTR programs by increased infusion of SBIR/STTR technology into NASA's programs and projects. A key element of this strategy is integration of SBIR/STTR investments into the overall technology development portfolio of NASA's four (4) Mission Directorates (Science, Aeronautics Research, Space Operations, and Exploration Systems). As an investment opportunity, SBIR/STTR projects address specific technology gaps in mission programs, provide a foundation for future technology needs, and are complementary to other research investments within the Directorates. Mission Directorates provide priorities for SBIR/STTR topic and subtopic areas as a direct means for obtaining needed technology breakthroughs for their ambitious programs in space and aeronautics.

In October 2006, NASA initiated a new consolidated structure for NASA's SBIR/STTR programs. The new program structure seeks to reduce program administrative cost, increase operational efficiency, streamline communications between Field Centers and Mission Directorates on technology needs and focus on achieving greater infusion of SBIR/STTR technologies into NASA's programs and projects. While all Field Centers continue to execute and manage SBIR/STTR awards, there are now four (4) primary Level III Centers who provide the direct interface with the four (4) Mission Directorates for identification and prioritization of SBIR/STTR topics and subtopics.

In another recent change, NASA is now beginning to track the maturity of technologies funded by SBIR/STTR through use of Technology Readiness Levels (TRLs). This is important for understanding when technologies will be ready for infusion into NASA's programs and projects, as well as their readiness for commercial use. TRLs range from one (1) to nine (9), with one (1) being a conceptual idea, six (6) being a prototype demonstrated in the relevant environment, and nine (9) being a fully operational mature technology. For infusion purposes, this is very important information to know because NASA's projects generally avoid technologies that are not at least a TRL six (6) by their preliminary design review. Tracking TRLs will also provide insight into the progress that technologies are making, and over time, the performance of different firms for successful maturing technologies.

NASA's extramural R&D spending increased by about 14% from 2000 to 2001, but has stayed relatively flat since that time, varying between $4.2 and $4.4 billion. As NASA retires the Space Shuttle and shifts resources towards development of new exploration systems in the next few years, it is expected that extramural R&D will increase.

Outreach Activities

NASA conducts many outreach efforts, primarily through conferences and workshops, to focus on increasing participation by the small business community. NASA continues to experience a steady flow of new firms in attendance to the NASA SBIR/STTR programs each year and is working closely with NASA's Office of Small Business Programs (OSBP) to more effectively reach all categories of small business concerns. The percentage of new firms participating in NASA's SBIR/STTR programs each year has been in the 30-50% range, yielding regular refreshing of the pool of applicants. These new participants have submitted between 20-35% of the total number of proposals in any given year. NASA conducts technology conferences and small business forums at many of our Field Centers, and also attends federal, state, and local sponsored conferences and workshops. At these conferences, we present our program and encourage dialog with attendees through one-on-one discussions with prospective SBIR/STTR recipients. We generally have speakers, as well as a display booth, to showcase the types of SBIR awards which were previously made, how they have benefited NASA, and how they have led to new commercial products.

NASA also has several publications that promote our SBIR/STTR programs by highlighting SBIR/STTR success stories and providing partnership opportunities for specific NASA technology needs. "*NASA Tech Briefs*" reaches roughly 250,000 unique readers each month, "*Innovation Magazine*" provides insight into NASA's priorities and activities as well as useful how-to information, and *"Spinoff"* documents 40-50 technology transfer successes each year, typically half of which come from the SBIR/STTR program. These publications are available in hard copy and on the web. Interested parties can gain access to these web-based publications through our IPP portal (http://www.ipp.nasa.gov) which acts as a one-stop-shop for all inquiries about the IPP programs, partnership opportunities, and NASA technology needs.

In addition to our publications, we produce annual *"Hallmarks of Success"* video stories featuring SBIR/STTR companies and the successful technologies they have developed in partnership with NASA. As an outreach and informational tool, "Hallmarks" are prime examples of investing federal dollars in research and development that are infused back into government programs and transferred to the commercial marketplace. As an educational mechanism, these stories also serve as role models for other small firms and research institutions that are interested in NASA's SBIR/STTR programs and its technology development partnerships. "Hallmarks" are distributed on DVD and on the web at http://sbir.gsfc.nasa.gov/SBIR/successvideo.html.

NASA's SBIR/STTR programs have achieved strong geographic participation, with all but five (5) states receiving Phase I awards from the program since 2000, and all but seven (7) states receiving Phase II awards. Since 2000, 24 states have received more than 20 awards from NASA's SBIR/STTR programs and 18 states have received more than 50.

Changes in Applicant Pool

Participation in NASA's SBIR/STTR programs has continued to be more than satisfactory. NASA has received an average of about 2,000 proposals annually since 2000, with a minimum

of 1,660 in 2001 and a peak of 2,695 in 2003. In 2006, NASA received 1,709 SBIR proposals. STTR proposals have ranged from a low of 45 in 2002 to a high of 232 in 2005, with 201 proposals received in 2006. There is no clear trend in the annual variation, and no apparent correlation to funding levels or numbers of topics and subtopics. The number of awards has remained relatively constant, consistent with the level of extramural R&D, with a total of about 450-500 awards annually.

Since 2000, between 15% and 18% of participating SBIR firms were minority-owned, and between 12% and 14% were women-owned. These firms competed well, with minority-owned firms accounting for 13% to 16% of firms receiving awards, and women-owned firms accounting for 9% to 13%. For STTR, since 2001, 8% to 16% of participating firms were women-owned and those firms accounted for up to 20% of the firms receiving awards, although none did in 2001. Minority firms have been strong participants in the STTR program since 2001, including 16% to 23% of participating firms, which accounted for 13% to 29% of firms receiving STTR awards. These statistics vary year-to-year and there is no clear trend.

Topic Selection

In the pursuit of mission objectives in aeronautics and space exploration, NASA is often pushing the boundaries of what has been done before, needing many technologies to either enhance current capabilities or enable new capabilities. Accordingly, SBIR/STTR topics are selected by representatives of NASA's four (4) Mission Directorates (Exploration Systems, Space Operations, Science, and Aeronautics Research), who ensure the topics are addressing important technology needs and are complementary to other technology investments. These Mission Directorate representatives work closely with technology experts at the Field Centers to identify technology needs at the subtopic level, in consultation with principal scientists and program/project managers. This ensures that the topics/subtopics are relevant to mission needs and fit into technology roadmaps so that infusion is more likely. In some cases, technologies may be aimed at the needs of particular projects with known development milestones. Subtopics are then written with TRL goals in mind to encourage innovations that achieve, at the conclusion of Phase II, maturity levels consistent with project needs. NASA's STTR topics also reflect the needs and priorities of NASA's Mission Directorates. Typically, STTR topics address NASA's longer-range research needs, at lower TRLs, which is appropriate for university researchers and non-profit research organizations. Near the conclusion of topic selection process, topics and subtopics are distributed for broader review and validation within the Mission Directorates.

Many technologies funded by SBIR/STTR have made important contributions to NASA programs and projects, and many have also been commercial successes that are bringing important benefits to society. The Agency is actively working to increase the number of NASA-funded SBIR/STTR technologies with applicability and adequate maturity for use in NASA's missions and projects. Two (2) prime examples of SBIR/STTR technologies that are making important contributions to some of NASA's high-profile programs are provided below:

- NASA's Mars Exploration Rovers are using SBIR technologies including lithium ion batteries from Yardney Technical Products of Pawtucket, Connecticut, heat switches from Starsys Research of Boulder, Colorado, and ASCII chips from Maxwell Technologies of San Diego, California.

- Space Shuttle return-to-flight after the Columbia accident used SBIR-developed wireless sensors from Invocon of Cunroe Conroe, Texas, for the impact detection system in the wing leading edge of the Shuttle. These wireless sensors are also used for vehicle health monitoring and microgravity instrumentation on the International Space Station.

Proposal Selection Process

Each proposal is evaluated on its own merit. NASA is under no obligation to fund any specific number of proposals in a given topic and may elect to fund several or none of the proposed approaches to the same topic or subtopic. Evaluations are performed by NASA scientists and engineers, as well as qualified experts from industry, academia, and other government agencies who may assist in performing evaluations. These individuals are well versed in their specialties, know what real innovations are, and understand the applicability to NASA missions and projects. Normally, each proposal is evaluated and scored using four (4) evaluation factors: Factor 1 – Scientific/Technical Merit and Feasibility; Factor 2 – Experience, Qualifications and Facilities; Factor 3 – Effectiveness of the Proposed Work Plan; and Factor 4 – Commercial Potential and Feasibility. Factors 1, 2, and 3 are scored numerically. The sum of Factors 1, 2, and 3 comprise the Technical Merit score. Factor 4- Commercial Potential and Feasibility is evaluated by using an adjectival rating.

Program Databases

Since 1996, NASA's SBIR/STTR program has been one of the largest end-to-end totally paperless programs in the Federal government. Every sub-process is paperless, from solicitation development to Phase I/II review and selection, contract negotiations, administration and closeout, and even post-closeout surveys. Users, with password access, interact through Electronic Handbooks that implement the collection and distribution of all data and documents including submissions, reviews, contracts, and deliverables, etc. As a result, every program item is effectively contained in our program databases. This internal database provides the data necessary for public access to a wide range of useful information.

The NASA SBIR/STTR home page (http://sbir.nasa.gov) is a gateway to this publicly accessible data with a range of information to help the public identify potential products to purchase or opportunities to partner with award recipients. Some examples include: 1) a searchable listing of all of the Phase I & II NASA SBIR/STTR awards over ten (10) years; 2) SBIR/STTR program contacts; 3) success story gateways and videos; 4) technology mall; 5) searchable archives of all abstracts of submitted proposals; and 6) proposal/award statistics by state. While all abstracts of submitted proposals and announcements of Phase I and II awards are made available to the public, full proposals, final reports, and deliverables are not made available to the public due to the proprietary nature of the information. In addition, award data is submitted annually to the Small Business Administration (SBA) for inclusion into their Tech-Net database.

TechSource is another publicly accessible database that provides information on current and recently completed SBIR/STTR Phase II projects funded by NASA. The purpose of this site is to facilitate the transition of resulting technologies into further development, investment and utilization for NASA mission programs and commercial applications, as well as allowing the public to search ongoing and recently completed SBIR/STTR Phase II projects funded by

NASA. These projects are also classified by technology areas to facilitate searches for specific technologies. The NASA SBIR/STTR home page also provides numerous assistance links including: business assistance, technical assistance, small business financing guidelines, strategic alliance partnering guidelines, angel capital electronic network, guidance for creating a business plan, state small business programs, venture capital information, etc.

Program Enhancements

NASA has implemented several program enhancements targeted at technology infusion into NASA programs, as well as commercialization assistance specific to the individual needs of funded companies. To address the gap between Phase I and Phase II awards, NASA has implemented an efficient process that has reduced the gap to two (2) months. This minimizes the impact to firms with limited resources who have teams in place ready to continue advancing their innovative technologies.

NASA has several programs aimed at assisting with commercialization and attracting private equity and partners for SBIR/STTR firms. One of our new programs is TecFusion™, a highly customized innovation-sourcing program targeted at meeting the requirements of large businesses. Through TecFusion™, large businesses are able to source innovations from SBIR-funded firms and provide mentoring to the small business. This enables the large businesses to develop new products for the commercial market as well as mission-relevant products that NASA can purchase off-the-shelf. Eight (8) large businesses have participated in NASA's TecFusion™ program so far. They have reviewed almost 1,000 SBIR-developed innovations, personally interacted with over 150 SBIR firms, and developed partnerships with over 50 firms. NASA will conduct seven (7) TecFusion™ events in 2007, with even more planned in the future. The NASA Alliance for Small Business Opportunity (NASBO) represents a strategic alliance between NASA and firms seeking to facilitate private investment in, and commercial development of NASA sponsored technologies. As an example, NASA has a non-exclusive, non-reimbursable Space Act Agreement with Technology Tree, a firm who assists SBIR/STTR firms on a fee or equity basis, in obtaining capital, productizing, licensing and commercializing their technology.

A key objective of NASA's SBIR/STTR program is to achieve higher infusion into programs and projects, which result in increased Phase III funding for small businesses. Existing SBIR/STTR Phase III authority allows access to follow-on sole source opportunities with SBIR/STTR firms for continued technology development work with non-SBIR program funding without the need for a ' full and open competition'. This authority has been beneficial in terms of making it easier for NASA's programs and projects and their prime contractors to get access to these small businesses; NASA is seeking to make fuller use of this authority. It provides incentives for NASA's development programs and their prime contractors to continue funding SBIR technologies, and has great potential to increase the infusion of SBIR/STTR technologies into NASA programs and projects, and to increase the amount of federal procurement funding going to SBIR/STTR firms. In addition, a new tool called the "Technology Infusion/Advisor" is being implemented through the Electronic Handbook, to facilitate more Phase III investments and close gaps in the infusion process. SBIR firms will be matched to NASA projects that are in need of the relevant technology, to facilitate communication throughout Phase I and II. This closer relationship increases the likelihood of Phase III contract opportunities with a NASA

Project or a subcontract with a NASA project's prime contractor.

In closing, NASA is using the SBIR/STTR programs as an important source of technological innovation – which in turn is vital to the performance of NASA's Mission and the Nation's prosperity and security.

Mr. Chairman, I would be pleased to respond to any questions you or the other Members of the Subcommittee may have.