ONR Spearheads Successful Mine Countermeasures Program

Let Common Sense Rule

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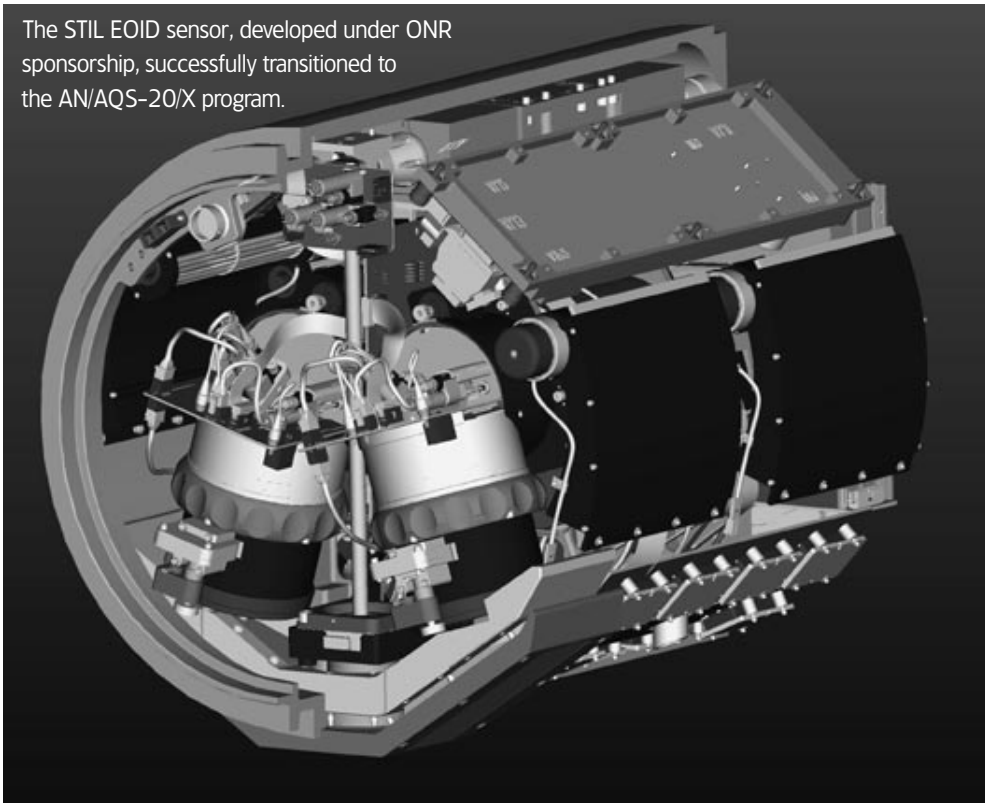
In this article, we examine the managerial and programmatic processes that successfully enabled a Science and Technology feasibility project to transition into an Acquisition effort within the Department of Navy. We also identify a number of "lessons learned" that other program managers and industrial performers may find useful to follow in their own program management efforts. While many of them are commonsense and practical, our experience is that most of these principles are often not followed for a variety of reasons. While we make no claim that following these principles will ensure success nor are they the *only* keys to success, we believe it is important to offer these principles as program management options well worth future consideration.



The STIL EOID sensor, developed under ONR sponsorship, successfully transitioned to the AN/AQS-20/X program.

What Went Right

Despite formal training of Department of Defense personnel for management of programs and projects, programs can go awry, either in terms of schedule, cost, or technical performance. While much has been written regarding "lessons learned" from such experiences, it seems rare that successful programs are examined for what went right. We have been involved in a very smooth-running program for nearly five years; fortunately, nothing has emerged in the way of schedule, cost, or technical performance challenges that could not be overcome with routine, minimal effort.

In this article, we intend to explain how our collective management style and procedures facilitated this success, yet recognizing that what we learned may not apply to all other programs at all times. Nevertheless, we believe that a number of essential management practices we used over the past five years may be beneficial for many programs and projects. Admittedly, we did not start out the project with these specific management practices in mind; but again, using common sense we learned what was successful as we went along.

To more easily understand these managerial lessons learned, we placed them in context, describing the program in chronological order, with perspectives from both the government and industry.

The Proposal Process

In April of 1995, the Office of Naval Research (ONR) received a proposal from Arete Associates to develop a laser-based device for detection and identification of sea mines from a variety of platforms.

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Image courtesy Arete Associates

The AN/AQS-20 system, tow vehicle, winch, and computer operator station being readied for loading onto a mine countermeasures helicopter (MH53).

ONR's basic mission is to develop Science and Technology for the Department of the Navy, determine its technical merit, risk, and feasibility for future naval applications, and if successful, "transition" the technology to the Acquisition side of the Research and Development portion of the Navy. ONR has three basic categories of funds: 6.1 or basic research, 6.2 or applied research, and 6.3, advanced technology development.

Based upon the submitted proposal, ONR determined that the basic technology using Streak Tube Imaging Lidar (STIL — developed for medical and nuclear blast monitoring) offered some promising technology to the mine countermeasures programs. STIL technology offered the advantages of Commercial Off-the-Shelf (COTS) technology with no moving parts, both of which are attractive in terms of life cycle or total ownership costs.

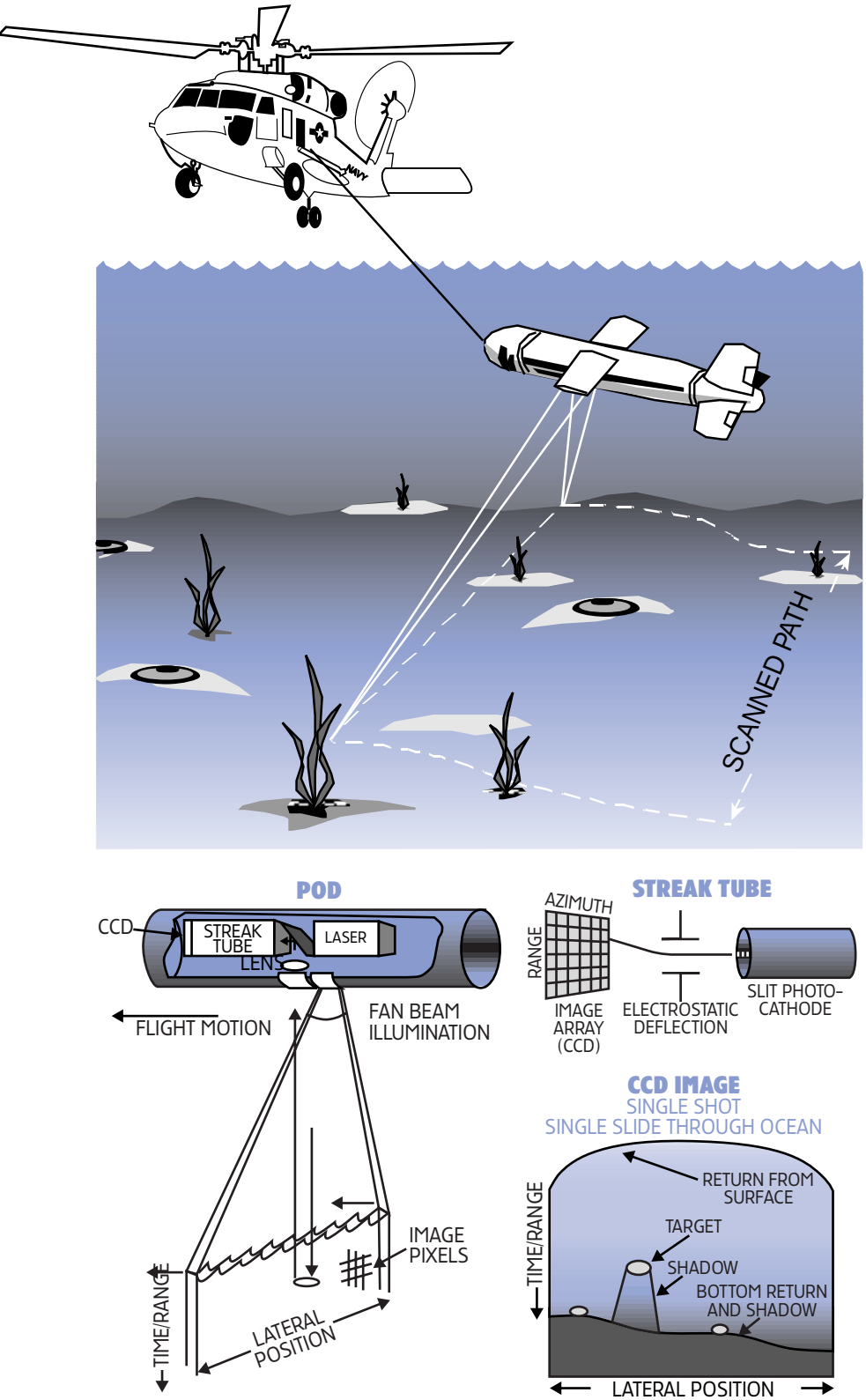
The original proposal was based upon Arete discussions with various Navy offices, which resulted in a proposed effort that was extremely ambitious in terms of scope and schedule (full system development within two years). Further, the application proposed by Arete was to place the STIL on an airborne platform for minefield detection. ONR felt that the schedule involved too much risk, and combined with an aggressive budget was inconsistent with ONR's investment strategy at the time.

At that time there existed two airborne minefield detection systems being developed at the direction of Congress. Since the proposal did include other possible applications, including underwater mine identification from a towed platform or unmanned underwater vehicle, ONR entered into discussions with Arete to shift the scope of the program toward this underwater mine identification problem. The emphasis of this revision was toward a demonstration of technical feasibility more appropriate to 6.2 efforts. (The schematic diagram on the next page shows how airborne mine identification operations would be conducted. The lower half of the diagram contains generalized information on how the STIL works.)

Following these discussions, a basic work statement was agreed upon for a one-year contract and a follow-on two-year effort as an option, contingent upon reasonable progress performed in the first year. Since the funds available to ONR at this time were "one-time" funds, ONR had no assurance that sufficient funds would be available in the out-years. From ONR's perspective, this approach offered realistic expectations and requirements for Arete, who appeared to be enthusiastic about the revised approach although somewhat disappointed at the slower rate of progress than originally proposed.

Negotiation of a Statement of Work (SOW) between the performer and the program manager involves more than the work proposed: schedule, funding, and the manner of contract implementation play a role as well. A gentlemen's agreement was reached to minimize Contract Data Requirements List (CDRL) items to reduce costs, and to allow a certain amount of "contingency funds" for unanticipated problems or issues that might arise during the course of the project. ONR offered a less aggressive management style if Arete could stay within budget and perform on schedule. Without knowing it at the time, ONR and Arete had agreed to a Firm Fixed Price contract with our gentlemen's agreement. Once all sides had agreed to these "conditions,"

Photo courtesy PMS 210



Streak Tube Imaging Lidar (STIL) System

the Cost Plus Fixed Fee contract was officially awarded Dec. 8, 1995.

Lessons Learned

- *Start with good technology or a product that has utility for improving fleet operations.*
- *Balance technical milestones and requirements against realistic schedules and budgets.*

Program Review

Close to a year later, a program review was held at Arete's facilities in Tucson, Ariz. Various government representatives with lidar and optical knowledge were invited to review the progress and quality of the effort to date. The professionalism and candor exhibited at the review solidified the trust and respect that had been developing between the sponsor (ONR) and performer (Arete). Attendance by representatives from the mine warfare community at Coastal Systems Station provided critical and timely feedback on the mission needs and program timelines. The review went well, and everyone concurred that significant progress was being made and future efforts were warranted.

Based upon this program review of the first year's efforts, ONR decided to fund the two-year option, providing all of the funds at one time, thereby permitting Arete even more flexibility to accomplish its goals. This stable funding enabled the company to commit both experienced personnel and capital facilities for an extended period, resulting in rapid progress toward a challenging technical objective. This turned out to be a win-win proposition for the program.

Lessons Learned

- *Provide stable funding with clear expectations.*
- *If agreements are made beyond the actual contract, make sure that they are met.*

Transition

A few months later, the Navy announced a call for proposals for Advanced Technology Demonstrations. These ATDs are for 6.3-level efforts and are reviewed by a wide range of naval personnel, from ONR to Resource Sponsors to Acquisition Managers. Arete Associates submitted two ATDs for the STIL technology: one for underwater mine identification and another for airborne minefield detection. Both proposals made the final submission list, but the Navy ultimately deemed another mine warfare proposal to be of higher priority. Nevertheless, a wide skills mix of naval personnel were exposed to the advantages of STIL technology, and the proposal presentations did a lot of good for promoting what had already been done by Arete.

Meanwhile, the Navy demonstrated a separately sponsored ONR program for mine identification in a Fleet exercise; and the capability for identifying mines in stride and in real-time proved to be a major paradigm shift in possible tactics for mine countermeasures. The technology demonstrated was more mature than STIL, and it was quite different in design but offered similar capabilities. As stated earlier, ONR's mission is to provide state-of-the-art technology solutions that offer significant improvement in capability and lower cost to the Acquisition managers. But, it goes far beyond that: we should also offer them alternatives or options to evaluate, i.e., competition and risk reduction.

Overall, ONR believed that the progress for STIL was good, the external pressure for mine identification was growing, and that it was time to budget for a follow-on program for STIL in the 6.3 arena. Since it takes two years to prepare for 6.3 project funding in the congressional budget requests, the time was propitious. Further, there were two separate opportunities for "transition" into Acquisition programs in the Fiscal Year 2001/2002 time frame: the airborne towed subsurface mine hunting system, AN/AQS-20, and the surface deployed semi-submersible, Remote Minehunting System, now designated AN/WLD-1.

Lesson Learned

- *Prepare for transition early in the development cycle, including developing visibility and credibility with the user community.*

Integrated Product Team

The second annual review of STIL was also held in Tucson at Arete's offices. Representatives from OPNAV N85 (Expeditionary Warfare) and the Program Executive Office (Mine and Undersea Warfare), or PEO (MUW) attended. Again, the review went exceptionally well, and the information presented, both technical and managerial, was provided in a form that everyone could understand. By this time, the sponsor, performers, and user community were, in essence, functioning as an integrated team working toward a common objective and purpose. The meeting was simultaneously rigorous in content, while informal in atmosphere. Such an atmosphere facilitated frank discussions of technical maturity, mission needs, and programmatic milestones. Informal discussions continued into the evening over dinner, providing a forum for informal one-on-one discussions.

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By the third year of the 6.2 program, it was clear that STIL technology had many benefits for mine warfare, and that the technical risks were reasonably small. At this point, the Navy reached concurrence for the follow-on 6.3 program. ONR asked Arete Associates for a formal proposal, based upon the previous ATD proposal, to integrate the STIL technology into a towed body matching the form, fit, and function of the AQS-20 system. Since Arete Associates patented the STIL technology for mine countermeasures, ONR sole-sourced the contract.

A formal Integrated Product Team (IPT) was developed between PMS-210 (the airborne mine countermeasures portion of PEO(MUW), Coastal Systems Station, N85, ONR, and Arete Associates. In addition, a draft memorandum of roles and responsibilities of the IPT was circulated, and all parties concurred with the IPT structure. ONR would retain the lead for funding and technical oversight, PMS-210 would be the execution agent, CSS the technical agent for interfacing with Navy assets, and Arete would be the main performer.

Seeking input from all parties involved, ONR forwarded Arete's proposal to the IPT members for comments. In August 1997, representatives from Arete, ONR, PMS-210, and CSS met in Washington to agree to the proposal's SOW, schedule, and budget. This meeting was significant in that the IPT agreed upon not only Arete's budget, but also the budgets for PMS-210 and CSS. The ground rules agreed to by all sides were threefold:

- The budget would be guaranteed across the three years.
- Minimal documentation would be required.
- There would be no dramatically aggressive management unless required, in exchange for no cost growths and a performance on schedule.

Various other options were also included in the proposal in the event extra funds were made available to ONR. Upon unanimous consensus by all IPT members, ONR submitted the proposal to ONR's Acquisition Department for contract negotiation.

Lessons Learned

- *Balance technical milestones and requirements against realistic schedules and budgets.*

- *Provide stable funding with clear expectations.*
- *IPTs do work, given a clear understanding of the rules and responsibilities of all involved.*

Contract Award

The Navy awarded the contract for the 6.3 program in December 1998 and held a kick-off meeting the following day in Tucson. This was the first meeting at which all four authors of this article were assembled together. The informal atmosphere again prevailed, reflecting the community spirit and common purpose of the group. A number of working group meetings between Arete Associates and CSS personnel had been ongoing since the beginning of the 6.2 program, and by this time a Navy/industry true team had developed.

Moreover, expertise at Arete and CSS proved to be entirely complementary, resulting in a very harmonious working group. CSS provided detailed knowledge of mine warfare and the AQS-20 capabilities and requirements, and was primarily responsible for vehicle integration and test operations, with Arete responsible for the electro-optic sensor technology.

One of the most challenging aspects involved was incorporating the sensor package into the very limited space available; close working relationships between CSS, Arete, and sub-contractor Metro Engineering helped simplify an otherwise daunting task. Progress was sure and swift, with no major problems developing. Within these working groups, team members worked hard to ensure a smooth-running program, and once again, the strong spirit of teamwork contributed to this effort.

A Preliminary Design Review and Critical Design Review were held over the next few months. These meetings were moved from Arete's Tucson offices to larger facilities at a nearby hotel, where the conference room and lodgings could be co-located. This arrangement allowed discussions to continue after the formal presentations and reinforced the team atmosphere.

Serendipitously, the ONR and Arete program managers discovered many mutual interests outside of the project, including hiking, where the desert served as a backdrop for discussion on a wide range of issues inappropriate for discussion during the more formal reviews, such as finance, programmatic balance, and personnel issues. Discussions of this nature proved crucial in cementing the mutual respect and trust between performer and sponsor.

Arete raised a concern regarding the transition window of opportunity for the RMS and AQS-20 programs. Each program's projected schedule was changing rapidly, sometimes being foreshortened; other times stretched out. For those not intimately involved in the details, the actual dates for selection of the Electro-Optic ID portion of these efforts seemed a moving target. Some on the IPT wanted to accelerate the STIL program to match the current AQS-20 program schedule.

By now, a variety of EOID components for RMS, AQS-20, and AN/AQS-14A (the existing Fleet helicopter towed sonar system) were envisioned, all with different selection dates. Eventually, ONR recommended keeping the original STIL schedule, since most DoD program schedules remain in flux until the last minute, and chasing a moving target would expend resources unnecessarily. The philosophy was to mature the STIL technology at an appropriate pace, and let the chips fall where they may. While taking a risk of missing a schedule for transition, it seemed a prudent approach to take. Since that decision, the AQS-14A selected a COTS laser line scan system for a Deployment Contingency Program of four units, and the RMS program chose to incorporate the AQS-20 sensors and towed body to save costs to the government.

Further, the AQS-20 program was renamed as the AN/AQS-20/X to reflect the addition of the EOID sensor. The merger of RMS and AQS-20/X sensor/tow body configuration had the effect of moving the selection date of the EOID sensor up by about six months. As the Navy was set to conduct a number of interim test demonstrations of STIL prior to this selection date, the team believed that there was still no need to accelerate the STIL schedule.

Lesson Learned

- *Balance technical milestones and requirements against realistic schedules and budgets.*

Testing

Two interim risk-reducing tests were originally scheduled using the same hardware, in a slightly more convenient packaging, for testing of glass bottom boats. The first test collected data, but it proved hard to correct and place the data into appropriate images due to the rolling of the boat and the failure of the Inertial Measurement Unit. The second test was delayed due to poor water clarity, but was finally undertaken in May 1999 in the waters around Panama City, Fla. The water clarity was again very poor; some data was collected, but the results were not particularly pleasing for demonstration of the system's capabilities to those not intimately familiar with ocean optics.

Because of the poor test conditions, the IPT decided that one additional test should be performed where clear waters were virtually guaranteed to prove the resolution and performance of the STIL system in optimal conditions. The team selected Nassau, Bahamas, as the site because of its clear waters. Upon approval of the site selection, the team shipped their equipment to Nassau and chartered a glass bottom boat, only to be met by Hurricane Floyd, which forced an emergency evacuation of all personnel. Rescheduling the test for the following week, team members finally succeeded in collecting a large set of data—all of excellent quality.

While this final extra test was not budgeted, the IPT agreed that: 1) it was important to collect the data, and 2) ONR funds should be allocated for that purpose. Because the team conducted the unanticipated extra test at the end of the fiscal year, ONR did provide the extra funds after the experiment and covered

the extra costs at Arete and CSS. Results of the interim testing, as well as the sensor integration efforts, were subsequently reviewed in Tucson during periodic Interim Progress Reviews (approximately quarterly).

Lessons Learned

- *If agreements are made beyond the actual contract, make sure that they are met.*
- *IPTs do work, given a clear understanding of the roles and responsibilities of all involved.*

Five Years Later

During 1999, the Navy solicited two Requests for Proposals for mine hunting sensors for: 1) an airborne version for minefield detection by PMS-210; and 2) an underwater EOID for the AQS-20/X by Raytheon, the prime contractor for the AQS-20 system under sponsorship of PMS-210. While the STIL system had not been funded for the airborne detection system by ONR, its basic technology could easily be adapted for that purpose. In fact, Arete Associates spent independent research and development funds to demonstrate its capability to detect subsurface mines, and had a contract with the Australian government using airborne STIL for determining bluefin tuna fish stocks. Each of these programs used the system built under ONR sponsorship in the 6.2 program.

In addition, Arete teamed with another industrial partner and submitted a proposal for the airborne laser mine detection system. This Request for Proposal for an airborne mine detection system was the same concept that Arete originally presented to ONR for funding in 1995. In taking the modular technology approach, the advantage for Arete and the government was that it allowed the company flexibility to respond to a variety of Acquisition programs, rather than a single transition opportunity.

The other RFP from Raytheon was for the underwater mine identification subsystem, and required a much shorter turnaround time for proposal preparation and selection for award. The government received two proposals and after careful consideration, chose Arete Associates' STIL technology due to the technical and packaging maturity, the lack of moving parts, and the ability to collect three-dimensional data. Thus, within five years of starting the STIL program, ONR successfully transitioned the hardware, design, and personnel involved from a Science and Technology Program into an Acquisition Program under PEO(MUW)'s cognizance. Further, the Airborne Laser Mine Detection System was awarded to the combined team of Northrop Grumman and Arete Associates, fulfilling the original goals of Arete when they first submitted their proposal to ONR.

Trust and respect for each member of the program is absolutely imperative. This is perhaps one of the hardest things to quantify, measure, or implement; but without it, the program will likely not succeed.

Principles for Successful Program Management

Based upon our experiences in this program, we offer the following seven principles for successful management based on, once again, common sense and practical management.

Start with good technology or a product that has utility for improving Fleet operations. It can either be a new capability, an improvement to an existing one, or an equivalent capability that lowers maintenance or life cycle costs. Without the quality product, the program will not transition to Acquisition. Quality performance by industry and laboratories is essential to see the product through to completion on time and within budget.

Balance technical milestones and requirements against realistic schedules and budgets. Most programs can't afford large investments on short lead times, particularly with very ambitious goals, aggressive schedules, and concomitant risks. A more modest program, designed to reduce risk in stages, is often more affordable and allows time for proper maturity. Technology needs to be matured at a natural, intrinsic pace, and acceleration of this pace only creates problems that additional funds usually cannot remedy. Similarly, transition windows should not be chased needlessly by accelerating a program more than it can accommodate. Most acquisition program schedules slip until the very end, and if the project schedule is reasonable in the first place, the team can accomplish more by proceeding at their own natural pace.

Prepare for transition early in the development cycle, including developing visibility and credibility with the user community. It typically takes two years of preparation to program a new project into the 6.3 or 6.4 category of funds, with a lot of maneuvering and paperwork done in the background. Industry, in particular, often does not realize this and becomes discouraged by the seemingly slow pace of DoD program planning, and then resorts to external pressures or influences.

IPTs do work, given a clear understanding of the roles and responsibilities of all involved. The roles were assigned to be entirely complementary between organizations, which minimized conflicts and reinforced our common goals. This teaming relationship worked so well that any member of the IPT could speak for another since we all shared a common vision for the project and program.

Provide stable funding with clear expectations. In STIL's case, the team cultivated, continued, and reinforced mutual trust and respect from start-up of the original budget/SOW negotiation throughout program execution. ONR provided stable funding at all times and expected work to be completed on time and on budget. Funding and scheduling stability is often hard to achieve, but for this challenging program it has allowed performers to dedicate personnel and facilities to ensure continued success.

If agreements are made beyond the actual contract, make sure that they are met. Guarantees, if made, should be for those aspects that can be actually controlled, such as stable funding, CDRL requirements, etc. In our case, a guaranteed transition to an Acquisition program was never an option—only that we, as a team, would do everything possible to provide the opportunity to compete. If a specific commitment cannot be guaranteed, that commitment should not be offered or made under any circumstances.

It's the people, stupid! Trust and respect for each member of the program is absolutely imperative. This is perhaps one of the hardest things to quantify, measure, or implement; but without it, the program will likely not succeed. If the product is great, but the people don't trust one another, the program will likely fail. Given the right mix of personnel, success is more likely to be achieved. Supervising managers may want to consider mixing and matching people to enable development of a good rapport. This can be achieved by knowing the strengths and weaknesses of the individuals involved—both technical and personal—and determining the best mix of personalities to achieve results. In our case, the rapport between people developed spontaneously.

Let Common Sense Rule

We all know all of these things intuitively, but it is easy to overlook any one of them. And this oversight could very well lead to the failure of even the greatest of ideas. For these authors, the ability to see this project through from technology development to insertion into two active acquisition programs was a rewarding achievement, but it was only possible because we allowed our common sense to rule. Starting with a good technology that had real application, we framed the development cycle in realistic terms; instilled a focus on the issues that would arise from future transitions and tackled them early (including Fleet participation); maintained a strong common vision; understood the expectations of all concerned; and put together a team that made the most of what each had to offer. And the result? A successful program, of course.

Editor's Note: The authors welcome questions or comments on this article. Contact Jacobson at **jacobsr@onr.navy.mil**, McLean at **jmclean@aretaz.com**, Hunt at **HuntSG@navsea.navy.mil**, and Hulgan at **hulganmc@ncsc.navy.mil.**

Defense Awards Given for Competitive Research

Deputy Under Secretary of Defense for Science and Technology Delores M. Etter announced today [Feb. 16, 2000] plans for the Department of Defense (DoD) to award $24 million to 35 academic institutions in 18 states, including Puerto Rico, to perform research in science and engineering fields important to national defense. Eighty-one projects were competitively selected under the fiscal 2000 Defense Experimental Program to Stimulate Competitive Research (DEPSCoR). The DEPSCoR is designed to expand research opportunities in states that have traditionally received the least funding in federal support for university research. The average award will be approximately $296,000.

University professors in Alabama, Alaska, Arkansas, Idaho, Kansas, Kentucky, Maine, Mississippi, Montana, Nebraska, Nevada, North Dakota, Oklahoma, South Carolina, South Dakota, Vermont, West Virginia, Wyoming, and the Commonwealth of Puerto Rico were eligible to receive awards under the Defense Experimental Program to Stimulate Competitive Research competition.

The Air Force Office of Scientific Research, the Army Research Office, the Office of Naval Research, and the Ballistic Missile Defense Organization (Science and Technology Directorate) solicited proposals utilizing a Defense-wide Broad Agency Announcement (BAA). The DEPSCoR BAA was published on the Internet and accessed by the Experimental Program to Stimulate Competitive Research State Committees, which solicited and selected projects for their state's proposal. In response, 20 proposals consisting of 256 projects were submitted requesting more than $82 million.

Editor's Note: This information, published by the Office of the Assistant Secretary of Defense (Public Affairs), is in the public domain at **http://www.defenselink.mil/news** on the Internet.