

AN INNOVATIVE PARTNERSHIP PROGRAM BETWEEN THE DEPARTMENT OF ENERGY, INDUSTRY, AND SMALL BUSINESS

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INTRODUCTION

Moving an idea from a concept to the marketplace is a long and difficult climb. At each step, trials and pitfalls can hinder an innovator's progress. Many innovators received assistance to overcome those obstacles with the help of the U.S. Department of Energy's (DOE's) Office of Industrial Technology's (OIT's) Innovative Concepts (InnCon) Program. InnCon is one of six Alliance for Industrial Excellence programs within OIT. Throughout the country, creative thinkers are finding ways to save energy and increase industrial productivity with the early phase assistance provided by the Innovative Concepts Program.

The InnCon Program provides seed money to allow innovators to determine if their ideas are technically and economically feasible. It is expected that this initial funding and the development it supports will help the innovator get their idea to a point that some of the initial risk associated with their new technology is reduced such that internal or external investors are more willing to provide follow-on funding. Through Pacific Northwest National Laboratory, InnCon also provides valuable non-financial support by helping innovators find technical partners, commercial sponsors, and new sources of funding. One example of this support is sponsorship at a technical trade show or conference, at which the innovators are given a chance to present their initial findings to a wide audience of private and commercial investors.

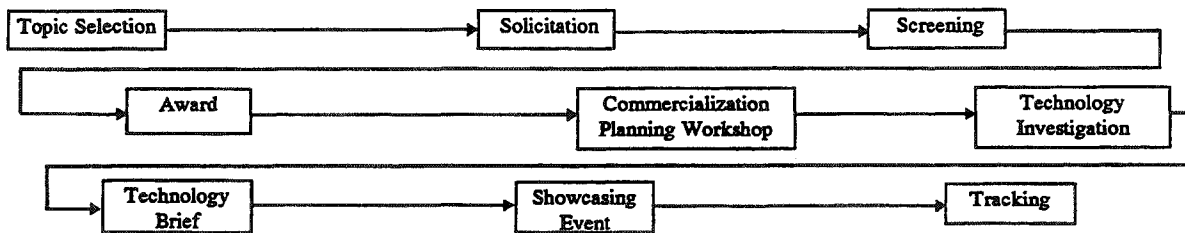
Since the InnCon program began in 1983, over 100 projects have been funded and over half of them have received follow-on funding from other sources to pursue their innovations or inventions. InnCon operates in cycles of roughly 1-2 years. For each cycle, the InnCon Program chooses an energy-related topic and invites innovators to submit proposals; up to 15 innovators per cycle are awarded seed money - typically \$20,000 to \$22,000.

This paper will briefly profile the process the InnCon participants go through, discuss lessons learned since the program began in 1983, and relate some of the experiences of the participants in InnCon's most recent cycle focused on the Aluminum Industry.

THE INNOVATIVE CONCEPTS PROCESS

The process used in the InnCon Program is designed to begin with topic selection and ends with tracking and providing continuing support to the inventor. The process is repeated for each new cycle and at times can have two cycles running concurrently (i.e., with one cycle in the middle of the process and another cycle beginning.) Each step in the process is discussed below and is illustrated in Figure 1 - The Innovative Concepts Process.

Figure 1 - The Innovative Concepts Process



Topic Selection

A program cycle starts with the identification of a sponsor and a topic. The topic is chosen based on the needs of the cycle's sponsor. In the early cycles of InnCon, the topics varied from basic industrial needs, such as materials separation, which is common to a number of industrial processes, to buildings, which is one industry with many manufacturing processes involved. The topics have all been energy related and most have had multiple sponsors ranging from other divisions within the Department of Energy to other Federal and State agencies.

The sponsoring agency determines the research needs it would like to fund in hopes of finding solutions to technology gaps in the industry. In the case of the Aluminum Industry team, the needs were identified by a group of industrial representatives. These needs were common to many aluminum producers or processors and were felt to be important to the industry as a whole.

Solicitation

The next step in the process is the solicitation of concepts. The solicitation is advertised in technical journals related to the topic of the cycle. For instance, for the cycle related to the aluminum industry, advertisements were placed in the *Journal of Metals (JOM)* and in *Modern Metals*. In addition, notices are placed in the *Commerce Business Daily* and *Federal Register*. The Innovative Concepts program has also developed a list of inventors and innovators that follow the program and are interested in contributing to it, through the development of their ideas. This list is used to solicit proposals as well.

Screening

The concepts are evaluated using several criteria. Initially the proposals are reviewed to ensure they are responsive to the solicitation (related to the topic) and are not for basic research nor promotion of an existing product. Once past the initial review, the proposals are scored according to the following criteria:

- 1) technical feasibility - technically feasible, addresses an industrial need, has benefit over the current state-of-the-art, has appropriate literature references
- 2) market size and market potential - has a significant market, has an understanding of the market and its size, reduces the energy consumed or wasted specific to the industry, minimizes or reduces the production of waste streams while improving and maintaining quality/integrity of the product/process, has favorable costs in comparison to other solutions
- 3) qualifications of the principal investigator - Principal technical investigator resume- experience on related topics, and/or patent(s) issued to the investigator.
- 4) previous work on concept by proposing organization - Current stage of development of the concept, Work on the technology from which the proposed concept arose or on related technology or markets, Previous technical progress on the proposed concept, previous state or federal contracts
- 5) work plan - Brief description of work to be performed, schedule of work plan

Award

One of the strong selling points of the program is the fast turn-around in terms of awarding federal dollars. The program prides itself in quick response time from the opening of the solicitation to the award of contracts. This typically takes only 3 months and allows nearly 2 months for the solicitation to be open.

Commercialization Planning Workshop

A critical part of the InnCon program is the "business guidance" given during an intense workshop where the concept originators are immersed in the business aspects of taking a product or idea to market. The sessions are interactive with brief lectures, hands on exercises customized to the concept developers, and one-on-one consulting sessions. The topics covered include technical development, marketing, financing, intellectual property protection, licensing, and business planning. Participants come out of the workshop with a strategy and plan for commercializing the technology.

Technology Investigation

The majority of the funding for this program goes to the investigator to investigate the technical and economic merit of the concept. This usually is done through technical development and a preliminary market investigation. The award winner is at liberty in choosing how best to allocate the funding for this portion of the program. Typically, we have seen innovators put out more effort beyond the small amount of funding that is provided. It is common for the investigator to use the funding to cover testing or materials that require a cash outlay, and then invest their own "sweat-equity" to leverage the funds provided.

Technology Brief

A synopsis of each of the technologies has been a very useful part of this program. Originally, the tech briefs were developed to be used at technology fairs or showcasing events, and have subsequently been used as direct mail pieces and advertisements for the concepts. The tech briefs are designed to briefly tell anyone that is interested in the concept, what the concept is, what the concept would be replacing, market and economics of the concept, future development needs and a summary of the testing data to date. It allows the reader to take a look at the concept and know whether they need more information or not, and it includes the contract information for the innovator.

Showcasing Event

The showcase is the culmination of a cycle, where the award recipients can present their concepts to industry, allowing potential funding agencies and users to be introduced to the concept and to shape the future development of the concept. It forces the innovators to freeze the concept at least once during its development and to get industrial feedback early on in the development process.

Table 1 - InnCon Program Results

Topic Area	Number of Concepts Funded	InnCon Seed Funds Awarded	Number of Concepts with Follow-on Funding*	Follow-on Funding*
1984 Building Materials	12	\$171K	5	\$1.3M
1985 Industrial Processes	10	\$158K	6	\$7.3M
1988 Separation Processes	10	\$148K	7	\$1.6M
1989 Building Retrofit	8	\$160K	3	\$1.1
1990 Waste Minimization	15	\$300K	6	\$1.2
1992 Waste Minimization II	15	\$300K	14	\$8.4
1994 Industrial Process Improvement	15	\$330K	6	\$0.8
1995 Metal Adsorption/ Lightweight Metal Alloys	15	\$330K	?	?
Total for 8 Cycles	100	\$1,897K	47	\$21.7M *as of 1995

Tracking

The final part of the program involves tracking the concepts to see how the investment that DOE has made is being leveraged by other development funds. It also allows InnCon to continue to provide support to the inventors where appropriate through introductions to other sources of funding or technical assistance. Table 1, InnCon Program Results, shows the results of the InnCon program tracking effort as of 1995.

LESSONS LEARNED

Since program development in 1983, the program has undergone several metamorphoses and revisions. Some of the changes were due to a changing environment, and others were based on improvements discovered over time. A few of the more notable lessons learned are discussed below.

Jointly Sponsoring the Topic

When the program first started in 1983, the funding for the topic was provided solely by the Inventions and Innovations Division in the DOE's Office of Financial and Technical Assistance. As the funding agency, IID chose a topic based on a review of the technical literature, trying to identify gaps in the research and technology where inventors could offer potential solutions. The IID then also had the responsibility of trying to help connect these solution technologies to the problem holders, or people that needed the solutions. It was stronger than a technology looking for a problem to solve, because research had been conducted to determine what the problems were that needed addressing, but it was not easy to find the actual agencies or people that might be interested in funding the development of the solution. With the fourth cycle, we enlisted sponsors for the topics. The sponsors were responsible for contributing funding for the award recipient to determine the technical and market feasibility, and for determining the exact topic for the solicitation. In future cycles, the sponsoring agency or organization also provided reviewers for the screening part of the program. Using this approach guaranteed interest in the concepts that resulted from the solicitation, as the agency or sponsoring organization looked to the program as an investment and were interested in helping to ensure a positive return.

In the current age of leveraging federal funding, this approach is also seen as a positive influence on the program. The sponsoring agency or organization funds the direct concept development/feasibility assessment, while the Inventions and Innovations Program within OIT funds the program costs including tech brief development, solicitation development and screening, showcasing event, advertising and tracking.

InnCon has jointly sponsored topics with the U.S. Environmental Protection Agency; the U.S. Bureau of Mines; and the Office of Industrial Technologies' Aluminum Team, the Office of Transportation Technologies, and the Office of Environmental Management within the U.S. DOE.

Technology Briefs

As mentioned earlier, the technology briefs have been an important part of the InnCon program. Initially, the only written documentation of the technologies funded was a final report for each concept. These typically ranged from 10-20 pages and were very technically oriented. The program needed something that was more like a "spec sheet" used in industrial marketing, that could peak interest and tell the reader enough to determine if he/she wanted to know more. The tech briefs have been very successful in attracting interest from users and investors. The language used in the tech briefs is not highly technical so that people with differing backgrounds can get a sense of the technology, and if interested, can get more information from the developer or can request a full and more technical description of the technology and its merits. The inventors have also been pleased with the tech briefs and their usefulness in promoting the concept to investors and users. The tech briefs are often used by the inventors as a calling card to send, hand to, or leave with potential investors. One inventor remarked that he was constantly asked for a brief description of the concept and the only thing he ever had to leave with people was a full technical paper, which he knew would be thrown away when he left the room. He thought the tech brief was more likely to be read because of its appearance, and its brevity, and even if it was thrown away half the time, he could carry more and afford more copies of a one-page summary and did not waste resources leaving a full report with an uninterested party.

Small Dollar Investment - Big Returns

The initial philosophy of the InnCon program was that a small investment in a number of projects could, in time, provide a better return than a large investment in just one project, similar to the portfolio approach in financial markets (e.g., increase chances of funding a "big winner.") This approach seemed particularly appropriate given that the projects to be invested in were high risk concepts. The approach has proven itself over time, with more than half of the projects getting follow-on funding with an overall return of 20 to 1. The first projects were funded at \$15,000 each and the amount has since been increased to \$22,000 each. Many people have scoffed at the minimal investment and have encouraged InnCon to put more money up for these initial feasibility studies, however, with the number of proposals received to date and the quality of the proposals, more funding per concept does not seem to be warranted. As originally planned, this funding is not intended to take the concept to market, but rather to help reduce the technical and economic risk associated with a market entry. The financial burden of development is intended to rest with the company or agency that will ultimately profit from it. Additionally, the time frame covered by this award is typically only six to nine months.

Showcase Planning and Sharing

Initially the showcasing event was designed to be a stand-alone technology fair, highlighting the concepts funded by InnCon, and occasionally a few other DOE funded concepts. As more and more technology fairs were competing for people's time, fewer and fewer people were able to attend a show dedicated to ground breaking technologies, only a few of which might be relevant to a particular company. Consequently, the program has adopted a policy of "piggybacking" on existing, well established trade shows and exhibits, offering a change of pace to the attendees. For instance, with the most recently completed cycle for the aluminum industry, the concepts were showcased at the TMS (The Minerals, Metals, and Materials Society) Annual Conference, which attracts about 4,000 attendees. This helped to leverage the program funding, by not having to host an entire conference, and by taking advantage of the advertising and draw of the larger show.

Early Commercialization Planning

The Commercialization Planning Workshop was originally developed for concepts that were further into development than the InnCon concepts (through the Energy Related Inventions Program, a related DOE program). A common complaint of industrial and business managers is that the research coming from inventors and research laboratories is not geared to real-life problems and is too theoretical. The research is not designed to work in a rugged industrial environment, and typically is too costly to implement. Often these problems weren't discovered until after the fact causing huge customization costs or even worse, abandonment of the research project after substantial investment. The CPW was designed to help address these concerns, by introducing the business and economic realities of the marketplace early in the concept development stage. Initially, it was thought that the InnCon concepts were just too early to be thinking of markets and costs, however, it has since been introduced as a full program element, recognizing that regardless of how difficult it is to discuss and put together market and economic data with these early stage concepts, benefits of thinking through the concepts with these parameters in mind, help steer the development toward a market and potential problem to address. In fact, often these elements can focus the inventor or innovator to produce a better design or process. It can also save costly investment in a concept or design for which the market is not large enough for anyone to make a profit, (e.g., it doesn't cover the cost to produce or implement the process.)

SUCCESS STORY - SORBTECH DIRECT SULFUR RECOVERY PROCESS

One of the successes of the InnCon program is a technology which is a process for controlling sulfur dioxide emissions from industrial applications, including crude oil refining, natural gas processing, and coal gasification. The concept was awarded in 1992, under the Waste Minimization II cycle. Since receiving a grant award of \$20,000, Sorbent Technologies (Sorbtech), Inc. has received follow-on funding of approximately \$800,000 for further development and commercialization of the process, including an investment of \$175,000 of the company's internal funding. The funding has come from diverse sources including DOE SBIR, and an EPA contract, as well as some spin-off work with NASA and the Air Force which is using the original InnCon concept as a part of a larger effort. Originally the concept was developed for coal gasification and has since been used in the oil refining industry and for natural gas processing.

Sorbtech developed and patented Magsorbent, a dry, regenerable magnesia on expanded vermiculite or perlite sorbent to remove SO₂ and some NO_x (30%) from flue-gas streams. (For more information on the technology the reader can get a copy of the tech brief from Mark Hatrup, (509) 372-4348.) This is just one of the projects that has used InnCon seed funding and program support to do an initial market and technical feasibility assessment, and after some promising initial results had the leverage to gain additional support (both internally and externally) for its development.

1996-1997 INNCON PARTICIPANTS' REVIEW OF THE PROGRAM

The 1996-97 InnCon participants were asked the following questions to obtain some feedback on their experiences with InnCon.

What Did You Find Most Useful in the InnCon Program?

David Larson, Manager of Product Development for Blasch Precision Ceramics, Inc. stated "The money facilitated first stage commercialization and promotion of a new Blasch concept. It enabled preparation of a technical concept summary for use in promoting this concept, in addition to providing funding to make some prototypes for field trials. This work, although quite necessary, may not have been done without this money or may have been delayed." Mr. Larson went on to state "Participation in the TMS trade show was quite useful, particularly the opportunity to display our concept and discuss it with interested personnel at the trade show. The opportunity to present a technical paper on our concept at TMS, to a meaningful audience was also very useful (it helped to promote our concept). Blasch is a small (30 person) company that manufactures parts used in steel and aluminum production processes.

Another participant indicated InnCon's focus on small businesses was of critical importance, suggesting other programs aren't geared to the 1-2 person shop. They went on to praise the CPW stating "the CPW was a real eye opener. I had read all the books before going to the workshop, but the intensive format really got the messages across to me. The workshop provided a real structure and vocabulary for me that has served me in our commercialization efforts." Another awardee indicated the InnCon program was very helpful in several aspects: "it provided seed money to determine the preliminary feasibility of a concept, the CPW forced me to think through the overall commercialization approach, and several critical industrial leads were obtained from the attendees of the TMS conference." Another participant echoed the comment regarding the importance of TMS, stating "attendance at the TMS meeting was valuable in that it provided us with first-hand exposure to individuals within the aluminum industry, and helped organize our strategic approach towards turning our concept into a real business opportunity."

Where Are You with the Technology in Terms of Industrial Interest?

Blasch has made prototypes while involved in the InnCon program and has shipped them to potential customers. At least three already have expressed an interest in trying this new product. Blasch is currently awaiting results from field trials.

One participant indicated that their participation in InnCon helped lay the groundwork for two SBIR proposals, one to DoD and one to DOE. "The DoD proposal was funded and we should hear from DOE in about 3 months. We believe that the credibility provided by the InnCon work was critical to the DoD win." The participant also indicated they are discussing the possibility of collaborating on a proposal with Reynolds International in response to DOE's Office of Industrial Technologies Aluminum Partnerships solicitation. Another participant also indicated that their work under InnCon "provided an invaluable foundation for subsequently writing an SBIR Phase I proposal to DOE."

One of the participants indicated it was still early but that several primary and secondary aluminum companies and a construction firm had expressed an interest in his technology and that he was in discussions with the companies trying to organize a team for further development.

One participant linked to a major university indicated the university had signed non-disclosure agreements with ALCOA, BASF (catalyst manufacturer), and a Pacific Rim aluminum technology broker that learned of the technology at the TMS conference. In addition another company has expressed interest in the technology

for an application outside of the aluminum industry. This participant is currently submitting a proposal with ALCOA in response to DOE OIT's Aluminum Partnership's solicitation to set up and demonstrate a version of the technology initially developed under the InnCon program.

What Could Be Done to Improve the Process from Your Point of View?

Generally the innovators were very satisfied with their experience as an InnCon participant. Several mentioned that this program worked well for them and that InnCon's focus of getting funding to independent inventors and small businesses was a strength of the program. Two of the 10 participants did offer suggestions for improvements. The first stated "The InnCon program is just about perfect. Aside from InnCon the most helpful advice we have received in our endeavor came from a VP of Technology at a small company that had been through the commercialization process just 10 years before (they recently went IPO). If individuals like this could be found to speak with the InnCon participants it would be a great benefit." Another participant indicated they would have liked to have had more communication with InnCon staff at the start of the program to help get them moving. That participant also went on to state, "Having the CPW earlier in the program would have been very useful. I would have changed my focus somewhat, aiming more towards practical goals which the CPW would have helped me set."

THE FUTURE OF INNCON

The InnCon Program is currently on its tenth cycle. This year's solicitation is targeting ideas pertaining once again to the aluminum industry as well as a topic targeting the titanium industry. The solicitation closed in June of 1997, and awards are anticipated in July. For those who would like to be included in the InnCon mailing list so that they can be informed of future topics and their corresponding schedules, please contact Mark Hattrup, Pacific Northwest National Laboratory, (509) 372-4348.