NATIONAL IMAGERY AND MAPPING AGENCY

SUBMISSION OF PROPOSALS

The mission of the National Imagery and Mapping Agency (NIMA) is to provide timely, relevant, and accurate imagery, imagery intelligence, and geospatial information in support of national security objectives. Therefore, NIMA pursues research which will help it guarantee the information edge over its potential adversaries. Potential proposers unfamiliar with NIMA can find more information about it on NIMA's home page at http://www.nima.mil.

NIMA has developed three topics to which small businesses may respond in the fiscal year 2000 SBIR Phase I iteration. These three topics are described on the following pages. NIMA will accept only unclassified proposals on its topics.

Proposers shall mail or hand-carry three copies of each proposal to the NIMA SBIR Contracting Officer (CO), Mr. Quan Tran. His mailing address is as follows:

NIMA
4600 Sangamore Rd.
Bethesda, MD 20816-5003

Mail Stop D-88
Attn: Mr. Quan Tran

To hand-carry the documents, proposers shall contact the CO to arrange a pick-up time. In addition to the address above, the CO may be contacted as follows:

Telephone: (301) 227-7822
Fax: (301) 227-2306
E-Mail: tranq@nima.mil

Proposers are encouraged, but not required, to also submit their proposal on a Zip disk in HTML 3.2 format with the root file called "index.htm". All other proposal files, if any, on the disk must be accessible through hyperlinks from the "index.htm" file.

Proposal submission questions shall be addressed to the CO, Mr. Quan Tran. All other questions shall be directed to the NIMA SBIR Program Manager, Dr. Kathleen Morrish. She may be reached as follows:

NIMA
12310 Sunrise Valley Dr.
Reston, VA 20191-3449

Mail Stop P53
Attn: Dr. Kathleen Morrish

Telephone: (703) 262-4557
Fax: (703) 262-4588
E-Mail: morrishk@nima.mil

Each NIMA Phase I contract will have a base period of performance of six months, with an option of an additional three months. The price of each proposal shall not exceed a total of $100,000, with $70,000 allotted to the base proposal and $30,000 to the option. The option shall be included with the base proposal at the time of submission. The base proposal plus option shall be prepared single spaced in 12 point Times New Roman font, with at least a one inch margin on top, bottom, and sides, on 8 ½" by 11" paper. The pages shall be numbered. The base proposal plus option shall not exceed 25 pages. Exercise of the option will be at the sole discretion of NIMA.

NATIONAL IMAGERY AND MAPPING AGENCY
SBIR 00.1 TOPIC DESCRIPTIONS

NIMA 00-001 TOPIC: Evaluating the Ability of Commercial Sensors to Satisfy Tactical Level, Geospatial Data Requirements in the Littoral Zone

KEY TECHNOLOGY AREAS: Sensors, Electronics, and Battlespace Environments; Information Systems

OBJECTIVE: Determine the extent to which tactical level geospatial data from emerging commercial remote sensing systems can improve the recognition, interpretation, and data quality of features and attributes in the littoral zone that are critical to U.S. Navy and Marine Corps amphibious assault plans and operations.

DESCRIPTION: The Navy and Marine Corps require remotely sensed, mission-specific, geospatial data in support of their Littoral Warfare program. Emerging sensor technologies appear to have the potential to deliver this data. NIMA seeks an empirical assessment of the ability of selected commercial sensors and image processing procedures to identify and characterize required mission-specific features and attributes. It is expected that data from multiple sources will be needed to satisfy the off-shore and on-shore collection and data quality requirements of this program. In order to evaluate the adequacy of this data, a testbed representing ground truth should be established using sensors and procedures of known fidelity. These would include side-scan sonar, echosounding, seabed metric videography, topography, topographic laser ranging, multispectral and hyperspectral optical sensing - actual or simulated - and advanced software to classify, fuse, and deliver preprocessed geospatial data to an off-the-shelf Geographic Information System (GIS). It is recognized that the choice of sensors for testbed construction ("reference data set") will not be identical to those selected for comparative evaluation ("experimental data set").

PHASE I: Conduct an interpretative examination of the state-of-the-art in hydrographic and topographic remote sensing and data fusion in the littoral zone. Develop an operational concept including a comprehensive design and methodology to demonstrate and evaluate the prospective value of commercial sensors in support of the Littoral Warfare Data (LWD) program.

PHASE II: Develop, in a naturally diverse coastal study area, a testbed representing ground truth ("reference data set"), and an "experimental data base" from a minimum required set of commercial sensors. Support the methods to be used to compare the data quality of the "experimental" with that of the "reference" database. Demonstrate a prototype system using Navy and Marine Corps mission-specific specifications as the standard.

PHASE III DUAL USE APPLICATIONS: In addition to the military application discussed above, there is a large and expanding demand in state and federal regulatory agencies, and in industry, for improved techniques of multi-source data collection in the coastal zone. This is true, for example, of NOAA's responsibility to upgrade and maintain U.S. nautical charts; the Bureau of Commercial Fisheries' requirement to conduct intensive fish habitat monitoring in littoral waters; and the Corps of Engineers' need to maintain detailed data bases, on and off shore, in support of environmental impact studies for pipeline routes, dredging operations, and the like.

NIMA 00-002 TOPIC: Intelligent Software Agents in Distributed Information Environments

KEY TECHNOLOGY AREAS: Information Systems

OBJECTIVE: Develop intelligent software agents tailored for imagery and geospatial analysis.

DESCRIPTION: The Intelligence Community is an information-rich domain with a growing number of tools available to help imagery and geospatial analysts extract information for the policy makers, the decision makers, and the commanders in the field. Information today is growing in volume, is more complex and varied than in the past, comes in multimedia formats, and is distributed. Tools that exist today to assist in the analysis of this data tend to be time-consuming and cumbersome to use. NIMA would like to apply intelligent agent technology to address this problem. Intelligent software agents must "understand" the intelligence problems the analyst is addressing, what information can/should be brought to bear on the problems, locate and process information on behalf of the analyst, and provide insight and recommendations to the analyst.

PHASE I: Investigate intelligent software agent technologies. Identify existing technologies and propose new technologies that show the most promise for use by imagery and geospatial analysts.

PHASE II: Develop and demonstrate prototype tools that implement the technologies identified in Phase I. Assess their usefulness.

PHASE III DUAL USE APPLICATIONS: In addition to military applications, the technologies described above can be used for civilian mapping, charting, and geodesy functions. They also pertain to medical applications, such as medical diagnosis from large amounts of multimedia data.

NIMA 00-003 TOPIC: Innovative Database Design and Methodology for Reasoing about Imagery, Geospatial Information, and Related Information

KEY TECHNOLOGY AREAS: Information Systems; Human Systems

OBJECTIVE: Develop a database design that efficiently handles geolocation in time and all three spatial dimensions, and also naturally represents objects and their properties and relationships on, above, and below the earth's surface. Develop methodologies for reasoning about the information in this database in conjunction with other sources of data (e.g., imagery, text information, and metadata, in separate files or other databases).

DESCRIPTION: Databases used today for geophysical data storage are adapted to function well with static, two-dimensional positional data. It is necessary to resort to methods such as tables to represent the vertical dimension and the non-geopositional aspects of objects located on, above, or below the earth's surface, and time is not usually considered. Further, methodologies to reason about the data in these databases are limited in their ability to consider diverse sources of data.

NIMA seeks an innovative database design that recognizes the earth's surface as a truly three-dimensional object which may intersect a normal to the geoid at multiple locations, due to natural structures such as cliff overhangs. In addition, the database should handle in an efficient manner the objects which exist on, above, and below the earth's surface. These objects may be very stable overall, like rock strata. They may be relatively stable, like buildings. They may be semi-stable, like trees, or periodic, like snow or crops. And they may be transitory, like a train on a track. Further, the objects may be associated with complex data, such as information on the type of crop in a field: its need for rainfall, susceptibility to insect infestation, etc. The data may be in any computer-storable form: text, tables, raster and vector imagery, etc. The location and properties of objects and points on, above, and below the earth's surface may be associated with measures of error. The objects may have elaborate internal structures that need to be represented in the database, like the inside of an important building. And the objects may interrelate. In addition, the objects and the earth itself can change with time, on time scales that are very short (destruction of a building by a bomb) or very long (decay of a mountain due to erosion).

The database must be associated with a front end that allows the user to input, update, maintain, and use the information in a natural fashion in near real time. It should be constructed so that it has no inherent, non-physical limitations in terms of the number of associations between its data elements. It should also have no inherent, non-physical limitations on the number of links to other sources of data that support it. And it needs to incorporate capabilities for verification and validation of data content and relationships in the context of its own data.

Finally, NIMA seeks innovative ways to identify, locate, access, filter, fuse, reason about, and present information derived from the data in this database and other linked data sources in response to users' queries. The database should be designed to facilitate automated reasoning. The user should have the ability to request a trace of from where the information came for each successful query. The information presented as a result of the query should include an error analysis about the result. For instance, if a street address is desired, the methodology could return one or more addresses and an estimated probability that the addresses are correct. If a geographic location is needed, the methodology could return coordinates in an appropriate coordinate space and the error associated with the coordinates. In both cases, images of the locations or other pertinent information could also be presented. If significant inconsistencies appear in the data, the methodology should flag them so the user has a chance to resolve them. And the database should have a natural, user-friendly human-computer interface that makes it easy both to present queries and to receive and use the results of queries. A virtual reality type of interface is envisioned.

PHASE I: Investigate database designs and human-machine interface designs to efficiently handle geolocation in time and all three spatial dimensions, efficiently handle related non-geospatial data, and also naturally represent objects on, above, and below the earth's surface and their properties and relationships. Identify those database designs and human-machine interface designs which show the most promise in terms of system performance, ease of population, ease of change, ease of maintenance, and ease of use. Also, investigate methodologies to identify, locate, access, filter, fuse, reason about, and present information in response to queries on the data in this database and other data sources. Identify those methodologies which show the most promise in terms of accuracy, efficiency, and utility.

PHASE II: Develop and demonstrate a prototype database and human-machine interface that implements the best designs identified in Phase I. Assess its usefulness in terms of system performance, ease of population, ease of change, ease of maintenance, and ease of use. Also, develop and demonstrate a prototype reasoning capability that implements the methodologies identified in Phase I. Assess its usefulness in terms of accuracy, efficiency, and utility.

PHASE III DUAL USE APPLICATIONS: In addition to military applications, the techniques described above are necessary to revolutionize civilian imaging, mapping, charting, and geodesy functions. They will move them from today's static, separate, two-dimensional forms to an intelligent, fused, virtual reality system that provides the user with whatever information is desired about a place or object. There is also medical application, where image data (e.g., X-ray, MRI), textual medical history data, and even information about where a person lives can be combined to identify and describe normal and abnormal structures imaged in a patient for pretreatment investigation, post-treatment comparison, and storage in medical records.