NAVY STTR
PROPOSAL SUBMISSION

INTRODUCTION:

The responsibility for the implementation, administration and management of the Navy STTR program is with the Office of Naval Research (ONR). The Navy STTR Program Manager is Mr. John Williams ((703) 696-0342). All STTR Phase I and Phase II proposals, Phase I and II electronic summary reports, as well as Phase III Success Stories should be forwarded to Mr. Williams at the address below. If you have any questions, problems following the submission directions, or inquiries of a general nature, contact Mr. Williams. All Phase I proposals are due by **14 April 1999** and must be submitted to:

Office of Naval Research
ATTN: Mr. John Williams, ONR 362 STTR
800 North Quincy Street
Arlington, VA 22217-5660

UNIQUE NAVY REQUIREMENTS:

1. Navy requires Appendix A, B and E to be submitted electronically through the Navy SBIR/STTR Website. The company must print out the forms directly from the Website, sign the forms and send them with their proposal.
2. All Phase I award winners must electronically submit Phase I summary report(s) through the website at the end of their Phase I.
3. The Navy requires that all Phase II proposers submit Appendix A, B & E through the Navy SBIR/STTR Website.
4. Phase II award winners must also submit Phase II Summary Reports through this same website.
5. The requirements and time frames for Navy Fast Track submission have been modified and are described below.
6. The Navy only accepts proposals with a base effort of not exceeding $70,000 with an option not exceeding $30,000. Phase I base effort should run about 6 months and the option 3 months.

NEW THIS YEAR:

The Navy will allow firms to include with their proposals, success stories that have been submitted through the Navy SBIR/STTR Website at **http://www.onr.navy.mil/sbir**. A "Navy Success Story" is any follow-on funds that a firm has received from past Phase II Navy SBIR or STTR awards. To qualify the firm must submit these success stories no later than **19 March 1999,** through the Navy SBIR/STTR Website. The success story should then be printed and included as appendices to the proposal. These pages will not be counted towards the 25-page limit.

The success story information will be used in the evaluation of the third criteria "Commercial Potential", (listed in Section 4.2 of this solicitation) which includes Companies Commercialization Report (Appendix E) and the strategy described to commercialize the technology discussed in the proposal. Commercialization is viewed as any follow-on funds, from the DOD, DOD contractors or the private sector, used to further develop the technology or from sales of a product. The Navy is very interested in companies that transition SBIR/STTR efforts directly into Navy and DOD programs and/or weapon systems. The proposing company should make reference to the attached success stories in the "Commercialization Strategy" section of their proposal so the evaluator knows to look for them. If a firm has never received any Navy SBIR/STTR Phase II it will not count against them, and they will be evaluated on the other evaluation criteria listed in Section 4.2 Phase I Evaluation Criteria. If you have any

questions about this requirement, call John Williams at (703) 696-0342.

YOUR SUBMISSION TO THE NAVY STTR PROGRAM:

This solicitation contains a mix of topics. When preparing your proposal keep in mind that Phase I should address the feasibility of the solution to the topic. Phase II is the demonstration of the technology that was found feasible in Phase I. Only those Phase I awardees which have been invited to submit a Phase II proposal by the Navy technical point of contact (TPOC) during or at the end of a successful Phase I effort will be eligible to participate for a Phase II award (with the exception of Fast Track Phase II proposals per section 4.5) . If you have been invited to submit a Phase II proposal to the Navy by the TPOC, obtain a copy of the Phase II instructions from the Navy SBIR/STTR Bulletin Board on the Internet or request the instructions from the Navy STTR Program Office. All Phase I and Phase II proposals should be sent to the Navy STTR Program Office (at the above address) for proper processing. Phase III efforts should also be reported to the STTR program office noted above.

The Navy will provide potential awardees the opportunity to reduce the gap between Phases I and II if they provide a $70,000 maximum feasibility Phase I Base proposal and a fully costed, and a well defined ($30,000 maximum) Phase I Option to the Phase I. **The Navy will not accept Phase I proposals in excess of $70,000 (exclusive of the Phase I option).** The technical period of performance for the Phase I Base effort should be 6 months and for the Phase I option should be 3 months. The Phase I Option should be the initiation of the next phase of the STTR project (i.e. initial part of Phase II), and it must be included with the Phase I proposal. Please include brief task statements and milestones for the Phase I option, and include the costs on the same Appendix C, but in a separate column.

When you submit a Phase II proposal it should consist of three elements: 1) a $400,000 maximum demonstration phase of the STTR project; 2) a transition or marketing plan (formally called a "commercialization plan") describing how, to whom and at what stage you will market your technology to the government and private sector; 3) a Phase II Option ($100,000 maximum) which would be a fully costed and well defined section describing a test and evaluation plan for further R&D if the transition plan is evaluated as being successful. You must also submit your Phase II appendix A, B & E electronically to the Navy STTR Program Office at the address above. While Phase I proposals with the option will adhere to the 25 page limit (section 3.3), Phase II proposals together with the Phase II Option will be limited to 40 pages (unless otherwise directed by the TPOC or contract). The transition plan should be in a separate document.

The Navy will evaluate and select Phase I proposals using scientific review criteria based upon technical merit and other criteria as discussed in this solicitation document. Due to limited funding, the Navy reserves the right to limit awards under any topic and only proposals considered to be of superior quality will be funded.
The names of firms whose proposals have been selected for further consideration will be posted by topic number on the Navy SBIR/STTR Website, under "What's New" the STTR Program Information within 3 months of the proposal deadline. In addition the abstracts of companies that have received Phase I awards will be posted on the website within 5 months of proposal deadline.

Phase I awardees should submit a 5-page preliminary plan for Phase II to the Navy STTR Program Manager at the address above, 5 months and 2 weeks after contract award. However, only those Phase I awardees which have been invited to submit a formal Phase II proposal by the TPOC will be eligible for a Phase II award (with the exception of Fast Track Phase II proposals per section 4.5) . If you have been invited to submit a Phase II proposal to the Navy TPOC, get a copy of the Phase II proposal preparation and submittal guidelines from the Navy SBIR/STTR website.

ELECTRONIC SUBMISSION OF APPENDICES:

The Navy only accepts proposals that have had the Appendix A, B and E electronically submitted over the internet. Do not submit the main body of the proposal over the internet, only these appendices. **The Navy WILL NOT accept the forms in the rear of this book as valid proposal submission forms of the Appendix A, B and E or the Electronic download forms from any DOD Homepage.** Instead proposers must got to the Navy SBIR/STTR website and follow the instructions for Phase I STTR Appendix A, B and E submission.

A. Go to SBIR/STTR Bulletin Board (http://www.onr.navy.mil/sbir), click on "Submission" then click on "Submit or Edit Phase I Appendix A and B".
B. From this "Welcome & Instructions" page, click the "Continue to Appendices A, B & E, Login/Registration" button.
C. If you have not yet registered, click the "New Registration" button or, if you registered previously, enter your firm name and password and click the "Login" button. If you choose "New Registration", you will be prompted to enter firm information and then you may click the "Continue" button.
D. From the main menu, under the STTR section, click the "Go to Phase I Appendix A & B now" link.
E. Follow the instructions on this page to select your topic number and continue to the Appendix A & B form. Please fill out all information requested; the screen format will look different then the forms in the solicitation. Please click on the "Submit" button to submit your appendices electronically.
F. You should now see a text version of the Appendices on the screen, use your browser's print function to print the Appendices.
G. Go back to the page from where you selected the topic number and click on the "Continue to Appendix E Login/Registration" link at the bottom of the page. From this page, click the "Continue to Appendices A, B & E, Login/Registration" button. Log in and, then from the main menu, click on the "Go to Appendix E now" link.
H. Follow instructions to submit and print Appendix E.
I. Submit the signed Appendix A/B and E forms along with one original and four copies of your entire proposal (each copy should include a copy of the signed Appendix A, B and E forms) to the Navy STTR Program Office at the above address. Mark the outside of the envelope with your topic number.

ELECTRONIC SUBMISSION OF PROJECT REPORTS:

The submission of an electronic Phase I Summary Report will now be required at the end of Phase I. The Phase I Summary Report is a summary of Phase I results, includes potential applications and benefits, and should not exceed 750 words. It should require minimal work from the contractor because most of this information is required in the final report. The summary of the final report will be submitted through the Navy SBIR/STTR Website at: http://www.onr.navy.mil/sbir, click on "Submission", then click on "Submit a Phase I or II Summary Report". If your company does not have access to the Internet on your computer consult your local library or local computer service store.

The Navy is initiating this new program to help increase the awareness and implementation of SBIR/STTR funded efforts. The goal is to increase the market potential and transition of SBIR/STTR projects by increasing the visibility and ease in accessing information about these projects to DOD, government and DOD industry contacts. This should facilitate the transition of these projects into follow-on efforts and bring additional revenue to the SBIR/STTR Company.

To do this the Navy is asking companies to provide information on the status and benefits of their technology developments so that this information can be put into a media that others can easily access and review. The Navy plans to redistribute this information to a wide audience using such tools as the Navy Webpage, Accomplishment Book and a new interactive Navy SBIR Website. This will help provide parties with technical challenges or those with the need to implement new technology, with a user-friendly mechanism to access and identify SBIR companies that can provide them with solutions. This information should be **non-proprietary** yet detailed enough to provide the interested transition partner with enough knowledge to understand the potential use and benefit to their program.

NAVY FAST TRACK DATES AND REQUIREMENTS:

All Fast Track Applications and required information must be sent to the Navy SBIR Program Manager at the address listed above and to the designated Contracting Officers Technical Monitor (the Technical Point of Contact (TPOC) for the contract and the appropriate Point of Contact at the end of this Introduction). The following dates and information are required by the company to qualify for the FAST TRACK program. All of the requirements listed in the Fast Track Section of the front of this solicitation must be met. The information provided below provides specific dates and some additional information that is required by the Navy STTR

Program Office.

Party/Days After Phase I Award	**Required Deliverables**
STTR Company / 150 Days	- Fast Track Application and all supporting information. (See instructions in the DOD section of this Solicitation) - Phase II 5 Page Summary Proposal, as required of all Phase I Projects as described in Navy STTR Website listed above. (It is strongly recommended that if you are contemplating the submittal of a Fast Track Application, you make your intention known to your technical point of contact and the STTR Program Manager) - Request to initiate Phase I option (interim funding) which must have been included in the original Phase I proposal
Navy / 181 Days	- Navy will initiate option funding if all requirements are met.
STTR Company /181 - 200 Days	- Phase II Proposal - Phase I Final Report
Navy / 201 - 215 Days	- Navy will formally Accept or Reject your Phase II proposal.
STTR Comp. /260 Days	- Proof that Funding has been received by STTR company.

PROPOSAL SUBMISSION CHECKLIST:

All of the following criteria must be met or your proposal will be REJECTED.

1. You must use the electronic format described in the section Electronic Submission described above. The Navy will not accept any proposals that do not have electronic forms of Appendix A, B, and E. The electronic appendices submitted must match the paper copies submitted via mail/express delivery.

2. An electronic version of Appendix E must be submitted with all proposals. Even if you have no Phase II or Phase III information to report.

3. Your Phase I proposed cost for the base effort can not exceed $70,000. Your Phase I Option proposed cost can not exceed $30,000. The costs for the base and option should be clearly separate and identified on Appendix A, the cost proposal and in the work plan section of the proposal.

4. Your proposal must be received on or before the deadline date. The Navy will not accept late proposals, or incomplete proposals. If you have any questions or problems with submission of your proposal allow yourself time to contact the Navy and get an answer to your question. Submit Appendices early, as computer traffic increases, computer speed slows down. Do not wait until the last minute.

Navy STTR FY99 Topic Descriptions

N99T001 TITLE: Technology for Shipbuilding Affordability

OBJECTIVE: The objective of the project is to develop and implement innovative technologies that will reduce the cost to construct ships and thereby improve the competitiveness of the domestic shipbuilding industrial base and reduce the cost of military ships.

DESCRIPTION: During the last year, 9 shipyards along with suppliers, owner operators, and government personnel have developed the MARITECH Advanced Shipbuilding Enterprise (ASE) Strategic Investment Plan (SIP). This plan contains an industry led strategy to promote commercial competitiveness and reduce the cost of military ships. It identifies Major Initiatives and Sub-Initiatives that are the R&D requirements for this industry. This entire plan is available for review on the Word Wide Web at http://www.nsrp.org/. Coordinating with US shipbuilders to adapt and implement "World Class" commercial best practices is encouraged. The application of best practices can cover areas such as production methods, production planning and control, accuracy control, supplier relations and design for Producability. Proposals under this topic can address any research area identified in that plan or any related innovative research idea. However, priority will be given to proposals in the following areas:

1) Major Initiative: Shipyard Production Process Technology
   Sub-Initiative: Process Control
2) Major Initiative: Shipyard Production Process Technology
   Sub-Initiative: Industrial Engineering
3) Major Initiative: Business Process Technologies
   Sub-Initiative: Sourcing and Supplier Integration
4) Major Initiative: Systems Technology
   Sub-Initiative: Development and Access to Logically Integrated Database
5) Major Initiative: Crosscut Initiatives
   Sub-Initiative: Education and Training

Proposals should specifically describe the technology, how it will be developed, what the estimated benefits will be and how it will be transitioned into the shipbuilding industry. Teaming with the shipbuilding industry to form integrated project execution and implementation team will improve transition potential and is strongly encouraged. Shipbuilding industry contacts for each Major Initiative are available on the web site.

PHASE I: Prove feasibility for improvements being developed and detail where and why they will impact shipbuilding affordability. Include a Return-On-Investment (ROI) analysis for industry implementation.

PHASE II: Develop a working prototype production system or prototype product to demonstrate its performance characteristics. Present the technology being developed to the MARITECH ASE Major Initiative teams, develop a commercialization (Phase III) plan, in coordination with MARITECH ASE members, including descriptions of specific tests, evaluations and implementations (including sites and points of contact) to be performed.

PHASE III: Implement the Phase III plan developed in Phase II in coordination with the MARITECH ASE Program.

COMMERCIAL POTENTIAL: The technology developed under this program shall be applicable to military and commercial shipbuilding practices.

KEY WORDS: Shipbuilding; Affordability; Production; Manufacturing; Processes; Maintainability

N99T002 TITLE: Technology for Advanced Amphibious Assault Vehicle (AAAV) Affordability

OBJECTIVE: The objective of this project is to develop innovative technologies that will reduce the manufacturing and/or repair costs, reduce weight, or increase efficiencies of the Advanced Amphibious Assault Vehicle (AAAV), but not adversely impact performance.

DESCRIPTION: Affordability is a major consideration in all aspects of the life-cycle of Marine Corps systems. Technologies that will allow the Marine Corps to economically acquire, maintain, and upgrade weapon systems with modern technologies will significantly impact life-cycle costs. Areas of interest on these weight-critical weapon systems include but are not limited to lightweight materials, metalworking, composites, armor and increasing the efficiency of the drive train and propulsion systems. Proposals should specifically describe the technology, how it will be developed, its estimated benefits and how it would be transitioned.

The AAAV Program is currently in the Program Definition and Risk Reduction Phase, which leads to the Engineering Manufacturing Development (EMD) Phase in 2001. This is an ideal time to impact the EMD prototypes scheduled for delivery in 2003. The Navy and Marine Corps feel that to increase the potential that these technologies will be transitioned into the AAAV program, General Dynamics (GD), the prime contractor on AAAV, must be involved. This involvement will be funded under the AAAV program for Phase I of the STTR. Contracting arrangements can be pursued with GD for Phase II depending on the scope of GD's evolvement. GD will sign Non-disclosure agreements with the Marine Corps and GD currently has an Organizational Conflict of Interest Clause with the Marine Corps. GD will not be involved in the proposal evaluations. If there are any questions on how this will be handled, please call Scott Story at (703) 492-3328 or John Williams at (703)696-0342.

PHASE I: Identify improvements to be developed, and detail where and why they will be effective.

PHASE II: Choose one of those improvements, develop a working model/prototype, and demonstrate its performance characteristics. Develop a commercialization (Phase III) plan, including descriptions of specific tests, evaluations and implementations to be performed.

PHASE III: Implement the Phase III plan developed in Phase II.

COMMERCIAL POTENTIAL: Private sector applications and benefits must be inherent in the objective of the proposed effort.

REFERENCES: AAAV web page: http://www.aaav.hqi.usmc.mil

KEY WORDS: Amphibious; affordability; maintainability; manufacturing; weight reduction; corrosion

N99T003 TITLE: High Speed, Wide Dynamic Range, Multi-Channel, High Throughput Analog To Digital Converter

OBJECTIVE: Use new technology to develop a digitizer capable of accurately reproducing a wide dynamic range, wide bandwidth analog signal.

DESCRIPTION: The current technology for digitizing analog signals with bandwidths in excess of 100 MHz is limited to representing each sample of the signal with only 64 to 128 discrete levels (6 to 7 bits) on a shot by shot basis. Current digitizers are also limited to capturing and reading out signals with repetition of less then 100 Hz for small record lengths. Naval air to underwater, pulsed, blue-green LIDAR systems are typically pod mounted and require low power, compact multi-channel A/Ds. The A/D must be able to digitize the LIDAR return signals, with analog bandwidths of 100s of MHz, to better then 1 part in 1000 (10 bits) on a shot by shot basis. Furthermore, Naval LIDAR systems have repetition rates on the order of a kHz and record lengths on the order of a microsecond. To further enhance the capabilities of today's Naval LIDAR systems, signal conditioning such as variable gain on the digitizer input should be employed. Also the ability to use multiple, synchronized digitizers would allow the capture of signals with dynamic ranges beyond the capabilities of a single channel digitizer.

PHASE I: Provide a feasibility study for developing a modular 10 effective bits or better, 1-2 Gsample/sec, deep memory, kHz repetition rate analog to digital converter with variable gain front end.

PHASE II: Perform detailed design and develop a prototype of a multi-channel digitizer.

PHASE III: Fabricate digitizer units for operational testing and integration.

COMMERCIAL POTENTIAL: Commercial application for LIDAR systems for bathymetry, fish finding, and remote sensing of contaminants is increasing as technological breakthroughs provide improved performance at affordable costs. This technological advancements will significantly enhance the performance and of a commercial LIDAR for the specified applications.

KEYWORDS: Digitizer, A/D, ADC, Analog-to-Digital

N99T004 TITLE: Modeling and Analysis for Acquisition Affordability Measurement and Prediction

OBJECTIVE: Develop an effective interactive distributed advanced decision support system for acquisition modeling, simulation and analysis. This methodology is to be based on innovative application within a synthetic environment of visualization techniques, game theoretic models and multi-variate optimization research to support interactive simulations of acquisition policies and practices.

DESCRIPTION: Affordability of all Navy warfighting and support systems is a major concern in the Department of Defense. The ability to effectively define requirements; generate viable concepts, approaches, and designs; and select the most affordable of these alternatives will depend on the ability to measure the affordability of existing systems and predict the affordability of alternatives. An effective defense systems acquisition process, which includes research and development, design, engineering, production and deployment, depends on the ability to predict acquisition and operational affordability of future defense systems. Therefore, the Office of Naval Research (ONR) has been pursuing research and development in the areas of affordability measurement and prediction. Affordability measurement and prediction tools and techniques are being developed to support both the S&T community and the acquisition community. These tools will help S&T managers invest in research that offers the best opportunity for achieving downstream system affordability. Likewise, these tools will assist acquisition managers to make decisions that result in high performance defense systems that are available, when needed, for a reasonable cost. Tools and techniques currently under development are directed toward multivariate decision processes involving system performance, total ownership cost, initial availability, and life-cycle availability. Navy desires to broaden the scope of affordability research in terms of disciplines involved and application to more complex decision environments. Research and development is needed in the areas of integrating affordability measurement and prediction tools with acquisition modeling and war gaming, incorporating visualization techniques in the application of these affordability tools and techniques, and expanding affordability prediction techniques to include game theoretic and other modeling approaches. In this regard, researchers should be familiar with DOD high level architecture (HLA) requirements as they apply to modeling and simulation and address how these requirements might apply to their research. The desired result will be a comprehensive suite of practical decision tools that can be readily applied by users in the S&T and acquisition communities.

PHASE I: Define characteristics important for interactive simulations of acquisition policies and practices. Describe these characteristics, their computational requirements, and their interdependencies and relationships. Provide a high level architectural design of a distributed Web-based software environment that supports a practical collection of interactive decision support tools, which are extensible, interoperable, and scalable. Illustrate the user interface to this system. Demonstrate how affordability measurement and prediction decision support tools can be embedded in this environment.

PHASE II: Build a software research prototype based on the Phase I high level architectural design, conforming to standard software engineering practices. Develop specific tests, evaluations, benchmarks and applications that support affordable acquisition management activities, exercising affordability decision support tools identified in Phase I. Conduct testing of the prototype tools according to this plan.

PHASE III: Extend and enhance the research prototype into a commercial quality product. Validate and benchmark on increasingly more complex acquisitions.

COMMERCIAL POTENTIAL: Affordability measurement, prediction, and decision tools will have wide commercial application. They will be applied to requirement definition processes, evaluation and selection of viable alternatives, and affordability prediction during the design and production of defense systems as well as commercial products. They can also be used by commercial organizations in complex decision making environments to evaluate alternate courses of action and develop the most affordable products.

REFERENCES: Papers associated with the ONR Affordability Prediction and Measurement Research Program can be accessed at the following web sites:
1. ONR Affordability Program web page: http://www.onr.navy.mil/sci_tech/industrial/afford.htm
2. Georgia Tech Affordability Research web page: http://www.asdl.gatech.edu/affordability/
3. Clemson University Affordability Research web page: www.math.clemson.edu/affordability/

Other related research efforts can be found at:
1. Georgia Tech Aerospace Systems Design Lab web page: http://alpha.cad.gatech.edu
2. NASA Mathematical Technologies for Competitive Advantage web page: http://akao.larc.nasa.gov/dfc.mtec.html
3. Defense Modeling and Simulation Office High Level Architecture: http://hla.dmso.mil
4. National Center for Advanced Technologies: http://ncat.com/ippd.html (reference for Acquisition Process)

KEY WORDS: Affordability; game theory; modeling; simulation; visualization; decision support system.

N99T005 TITLE: Research In Affordability Measurement And Prediction Methods To Support Affordable Design Of Ship Systems

OBJECTIVE: Integrate and extend current Office of Naval Research Affordability Measurement and Prediction program research efforts related to cost estimating under uncertainty - including stochastic and heuristic methods, fuzzy logic, and other associated research results - into the areas of ship design and Total Ownership Cost (TOC) prediction, thereby extending affordability science to surface ship and submarine systems.

DESCRIPTION: Affordability measurement and prediction tools and techniques are being developed by the Office of Naval Research (ONR) to support both the S&T community and the acquisition community. These tools will help Science and Technology (S&T) managers invest in research that offers the best opportunity for achieving downstream system affordability. Likewise, these tools will assist acquisition managers in making decisions that result in high performance defense systems that are available, when needed, for a reasonable cost. The effort being solicited will provide an S&T foundation for Acquisition Program Integration activities related to TOC and affordability being sponsored by the Defense Systems Acquisition Council. Tools and techniques currently under development, including research into total ownership costs, have been primarily directed toward aircraft systems. Navy would like to transition results of its research efforts to the area of affordable ship design and prediction of total ownership costs for ships, possibly through existing Ship and Submarine Design Synthesis Models such as ASSET and PASS. Since design decisions made early in the acquisition process have a very large effect on Total Ownership Costs, affordability prediction capability is particularly important in the acquisition of naval vessels. Navy desires to expand the scope of affordability research in terms of systems being supported and disciplines involved as well as integration of efforts into a common "science of affordability." The desired result will be a set of practical affordability prediction and decision tools that can be readily applied to the surface ship and submarine design process by users in the S&T and acquisition communities.

PHASE I: Identify current affordability measurement and prediction research that will be integrated with the proposed research. Provide details of how this integration will be achieved. Describe expected results and provide supporting rationale. Identify high payoff potential areas of new research.

PHASE II: Conduct necessary research and integration efforts to develop a tool or set of decision tools that can be used by S&T or acquisition managers. Develop an implementation plan that includes specific tests, evaluations, and applications that will be implemented using these decision tools. Conduct testing of the prototype tools according to this plan.

PHASE III: Complete verification and validation of the tools developed. Transfer methods to shipbuilding program(s) in the private/public sector.

COMMERCIAL POTENTIAL: Affordability measurement, prediction, and decision tools will have wide application in commercial and public shipyards. Examples are planning and cost estimating in private shipyards and design and cost estimating by naval architecture firms. These tools can also be applied during the design and production of other defense systems as well as commercial products. In addition, these tools can be used by commercial organizations to evaluate the affordability of systems they wish to acquire.

REFERENCES: Papers associated with the ONR Affordability Prediction and Measurement Research Program can be accessed at the following web sites:
1. ONR Affordability Program web page: http://www.onr.navy.mil/sci_tech/industrial/afford.htm
2. Georgia Tech Affordability Research web page: http://www.asdl.gatech.edu/affordability
3. Clemson University Affordability Research web page: www.math.clemson.edu/affordability/

Other related research efforts can be found at:
1. Georgia Tech Aerospace Systems Design Lab web page: http://alpha.cad.gatech.edu
2. NASA Mathematical Technologies for Competitive Advantage web page: http://akao.larc.nasa.gov/dfc.mtec.html
3. Defense Systems Acquisition Council (DSAC) home page: http://www.acq.osd.mil/dsac

KEY WORDS: Affordability; Total Ownership Cost; ship design; prediction; cost assessment; decision support system.

N99T006 TITLE: Manufacturing of Functionally Integrated Multi-Component Modules and Devices

OBJECTIVE: Develop the capability to fabricate functionally integrated multi-component modules and devices as structures with three-dimensional architecture, with the module or device designed for specific electronic, packaging, or electro-mechanical application.

DESCRIPTION: There is a need for advanced electronic and electro-mechanical devices that are smaller (not microscopic), have greater functionality and enhanced reliability. Presently, devices for a variety of applications are manufactured from individual components, e.g., capacitors, inductors, switches, actuators, sensors, control ICs, structural elements, etc. These individual components are fabricated separately and assembled together one by one. The resulting packaged units are large, heavy, costly to assemble and inefficient. An alternative method is to manufacture devices with the level of functional integration demonstrated by the micro-electronics industry. Processes such as layered manufacturing (LM) could be explored for this purpose. Rapid, customized and accurate manufacture of these devices will bring the fabrication and acquisition costs down and will enhance performance. The key to building a low cost, high performance functional module or device is to attach all components that are necessary for a specific application in a fully integrated manner. This may involve depositing, embedding and interconnecting components within a housing or package. The process should allow for accurate placement of the individual components on the selected substrate. The resulting product must be portable, compact and reliable.

PHASE I: Select component and substrate materials and investigate their properties for forming and shaping, their electronic and mechanical behavior, their ability to functionally integrate with the module and their reproducibility. Demonstrate feasibility of making simple devices. Provide an assessment of the potential affordability and performance benefits of these materials and manufacturing processes over present approaches.

PHASE II: Build a functionally integrated multi-component module with a simple, specific architecture and evaluate the device for functionality and integrity. Develop capability for the rapid, customized manufacture of devices for a variety of applications. Assess potential of incorporating functionally integrated multi-component devices into military and industrial systems.

PHASE III: Prepare for commercialization of manufacturing processes.

COMMERCIAL POTENTIAL: Product line of multi-component modules and devices for electronic, packaging and electro-mechanical applications. Examples of products are customized computer modules, power electronic building blocks (PEBB), imaging devices, miniature electro-mechanical machines, etc. The electronics industry will benefit.

REFERENCES:
1. Badorf, MG. A Power Electronic Revolution. The Submarine Review. Naval Submarine League, Annandale, VA. April 1998.
2. Danforth, SC, Safari, A. Solid Freeform Fabrication: Novel Manufacturing Opportunities for Electronic Ceramics. Proceedings of 10th International Symposium on Applications of Ferroelectrics, IEEE 96CH35948, 1997: 183-188.
3. Dimos, D, Yang, P, Garino, TJ, Raymond, MV, and Rodriguez, MA. Direct-Write Fabrication of Integrated, Multilayer Ceramic Components. Solid Freeform Fabrication Symposium, The University of Texas at Austin 1997: 33-40.
4. Weiss, LE, Neplotnik, G, Prinz, FB, Schultz, L, Padmanabhan, P, Krishnan, R, and Merz, R. Shape Deposition Manufacturing of Wearable Computers. Solid Freeform Fabrication Symposium, The University of Texas at Austin 1996: 31.

KEY WORDS: Functionally Integrated; Multi-Component Modules; Layered Manufacturing; Electronic Devices; PEBB; Miniaturization

N99T007 TITLE: Polymer/Ceramic Orthopedic Tissue Engineering

OBJECTIVE: Develop the capability to produce polymer/ceramic materials and customized components that are porous, biocompatible, resorbable, and usable as bone substitutes

DESCRIPTION: Trauma, oncologic surgery, and congenital disorders often leave patients with large bony defects that require reconstruction. Creation of a suitable bone substitute for the repair of these defects has been a difficult goal to achieve. Present bone substitutes do not behave physiologically or mechanically like true bone. The current challenge is to create a readily available implantable bone substitute with the aforementioned properties.

PHASE I: Investigate materials, capable of acting as bone substitutes, their properties for forming and shaping, their bio-mechanical properties, and their producibility. Provide an assessment of the potential affordability benefits of these materials and manufacturing processes over current approaches.

PHASE II: Evaluate these materials in vitro for osteoconductive and osteoinductive properties. Develop a capability for the rapid customized manufacture of components from these materials. Assess potential in healing wounds such as compound fractures, bone loss, and bony non-unions.

PHASE III: Prepare requests for FDA approval for further testing. Prepare for commercial production of materials and manufacturing processes.

COMMERCIAL POTENTIAL: Product line of bone substitute products for orthopedic and other reconstructive surgical applications. These products include facial fracture plating system, bone graft substitute, and bony packing material.

REFERENCES:
1. Bolander, ME, and Balian, G. The use of demineralized bone matrix in the repair of segmental defects. J Bone Joint Surg 1986; 68(A): 1264-74.
2. Miller, TA, Ishida, K, Kobashi, M, Wollman, JS, Turk, AE, Holmes, RE. The induction of bone by an osteogenic protein and the conduction of bone by porous hydroxyapatite : a laboratory study in the rabbit. Plastic Reconstructive Surg 1991; 87: 87-95.
3. Ohgushi, H, Dohi, Y, Tamai, S, and Tabata, S. Osteogenic differentiation of bone marrow stromal cells in porous hydroxyapaite ceramics. J Biomed Mat Res 1993; 27: 1401-07.

KEY WORDS: Bone graft; Biomaterials; Hydroxyapatite; Scaffold; Tissue Engineering; Surgery

N99T008 TITLE: A System to Produce Sterile Water for Injection from Potable Water

OBJECTIVE: Develop a compact, automated water conversion system to produce sterile, pyrogen-free water for injection (WFI) from potable water abroad U.S. Navy ships, which can be further used in the production of Intravenous (IV) fluids and blood transfusions.

DESCRIPTION: During Desert Storm and other recent major emergencies, the military has encountered logistic problems in collecting, transporting, delivering, and storing units of whole fresh blood before the products become outdated. As a result of this situation, the U.S. Navy has been investigating new techniques in freeze-drying platelets and red cells for longer storage life. This technique will also decrease required storage space for the blood banks, thus allowing more room for other much needed medical supplies. The freeze-dried blood products would require reconstituting with sterile injectable fluids before use. Currently, the medical facilities would need to store bags of prepared sterile IV solution. This would require a bag of IV solution for every bag of freeze-dried blood products, therefore negating the space saving properties of this technique. Space is very limited on board ships and finding room to store extra IV bags may be very difficult. A device is needed to produce sterile, pyrogen-free WFI from potable water manufactured aboard U.S. ships. The WFI produced by this system would be used to produce IV solutions by diluting concentrated solutions of lactated Ringer's solution, sodium chloride-glucose-phosphate solution, and sodium chloride solutions. The WFI would also be used to reconstitute freeze-dried platelets and red blood cells for transfusions. Potable water manufactured on ships has very few contaminants in it, but further purification would be needed to make the water meet United States Pharmacopoeia (USP) XXII standards. The system would also need to receive Food and Drug (FDA) approval. Research conducted by both the U.S. Army and navy to address the design and development of a device to produce sterile IV fluids from potable water sources (1-3) has been limited by the lack of a final heat sterilization method, which is currently required for FDA approval.

PHASE I: Design a system that will produce sterile, pyrogen-free WFI from potable water manufactured aboard U.S. Naval ships, combine the WFI with a concentrated solution, and then pump measured quantities into sterile receiver bags. This system must produce solutions to meet United States Pharmacopoeia (USP) XXII WFI standards and the FDA standards for injectable fluids. The system shall be designed to meet the requirements of U.S. Navy medical treatment facilities. The system must also have quality assurance and monitoring systems and procedures.

PHASE II: Deliver a prototype. Develop and test the prototype system under laboratory conditions, including testing of solutions to USP and FDA standards, storage integrity of manufactured and packaged solutions, and performance assessment in simulated or actual work demands and environments.

PHASE III: Based on successful Phase II effort, expand the testing and evaluation to shipboard conditions and apply for FDA approval. Further testing may be investigated in land based hospital environments.

COMMERCIAL POTENTIAL: Both military and civilian hospitals would have an interest in a systems that can produce injectable fluids from local water sources. This system could be combined with current field water purification systems to provide injectable fluids to field medical units performing in both military situations and civilian aide missions. This system could provide continuos injectable fluids for those facilities that have difficulty receiving supplies or in countries that are limited in their production of such fluids.

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KEY WORDS: Intravenous; Fluid; Potable; Water; Filtration; Parenteral

N99T009 TITLE: A System to Generate Spatialized Auditory Displays

OBJECTIVE: Develop computer algorithms for faithfully rendering headphone-presented sounds at locations throughout the azimuthal and elevation planes.

DESCRIPTION: The Navy's Science and Technologies Requirements Guidance identifies the need for improving human-machine interfaces to better accommodate information management, data presentation, and spatial orientation. Spatialized audio is a technique where the direction- dependent acoustic cues (created when a sound diffracts around the listener's head and pineal) are simulated through appropriate filtering and headphone presentation. Such schemes are severely compromised since the directional filters poorly approximate the actual pattern of diffraction. The mis-match is dominated by the impracticality of measuring waveform diffraction on individual listeners. Signal processing techniques could be used to effectively individualize a set of directional filters for an operator (e.g. variations of adaptive filtering techniques). The development of such techniques along with effective hardware and software implementations could then allow testing of Spatialized audio as a method for presenting multiple streams of acoustic data to operators. Such an interface would allow operators to monitor multiple communications or sensors (i.e., sonar data). Other applications of spatialized audio include training, mission rehearsal, data visualization ("sonification"), alarms, and virtual reality presentations. This topic represents an opportunity to refine and combine innovative technologies that would have immediate application to Navy applied research programs and enable a transition of advanced technology into Navy combat systems displays and trainers.

PHASE I: Design an innovative signal processing scheme that will allow a customization of "directional filters" as well as a set of software tools for presenting spatialized audio.

PHASE II: Optimize the above technology and deliver it as a prototype board and software system that can be easily implemented on a standard personal computer. Test the accuracy and reliability of the prototype for synthesizing a spatialized auditory environment.

PHASE III: Based on a successful Phase II effort, transition the product to a commercial device. Expand the testing and document the performance gains achieved using spatialized audio compared to standard audio presentations.

COMMERCIAL POTENTIAL: Both defense and commercial contractors would have an interest in spatialized audio systems. The applications would include training systems (virtual reality trainers), data display systems (tactical and sensor displays). The largest potential would of course be in the entertainment and game industry where crudely designed spatialized audio displays are now emerging.

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KEYW WORDS: Spatialized Audio; Auditory Display; Human Computer Interface; Sensor Management; Virtual Reality

N99T010 TITLE: Multivariate Manpower, Personnel and Training (MPT) Modeling and Management System

OBJECTIVE: Increase substantially the payoff from Naval personnel assignments and re-assignments by increasing the ability to trade off from among the many variables that are considered today in isolation. These include aptitude, personality characteristics, interests, career-tendencies, medical characteristics, anthropometrics, training (regimen) sensitivity, etc.

DESCRIPTION: The performer will develop a large-scale system capable of accessing, modeling, and organizing multiple, cross-discipline variables that will improve the predictability of successful recruiting, training, assigning, and fielding Navy and Marine Corps personnel. The performer will identify the appropriate variables, model and analyze the multivariate interaction, and develop a tool capable of performing trade-off analyses.

PHASE I: The contractor will identify the variables that interact multivariately in predicting down-stream trainability, performance, re-enlistment likelihood in ten or fewer Navy or Marine Corps ratings to be selected by the contractor; and produce a working model in software.

PHASE II: The contractor will validate the model's kernel, and scale the model in order to include more ratings, and to identify opportunities for trades (e.g., visual acuity and leadership qualities).

PHASE III: The contractor will scale to all ratings; build, transition, and support a production-quality model/simulation system, with user-friendly query interfaces, which will automatically seek (e.g., via software agents) and download relevant data that will internally increase the model's validity over time.

COMMERCIAL POTENTIAL: Industry, particularly large corporations, will benefit from the technology by applying the variable trade-off methodology and algorithms to corporate assignment programs. Corporations, furthermore, have great potential to add incentive variables, which presumably provide an interaction with personality, medical, etc. variables identified. The technology should provide millions of dollars in savings for assignments not only to job categories, but also, assignments to work schedules, teams, training regimens etc.

KEY WORDS: Manpower, personnel, training, medical, tradeoffs, assignment.

N99T011 TITLE: Measurement System for Navy Mission-Related Performance in Extreme Environments

OBJECTIVE: The objective of this project is to develop a new state-of-the-art performance measurement system technology for the assessment of Navy-relevant cognitive performance in extreme and stressful Naval operational environments.

DESCRIPTION: Extreme environmental stress can have significant impact on Naval personnel during the conduct of their missions. In order to evaluate the impact of operational environmental stress, such as thermal and physical stress, on mission-related performance in a quantifiable fashion and to develop countermeasures to minimize the effects of such stress, it is important to develop standardized measures of mission-related performance. Standardized performance measures enable changes in performance to be accurately and reproducibly quantified and can lead to significant enhancement in the applicability and usefulness of future biomedical research.

Existing measures of cognitive mission-related performance currently used in military medicine programs are based on older testing and computer technology that has become significantly outdated. The advent of advanced computer technology has provided the opportunity for the development of newer tests for the assessment of cognitive performance that can be implemented in a standardized manner on portable computers for use in both medical laboratory and field settings. The development of a standardized performance measurement system should be directed at assessment of Naval personnel in extreme environmental conditions but should also have conceptual wide applicability to a range of standardized assessment capability of stress-related modulation of performance in the government agency, industry, and business workplace.

PHASE I: Based on existing biomedical literature and current military cognitive performance assessment systems used in military medicine programs develop a conceptual structure that allows selection of appropriate measures to assess the impact of extreme environments on Navy-relevant cognitive performance. Selection of cognitive measures must be based on a thorough scientific understanding of critical performance abilities required in a range of Naval operations. Measures must be able to be implemented on portable computers and be capable of use in a wide variety of harsh or stressful environmental conditions. As operational considerations dictate that such implemented measures in field conditions take no more than twenty minutes of an operator's time, the measurement system requires a precise integration of a constellation of cognitive performance tests within a limited time window.

PHASE II: Construct a working implementation of the cognitive performance assessment system on portable computers. Full utilization of state-of-the-art computer graphics and visual representation must be employed. System must be user-friendly, self-contained, capable of self-instruction, capable of automatically recording all data, and readily portable.

PHASE III: There is a high potential for dual commercial use of up-to-date cognitive performance assessment technologies in other government agencies and industry where maintenance of optimal levels of performance and safety are of paramount importance. This Phase would focus on engineering of the measurement system to be more universal for utilization in a wide range of occupational and environmental conditions.

COMMERCIAL POTENTIAL: Increasing emphasis on the maintenance of quality and safe performance of individuals in the workplace indicates extended requirements for the proposed technology relating to standardized methods of objectively quantifying such performance. Existing and potential interest is in workplace performance as it may be impacted by a wide range of medically-related industrial and commercial concerns such as prescription medication use side effects, alcohol and illicit drug effects, illness states, thermal conditions, workplace interrelationships, and worker fatigue.

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KEY WORDS: Performance, cognitive, stress, performance assessment, mission-related performance, computers