
SBIR/STTR Programs

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Small Business Innovation Research (SBIR) Program

The Small Business Innovation Research (SBIR) program is a competitive program currently administered by eleven federal agencies. The Small Business Administration plays an important role as the coordinating agency for the SBIR program and in providing policy oversight to the agencies that administer an SBIR program. The SBIR program is designed to support small businesses in the conduct of innovative research or research and development (R/R&D) that has potential for commercialization and public benefit and that addresses priority areas of the sponsoring federal agency. In addition, SBIR-supported technologies are expected to lead to commercial products and processes that engender economic growth.

The statutory purposes of the SBIR program are:

1. to stimulate technological innovation;
2. to use small business to meet federally funded research or research and development (federal R/R&D) needs;
3. to foster and encourage participation in technological innovation by socially and economically disadvantaged small businesses, as well as small businesses that are 51% owned and controlled by women; and
4. to increase private sector commercialization of innovations derived from federal R/R&D, thereby increasing competition, productivity, and economic growth.

Since its inception in 1982, the SBIR program has supported more than 14,000 small businesses

throughout the United States in the development of new technologies and in taking these concepts as products to the marketplace. One example of such a technology development is provided by Noesis, Inc., a small company in Arlington, Virginia. Noesis is currently engaged in "the development of enhanced metal fiber electrical brushes that significantly improve the operating efficiencies of electrical systems and drastically reduce the requirement for costly periodic maintenance" on US Navy submarines.¹

Under the 1982 Small Business Innovation Development Act, agencies with extramural R&D budgets of \$100 million or greater are required to conduct an SBIR program. A set percentage of a federal agency's total extramural R&D budget is set aside as a line item in the agency's budget for the fiscal year. The initial percentage was 1.25% in 1987 and currently is 2.5% of an agency's external R&D budget, which translates into a total of almost \$2 billion, reserved for eligible small, R&D firms each year. This is a significant infusion of funds, which has proven to be a worthy investment. The news release by the SBA Office of Advocacy on January 27, 2004, stated "Small highly innovative firms have a big impact on many high tech industries, according to a report issued today by the Office of Advocacy. The report shows that large firms in the biotechnology, medical electronics, semiconductor, and telecommunications industries are citing patents by small firms in higher than expected numbers."²

In this chapter, we describe the components of the SBIR program; list the agencies involved; describe how a companion program, the Small Business Technology Transfer (STTR) program

came into being; explain how the SBIR and STTR programs are used as mechanisms to link colleges and universities to small businesses; and describe possible changes in the eligibility requirements for the programs.

History of SBIR

The concept for the SBIR program goes back to the mid-1970s. At that time, researchers at small businesses were concerned about being shut out of funding for their research ideas by the National Science Foundation (NSF). If they worked at a university, grants would be available to them. But since they worked in small businesses, no mechanism existed to fund their research. Several companies went to Senator Ted Kennedy, who was then Chairman of the Senate subcommittee that had jurisdiction over the annual NSF budget authorization. To address this small business concern about R&D funding, Senator Kennedy included in the NSF budget a "floor" or minimum percentage of the applied research budget to go to small businesses. This budget requirement was placed on a program called Research Applied to National Needs (RANN). The set-aside for small businesses was ratcheted up to 12.5% over a period of three years, during which time the NSF inaugurated the SBIR program to meet the interests and capabilities of this new constituency.

The NSF tapped Roland Tibbetts, who worked in the Applied Research Directorate, to design a research program for the high-tech small business community. A Harvard MBA who had worked in the venture capital industry as well as in two high-tech companies in the Washington metropolitan area, Mr. Tibbetts consulted widely with government and business managers to develop the original three-phase program design of SBIR. The first NSF SBIR solicitation appeared in Fiscal Year 1977 and contained topics drawn from the RANN Program. In FY 1978 NSF funded follow-on Phase II grants, omitting a solicitation for new Phase I proposals. FY 1979 saw a new SBIR solicitation, and NSF has since conducted SBIR solicitations and funded projects in every following year. In FY 1979 the Department of Defense (DOD) began a program similar to the SBIR Program and called it DESAT. Roland Tibbetts worked closely with the DOD's program manager to make DESAT a fitting precursor to the eventual government-wide SBIR program.

As the earliest program manager of the SBIR program, Mr. Tibbetts is widely acknowledged today in the SBIR community as the "Father of

SBIR." In honor of this distinction, the SBA has annually given the national Tibbetts Award to exemplary small businesses and organizations in recognition of superior SBIR technological innovation, economic impact, and business achievements. Approximately sixty companies and individuals receive this prestigious award annually.³

The Small Business Innovation Development Act of 1982 (P.L. 97-219) established a federal SBIR program to assist small businesses in the areas of high-tech research and development. The 1982 act had a sunset clause and needed to be legislatively renewed. Thus, it was extended and revised by amendments in 1988, 1992, and 2001.

The 1992 Reauthorization Act was developed for the following purposes: "1) to expand and improve the SBIR Program; 2) to emphasize the goal of increasing private sector commercialization; 3) to increase small business participation in federal R&D; and 4) to improve dissemination of information on SBIR Program."⁴

Key provisions of the most recent reauthorization (Small Business Reauthorization Act of 2000, P.L.106-554) included the following:⁵

- Extension of the SBIR program through September 30, 2008.
- A new mentoring program for companies in areas underserved by the program.
- An annual reporting requirement on the SBIR program.
- Improved SBA reporting and database requirements.
- A comprehensive study of the SBIR program by the National Research Council.
- Policy directive modifications requiring commercialization plans for Phase II proposals.
- Agency reports for Phase III follow-on funding agreements.
- A federal and state technology partnership (FAST) program.

In the early days of SBIR, large corporations and universities were interested in learning more about this new program. In April 1984, the School of Engineering and Applied Science at the University of Virginia presented one of the first SBIR conferences entitled, "How High Tech Corps Acquire R&D, Capital and Federal Grants." This was a one-day seminar modeled after a similar event held at the University of Texas, Dallas by John A. Rodman in 1983. Bobbe Nixon worked with both academic and state entities to organize the conference. Sponsors included the governor's office, the School of

Engineering and Applied Science, the University of Virginia, and Center for Innovative Technology. Of particular note is the conference sponsorship provided by Arthur Andersen & Co., Packard Press, and the Commonwealth of Virginia. Speakers were drawn from SBA, DOD, NASA, and NSF to talk about their SBIR programs. In addition to describing the SBIR program, the seminar presented:

1. How the university could be a catalyst by working with small businesses to perform research;
2. How to find alternative financing sources;
3. How to promote the growth of high technology businesses in Virginia.

When this early seminar took place, the federal agencies participating in SBIR were awarding 780 grants to small businesses for a total value of \$44 million nationwide. At the time, they were expecting SBIR funding to triple within the next few years. In fact, the SBIR program has grown from \$44 million in 1983 to \$2 billion in 2004. This is a growth of fifty times the 1983 funding.⁶

The makeup of the 1984 Charlottesville conference is not so different from what we find today at state-sponsored SBIR conferences, agency conferences, FAST meetings, and national conferences. It is the magnitude of the program and the small business involvement that has grown tremendously. Industry-university partnership is still strongly encouraged, agencies are still detailing the SBIR program and providing information about how to win awards, and small businesses are working to identify alternative financing techniques for later-stage projects. These are the necessary components for success in the SBIR program.

Description of the SBIR Program

For the purpose of the SBIR and STTR programs, the SBA defines a small business concern as one that, at the time of award for both Phase I and Phase II funding agreements, meets all of the following criteria:

1. It is organized for profit, with a place of business located in the United States, which operates primarily within the United States or which makes a significant contribution to the United States economy through payment of taxes or use of American products, materials, or labor;
2. It is in the legal form of an individual proprietorship, partnership, limited liability company, corporation, joint venture, association, trust or cooperative, except that where the form is a

joint venture, there can be no more than 49% participation by foreign business entities in the joint venture;

3. It is at least 51% owned and controlled by one or more individuals who are citizens of, or permanent resident aliens in, the United States, except in the case of a joint venture, where each entity to the venture must be 51% owned and controlled by one or more individuals who are citizens of, or permanent resident aliens in, the United States; and
4. It has, including its affiliates, not more than 500 employees, and meets the other regulatory requirements found in 13 CFR, Part 121.

In addition, under the SBIR program, the principal researcher must be primarily employed by the small business concern. Each year federal agencies participating in the SBIR program are required by law to apportion a set percentage (currently 2.5%) of their extramural R&D funds to award to small businesses through announced agency solicitations. Once a solicitation is issued, small businesses review the topics in the solicitation and submit a proposal.

The SBIR program consists of three phases:

- *Phase I.* The objective of Phase I is to establish the technical merit and feasibility of the proposed R/R&D efforts and to determine the quality of performance of the small business awardee's organization prior to providing further federal support in Phase II. Support under Phase I is normally provided for six months/\$100,000 for SBIR and one year/\$100,000 for STTR.
- *Phase II.* The objective of Phase II is to continue the R/R&D efforts initiated in Phase I. Only Phase I awardees are eligible for a Phase II award. SBIR and STTR Phase II awards normally may not exceed \$750,000 total.
- *Phase III.* The objective of Phase III, where appropriate, is for the small business concern to pursue with non-SBIR/STTR funds the commercialization objectives resulting from the Phase I/II R/R&D activities. In some federal agencies, Phase III may involve follow-on non-SBIR/STTR funded R&D or production contracts for products, processes, or services intended for use by the US Government. In some agencies where a project will directly benefit an agency's mission, e.g., the building of a component on a Navy submarine, Phase III may be funded by non-SBIR sources within the agency. Generally, Phase III funds come from the private sector and are employed in product and market development.^{7,8}

Eligibility Requirements

To receive SBIR funds, each recipient of an SBIR Phase I or Phase II award must qualify as a small business. Other requirements apply in all of the SBIR funding agencies, as follows:

Phase I A minimum of two-thirds of the research or analytical effort must be performed by the awardee. Occasionally, deviations from this requirement may occur, and must be approved in writing by the funding agreement officer after consultation with the agency SBIR program manager/coordinator.

Phase II A minimum of one-half of the research or analytical effort must be performed by the awardee. Occasionally, deviations from this requirement may occur and these must be approved in writing by the funding agreement officer after consultation with the agency SBIR program manager/coordinator.

Phases I and II For both Phase I and Phase II, the primary employment of the principal investigator must be with the small business at the time of award and during the conduct of the proposed project. Primary employment means that more than one-half of the principal investigator's time is spent in the employ of the small business. This precludes full-time employment with another organization. Occasionally, deviations from this requirement may occur and must be approved in writing by the funding agreement officer after consultation with the agency SBIR program manager/coordinator. A small business may replace the principal investigator on an SBIR Phase I or Phase II award, subject to approval in writing by the funding agreement officer. For purposes of the SBIR Program, personnel obtained through a Professional Employer Organization or other similar personnel leasing company may be considered employees of the awardee. This is consistent with SBA's size regulation (13 CFR 121.106, Small Business Size Regulations).

For both Phase I and Phase II, the R/R&D work must be performed in the United States. However, in rare and unique circumstances, agencies may approve a particular portion of the R/R&D work to be performed or obtained in a country outside of the United States, for example, when a supply or material or other item or project requirement is not available in the United States. The funding agreement officer must approve each such specific condition in writing, according to the 2002 SBIR policy directive:

In the SBIR program, a research institution may partner with a small business through a subcon-

tracting arrangement. This is encouraged but not required. In Phase I, 33% of the award may be outsourced to a university and/or consultants. In Phase II, the allowed figure for such outsourcing is 50%.

Statistics Regarding the Size of the Program

The following statistics for Fiscal Year 2002 give an idea of the size of the program: 4,138 Phase I grants awarded to small businesses in all fifty states; 1,595 Phase II grants awarded; and a combined total of \$1.5 billion appropriated for both Phase II awards. This is a large investment into small companies to develop new, high-tech products for the marketplace. California received the largest number of SBIR dollars, a total of \$299,262,647 for 1,197 Phase I and Phase II awards. Massachusetts was second with \$215,459,825 in 799 awards. Virginia was a distant third with \$89,717,760 in 333 awards. Of the nearly \$300 million California received, \$89,952,185 was in the form of 892 Phase I awards and \$209,310,462 for 305 Phase II awards. The significance of these statistics is that California is submitting and receiving considerable start-up technologies with their Phase I projects. The 305 Phase II awards show that California is also developing these technologies toward products in the Phase II R&D process.

Participating Federal Agencies

Federal agencies with R&D budgets over \$100 million dollars participate in the SBIR Program. Currently these agencies are:⁹

- Department of Agriculture (USDA)
- Department of Commerce (DOC)
- National Institute of Standards & Technology (NIST)
- National Oceanic & Atmospheric Administration (NOAA)
- Department of Defense (DOD)
- Army
- Air Force
- Missile Defense Agency (MDA)
- Chemical and Biological Defense (CBD)
- Defense Advanced Research Projects Agency (DARPA)
- Defense Threat Reduction Agency (DTRA)
- Office of the Secretary of Defense (OSD)
- National Geospatial-Intelligence Agency (NGA)
- Navy
- Special Operations Command (SOCOM)
- Department of Education (DoEd)
- Department of Energy (DOE)
- Department of Health & Human Services (HHS)

- National Institutes of Health (NIH)
- Centers for Disease Control (CDC)
- Federal Drug Administration (FDA)
- Agency for Healthcare Research and Quality (AHRQ)
- Department of Transportation (DOT)
- Environmental Protection Agency (EPA)
- National Aeronautics & Space Administration (NASA)
- National Science Foundation (NSF)
- Department of Homeland Security (DHS)
- Homeland Security Advanced Research Projects Agency (HSARPA)

Together, these agencies currently provide over \$2 billion to the SBIR program annually.

At least annually, each participating agency must issue a program solicitation that sets forth a substantial number of R/R&D topic and subtopic areas consistent with stated agency needs or missions. Both the list of topics and the description of the topics and subtopics must be sufficiently comprehensive to provide a wide range of opportunities for small businesses to participate in the agency R&D programs. Topics and subtopics must emphasize the need for proposals with advanced concepts to meet specific agency R/R&D needs. Each topic and subtopic must describe the needs in sufficient detail to assist in providing on-target responses, but cannot involve detailed specifications of prescribed solutions of the problems.

Many agencies release only one solicitation per year, while others may vary from year to year. Historically, the DOD has released two separate SBIR solicitations per year. However, for FY 2002, the DOD released four SBIR solicitations, the most ever. In addition to its annual omnibus solicitation of the NIH, CDC, and FDA for SBIR/STTR grant solicitations,¹⁰ NIH releases funding opportunities to small business concerns through the NIH guide for grants and contracts as program announcements and requests for applications.¹¹

SBIR Proposal and Award Process

The SBIR process begins with an agency announcing a solicitation with the R&D topics it plans to fund during a given competition. All agencies now release their solicitations in electronic format only. Small businesses prepare proposals in response to the solicitation according to specific guidelines. The guidelines vary somewhat according to agency, and/or the agency component (i.e., Army, Navy, and Air Force). Submissions are due on a specified date with no allowance for late submissions. More and more agencies are moving to electronic submission-only systems, so applicants/offerors need to be

somewhat fluent with the World Wide Web and with using PDF format files.

Agencies base their award selections on technical merit, the firm's qualifications, and the potential for commercialization of the technology. Normally, SBIR agencies establish a proposal review cycle wherein successful and unsuccessful applicants are notified of final award decisions within six months of the awarding agency's Phase I solicitation closing date. However, agencies may extend that notification period up to 12 months based on individual agency needs.

Each agency has its own set of review criteria. In general, a quality proposal addresses the following areas:

Significance. What problem is going to be solved? What is the significance of the problem or business opportunity? What difference will the solution make?

Innovation. Does the project challenge existing paradigms or employ novel technologies, approaches, or methodologies? Are the aims original and innovative?

Approach. How is the identified issue going to be resolved? What are the technical objectives? What is the research plan for accomplishing the objectives?

Investigators. Why is this the right firm to perform the work? What credentials, experience in related R&D, and qualifications of key personnel make this firm the best choice?

Environment. Is there sufficient access to resources (e.g., equipment, facilities)? Does the scientific and technological environment in which the work will be done contribute to the probability of success? Do the experiments take advantage of unique features of the scientific environment or employ useful collaborative arrangements?

It is important to understand that each agency prescribes in its solicitation its own proposal format that must be adhered to closely.¹²

Small Business Technology Transfer Program (STTR)

In 1992, Congress enacted the Small Business Technology Transfer Act of 1992 (P.L. 102-564). The STTR Act established the Small Business Technology Transfer Program as a pilot program that requires Federal agencies with extramural budgets for research or research and development in excess of \$1 billion per fiscal year to enter into funding agreements with small business concerns that engage in a collaborative relationship with a research institution. The purpose of the STTR

Program is to stimulate a partnership of ideas and technologies between innovative small business concerns and research institutions.¹³

The STTR program was developed to “stimulate and foster scientific and technological innovation through cooperative research and development carried out BETWEEN small business concerns AND research institutions.”¹⁴ In the STTR program, primary employment is not stipulated. This means that the principal investigator can be employed by the research institution and/or a small business, although the award must go to the small business with a sub-contract to the research institution.¹⁵

Reauthorization of the STTR program runs through Fiscal Year 2009. The mandated set-aside increased from 0.15% to 0.30% of participating agencies’ external R&D budget in Fiscal Year 2004.¹⁶

There are some differences between the SBIR and the STTR programs, including the dollar amounts of the awards and the length of the award periods of performance.

- *Phase I.* Awards normally do not exceed \$100,000 for a period of 12 months.
- *Phase II.* Awards increased from \$500,000 to \$750,000 for a period of 24 months in Fiscal Year 2004.¹⁷
- *Phase III.* Non-STTR funds are used for commercialization.

In the SBIR program, research institution partnerships are optional. With the STTR program, however, the program requires research institution participation. Of the award, 40% to 70% may be allotted to small business. A total of 30% to 60% may be allotted to the academic partner.¹⁸

Universities may participate in the SBIR/STTR program in many different ways. The STTR program was created to attract more academics who own an interest in a small business to become involved in developing their technologies. With the National Science Foundation’s (NSF) SBIR/STTR Programs, faculty can own small businesses. They also may be senior personnel in a budget. Faculty members may even be principal investigators with official leave from their university. Faculty may be subcontractors to an award. University laboratories may be used for analytical and other service support for an STTR project.¹⁹

The NSF also provides additional assistance through supplemental grants to Phase II SBIR/STTR awardees. A Research Experience for Undergraduates (REU) supplement may be used to add an additional \$6,000 to the SBIR/STTR award for an

undergraduate student to work on the grant. One or two students per year may be awarded this supplement. The Research Experience for Teachers (RET) supplement can provide up to \$10,000 per K-12 teacher to participate on these grants.²⁰

STTR Solicitations

The number of STTR solicitations varies somewhat from year to year. Some agencies such as the DOD report their schedules far in advance, while others merely place an announcement on Fedbizopps (<http://fedbizopps.gov>) if contracts format or on (<http://www.grants.gov>) if grants format. Some agencies issue presolicitation notices while others do not. Occasionally, the Federal Register is used for presolicitations. For Fiscal Year 2004, the number of solicitations per agency for both SBIR and STTR are listed below:

- Department of Agriculture: 1 SBIR
- Department of Commerce
- National Institutes of Standards & Technology: 1 SBIR
- National Oceanic & Atmospheric Administration: 1 SBIR
- Department of Defense: 4 SBIR, 1 STTR
- Department of Education: 2 SBIR
- Department of Energy: 1 SBIR, 1 STTR
- National Institutes of Health: 1 SBIR, 1 STTR (NIH omnibus solicitation runs all calendar year but has three submission dates during the year and its STTR shares the same topics as its SBIR omnibus topics. NIH also releases several special program announcements [PAs] and requests for applications [RFAs] for extended Phase II opportunities.)
- Department of Homeland Security: 2 SBIR
- Department of Transportation: 1 SBIR
- Environmental Protection Agency: 1 SBIR (may have additional special solicitations, but all areas are released and due at the same time, usually in the spring)
- National Aeronautics & Space Administration: 1 SBIR, 1 STTR
- National Science Foundation: 2 SBIR, 2 STTR (SBIR and STTR share the same topics)

Where the SBIR and STTR Programs Are Today

According a 2004 report prepared by CHI Research, Inc., “Small Firms and Technology: Ac-

quisitions, Inventor Movement and Technology Transfer,” the overall findings show positive results:

Small firms are a vital element of new technology in many industries. Their importance is not immediately apparent when all industries are considered, because small firms tend to be excluded from such key capital intensive industries as automotive, aerospace, and oil research. In newer high technology industries, such as biotechnology, medical electronics, medical equipment, and telecommunications, large firms frequently rely on small firms’ discoveries and inventions.²¹

Highlights from the “Small Firms and Technology” report include:

- The influence of small firms in technology is increasing. Small firms represented 40 percent of the highly innovative firms in 2002, as opposed to 33 percent in the 2000.
- Between the mid-1990s and the early 2000s, large firms’ share of elite inventors (those with at least 10 patents in a two-year period) fell from 72 percent to 69 percent. The share of elite inventors employed by small firms rose from 12 percent to 16 percent during the same period. . . .
- Small firms have a greater technological impact in industries that tend to consist of many young, small innovative firms. Industries that fit these characteristics include biotechnology, computers and peripherals, medical electronics, medical equipment, semiconductors and electronics, and telecommunications. More than half of the small firms in these industries only obtained their first patents after 1990.²²

At the time of writing, lobbyists of influential and well-funded organizations such as the Biotechnology Industry Organization (BIO) and the National Venture Capital Association (NVCA) are working to influence legislation to change the SBIR eligibility rules. They seek changes that would allow large-scale venture capital organizations to own and control small businesses competing for SBIR funding. Many seasoned SBIR veterans believe that this change would result in greatly diminished opportunities for the small businesses. Rural and smaller states would be put at a major disadvantage because of the lack of venture capital funding in those states. The overall result would be a “widening gap between the richest SBIR states (California and Massachusetts) and the smaller rural states such as Wyoming, New Mexico, Montana and Maine.”²³

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Authors’ Note

The opinions expressed herein are those of the authors and do not necessarily represent the views of the National Institutes of Health, Department of Health and Human Services, or any other federal agency.

• • • Endnotes

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Cooperative Research and Development Agreements

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General Introduction

What a CRADA Is and Is Not

A cooperative research and development agreement (CRADA) is an agreement, "between one or more Federal laboratories and one or more non-Federal parties . . . toward the conduct of specified research or development efforts which are consistent with the missions of the laboratory."¹ CRADAs are usually multiyear agreements involving significant research projects.

A CRADA is the only agreement under which the government, "may grant, or agree to grant in advance, to a collaborating party patent licenses or assignments, or options thereto, in any invention made in whole or in part by a laboratory employee."² Prospective CRADA collaborators often see the grant of CRADA inventions rights as a prerequisite to their making the significant corporate investment required by most CRADA research projects.

In addition to the promise of intellectual property rights in advance, a CRADA can offer other significant advantages to a CRADA collaborator. Companies are able to leverage their existing personnel, facilities, and equipment, and to complement the skill sets of their employees with the scientific and engineering expertise of government professionals. Under a CRADA the federal laboratory may provide, "personnel, services, facilities, equipment . . . or other resources."³

Under a CRADA, the collaborator may provide, "funds, personnel, services, facilities, equip-

ment . . . or other resources."⁴ CRADAs are one of the few mechanisms that the federal government has to receive nonappropriated funds from the private sector.⁵

CRADAs are not funding agreements. That is, the nonfederal party to a CRADA may not receive funds from the federal party under the agreement. In fact, under a CRADA, quite the opposite is true. As discussed above, the nonfederal party *may provide* funds to the federal party under the CRADA.

CRADAs are also not acquisition contracts for the procurement of the research and development services of a federal laboratory. CRADAs should not divert the research and development activities of the federal laboratory to serve only the purposes of the collaborating party. The CRADA research project must be consistent with the missions of the federal laboratory involved.⁶

CRADAs also are not an alternative route to the licensing of already existing federal laboratory patents. If such patents comprise background intellectual property rights necessary to practice a CRADA invention, the collaborator must separately license such patents according to the terms and conditions of the relevant federal regulations.⁷

Legislation Related to CRADAs

The Stevenson-Wydler Technology Innovation Act of 1980 made federal agencies responsible for transferring federal technology to state and local governments and to the private sector.⁸ The Federal Technology Transfer Act (FTTA) of 1986, the first amendment to the Stevenson-Wydler Technology