



*National
Technology
Alliance*

Rosettex
NTA Project Portfolio
Final Edition - September 2009



Prepared for the National Technology Alliance
by the Rosettex Technology & Ventures Group

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Rosettex NTA Project Portfolio

Final Edition - September 2009

Preface

This document provides a brief summary of the Rosettex portfolio of administered technical projects of the National Technology Alliance (NTA) Program. The document summarizes the role of the Rosettex Technology & Ventures Group, describes the technology areas and challenges of the Program, and provides a summary of the projects for each technology area. Interested parties are encouraged to contact the Program representatives below for more information on projects of interest. As the final edition of the document, it represents the comprehensive summary of the Rosettex NTA Program.

Mr. Mark J. Reardon, NGA Program Manager for the NTA
Phone: 703.735.2758 Fax: 703.735.2799 Email: mark.j.reardon@nga.mil

Mr. David J. Scott, Chief Operations Officer, Rosettex Technology & Ventures Group
Phone: 703.310.1254 Fax: 703.310.1251 Email: dscott@rosettex.com

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APPROVED FOR PUBLIC RELEASE

This document has been approved for public release by the National Geospatial-Intelligence Agency, case number 09-456, on September 21, 2009.

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The Rosettex Technology and Ventures Group



In 2002, the trend toward commercial leadership in information and applications technology, microelectronics, and other important technology areas had accelerated rapidly. The emphasis on reducing mission-critical technology “time-to-market” intensified the need for broader and deeper access for the Defense Research and Development (R&D) Community into our nation’s commercial technology base. In contrast, the organizations that historically provided advancements and new technologies to the Intelligence and Defense Communities consolidated significantly. The primary focus of the fewer conglomerates that remained was the application of military-specific technology, and, to a much lesser extent, commercial technology to military systems.

As the defense supply base for this technology shrank and the Intelligence Community (IC) experienced greater budget pressures, it became increasingly important to improve the ability and incentive for commercial companies to support the IC. Understanding this problem, Government executives made the case for greater exploitation of commercial technologies, processes, and products to ensure that their limited R&D resources yielded maximum mission impact and return on investment. They challenged the IC to find ways to more aggressively leverage and exploit the very best technologies emerging from the commercial marketplace at affordable prices.

The National Technology Alliance (NTA) was an IC initiative that provided Government clients with this kind of access to commercial industry. The NTA was established in 1987 to foster relationships with critical commercial technology sectors, reduce the barriers that inhibit commercial firms from working directly with the Government, and motivate them to address IC problems by considering community needs in new product development. The NTA identified solutions to critical national technology challenges where the cost of development could be shared with the larger commercial marketplace. The NTA had a 20-year history of money-saving accomplishments through partnerships with industry and academic institutions. The National Geospatial-Intelligence Agency (NGA) was the Executive Agent for the NTA Program, chartered to execute the program on behalf of the IC, Department of Defense (DoD), and other Government agencies.

In February 2002, NGA awarded a procurement agreement to the Rosettex Technology & Ventures Group, a joint venture formed by Sarnoff Corporation (Princeton, NJ) and SRI International (Menlo Park, CA) to address user technology needs in Geospatial Intelligence (GI), Information Processing, Analysis and Management (IPAM), and Digital Technology Infrastructure (DTI). Rosettex assembled a team of over 80 leading research universities, institutes, laboratories, and commercial companies, with facilities in 34 states, to support the NTA.

The goal of projects executed by the NTA was to identify optimum solutions to Government technology challenges by directly engaging commercial industry. The NTA offered its Government clients access to the Rosettex business model with all the elements required to make this happen, namely: a contract mechanism designed for rapid procurement actions, an organizational structure designed to streamline management, a team with clearly defined roles to exploit their expertise, and an experienced management team ready and able to work in close cooperation with its Government clients and industry partners to facilitate access to best-of-class resources and provide independent project oversight. By design, the NTA encouraged cross-department and cross-agency cooperation. The NTA, through Rosettex, offered a unique approach to R&D encompassing two discrete processes:

- The first, Independent Assessment and Evaluation (IA&E), analyzed users’ needs and identified the best solutions to meet those needs. NTA partner companies, experts on the organization, missions, operations, and requirements of the communities they served, identified needs and provided the essential analysis and outreach to Government users of information technology. Other technology and market assessment experts compared potential solutions to the identified needs, and proposed best-of-class solutions and suppliers. The independence of the user needs and technology experts ensured that competitive business pressures had reduced influence on recommended program decisions. These partners did not participate in product design or development, or in systems integration, except in rare cases involving exquisite technology areas.

- The second process encompassed prototyping, product development, commercialization, technology insertion, and systems integration. Teammates that conducted these processes were separated from the needs and solutions identification process by a procedural conflict of interest firewall. This ensured that natural bias for one's own products or business sales pressures did not affect a best-of-class decision.

For the twenty-two years of its existence, the NTA had a rich history of solving user needs across organizational boundaries and was in a unique position to offer its clients rapid access to advanced technology resources - both in academia and industry - to address mission-critical technology development needs. Rosettex offered a trusted resource with an innovative business model to tackle difficult and complex problems, make breakthrough advances, and transition revolutionary solutions to a broad spectrum of technology needs. The portfolio presented in the following pages illustrates the NTA's completed activities and projects commissioned under its agreement with Rosettex from February 19, 2002 to September 30, 2009.

Independent Assessment & Evaluation (IA&E) Activities

The Rosettex NTA IA&E program area focused on the following activities:

- Evaluate and assess the state of commercial technologies relevant to technology areas applicable to Defense, Intelligence, and other Government agencies
- Develop an understanding of emerging commercial technologies relevant to the technology areas
- Assess Government users' technology needs specific to current and future mission requirements
- Analyze shortfalls in the ability of commercial technology to meet users' needs
- Develop technology transfer roadmaps and recommendations to address technology shortfalls
- Develop written reports on technology trends and technology forecasting relevant to the NTA technology areas (GI, IPAM and DTI)

The activities described in this section supported broad-based assessments of user needs and potential technology intended to provide overviews for program direction and planning. IA&E Activities for specific technology areas and technical challenges are described in later sections of this document.



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General IA&E Studies and Assessments

Emerging Technology Trends and Forecast Analysis

Rosettex Partner: Gartner
Sponsoring Agency: NGA



The Technology Trends and Forecasts (TT&F) Report presented an annual analysis of commercial technology trends and developments that may have Government or dual-use application. The effort included publication of specialized TT&F reports directed through technology candidate surveys that solicited areas of interest from NTA stakeholders. *This activity was completed in May 2005.*

Opportunities to Leverage Technologies from the War on Terrorism

Rosettex Partner: Ashland Institute for Strategic Studies
Sponsoring Agency: NGA

Ashland Institute

This IA&E study presented opportunities for improved use of technology for furthering US goals and objectives based on lessons learned from the war on terrorism, Afghanistan, Iraq, and experiences with homeland security. Using their network of industry relationships and access to research and development in the commercial and Government sectors, Ashland Institute developed and delivered a technology roadmap based on sound and verified information sources and analysis. Technology opportunities identified in the roadmap were vetted and prioritized; potential solution strategies were detailed and used as input into NTA program development planning. The principal investigators for this effort are now part of Vortex, Inc. *This activity was completed in October 2004.*

Telemedicine and Advanced Technology Research Center (TATRC) Needs Development and Assessment Studies

Rosettex Partner: Accella Learning, LLC
Sponsoring Agency: NGA



This NTA study provided TATRC with advanced technology assessments across the set of mutually defined user needs in support of their primary missions. It provided TATRC West with design consultation and planning expertise to support integration of advanced healthcare and entertainment technology into mission support systems. *This activity was completed in August 2005.*

Overseas Forces Needs Assessment and Development Studies

Rosettex Partner: Sullivan-Haave, Kentia, RL Camisa Consulting
Sponsoring Agency: NGA

Sullivan-Haave
RLCamisa Consulting, LLC
Kentia Management Group

Special Overseas Forces Technology Elements - National (SOFTEN) continually evaluates technologies with potential for rapid deployment to meet critical needs of overseas forces. Rosettex supplemented SOFTEN capability for performing specialized technology assessments in the areas of wireless communication solutions, energy propagation for communication and other purposes, information technologies, C4ISR, and technology performance and suitability for specific operational scenarios. Initial SOFTEN components included the IED Task Force and the Army Rapid Equipping Force. *This activity was completed in April 2005.*

In-Theater User Needs Identification

Rosettex Partner: Sullivan-Haave
Sponsoring Agency: NGA

Sullivan-Haave

In support of Operation Iraqi Freedom, senior level military consultants were employed to collect and document operational user needs. As a preliminary study, the consultants interviewed active, deploying, and returning personnel to gain and document knowledge and experiences critical to deriving technology needs for the Global War on Terrorism. *This activity was completed in December 2005.*

An Examination of Military Critical Technologies in the Global Environment

Rosettex Partner: Vortex, Inc.

Sponsoring Agency: Office of the Deputy Undersecretary of Defense for
International Technology Security



As the foundational element that informs both our nation's international military cooperation programs and export control regimes, the Military Critical Technology Program (MCTP) is an important document for shaping the global science and technology strategies of the Department of Defense. The MCTP currently contains 20 broad technology categories and is published every 1-3 years. The document is developed by 20 Technical Working Groups, each including a dozen subject matter experts. Since the MCTP definitions and the benchmark of militarily critical technologies were created, the information revolution has gathered pace and change continues at an exponential rate. The international environment and globalization have likewise changed and accelerated. Therefore, new definitions are needed to allow the United States to better identify and protect vital military technologies. This study: (1) examined the parameters that may impact on new definitions for militarily critical technologies, (2) suggested what some of those definitions should be, and (3) prepared a set of adaptive rules and algorithms based on the definitions that led to the creation of a priority list of militarily critical technologies. *This project was completed in July 2007.*

The Impact of Disruptive Technology on the IC

Rosettex Partner: XPLANE Corporation

Sponsoring Agency: Office of the Director of National Intelligence (DNI), Science
and Technology Directorate



The ability to describe and depict the future threat environment in which the IC will have to operate is critical to building consensus and innovative solutions. To accomplish this the IC must understand the historical context of technological change and how disruptive technology plays a pivotal role in the process. The goal of this IA&E effort was to conduct a quick turnaround user survey and technology assessment, and document findings regarding the past, present, and potential future impacts of disruptive technology on IC-wide transformation in a visual context to encourage use in executive decision-making processes. Questions addressed include the Strategic Context (how did we get here and how were we able to successfully adapt to global changes of the past), the Vision (where do we want to go), and the Process (how can we get to where we need to be). *This project was completed in September 2008.*

Information Assurance Technology Assessment

Rosettex Partner: Sarnoff, SRI

Sponsoring Agency: Special Operations Command (SOCOM)



A critical problem in joint warfighting operations is the inability of warfighters to communicate, access, share and control information across a full spectrum of DoD networks operating at various security levels. One potential solution proposed to SOCOM by InfoAssure® was the GateKeeper® hypervisor package. Sarnoff and SRI together evaluated this solution against a set of operational requirements. This activity consisted of a gap analysis and a comparative study of GateKeeper to other existing malware intercept and protection tools. The study ranked the capabilities required to support the Government's mission and offered appropriate recommendations. *This project was completed in June 2009.*

Geospatial Intelligence (GI) Projects

The focus of NTA GI initiatives was to discover, initiate, or accelerate the development of commercial technologies and applications for Imagery and Motion Imagery Processing and Analysis, Geographic Information Systems (GIS), and Cartography that facilitate a more effective and timely image and geospatial data analysis, production, and presentation. GI technical challenges included:

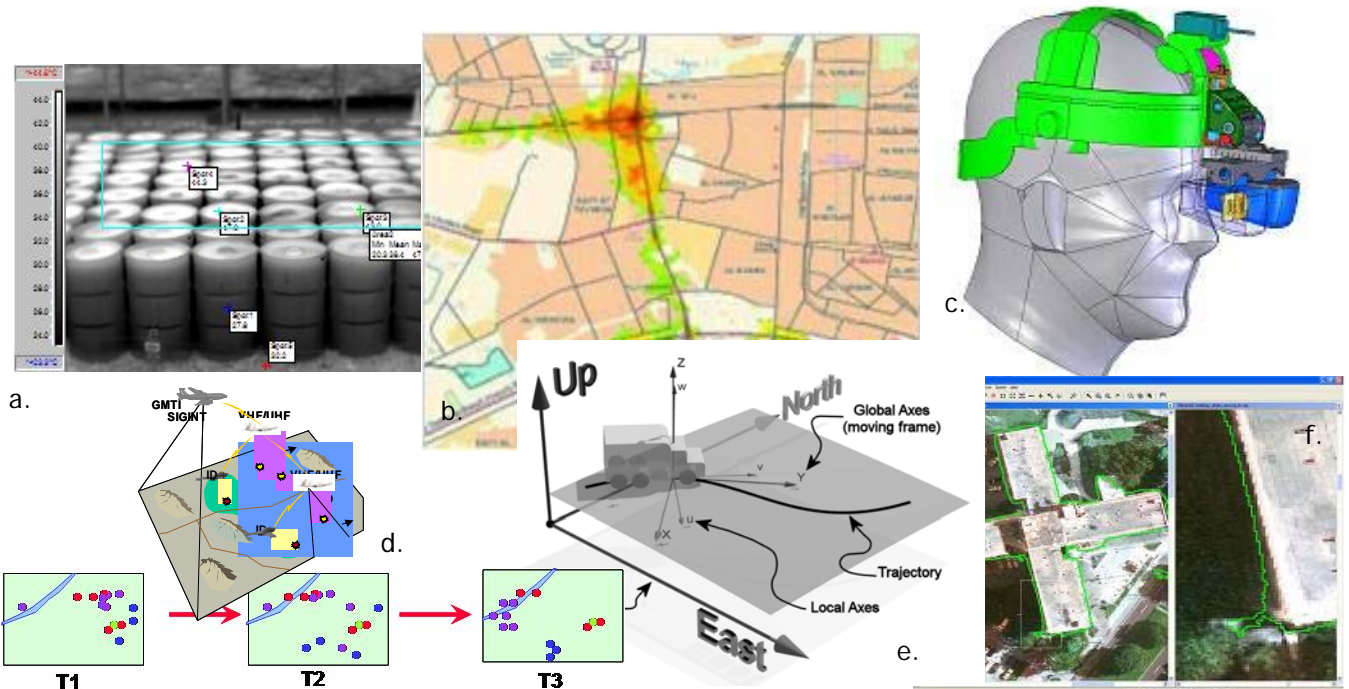
Temporal Geospatial Information Exploitation - Provide and leverage emerging temporal technology for efficient and economical improvements in geospatial intelligence for producers and users. Encourage development of software tools and data models to provide more robust and detailed temporal data for use by geospatial analysts to more efficiently and accurately generate dynamic decision analysis to meet customer needs.

Conflation Tools Development - Provide and leverage emerging conflation technology for efficient and economical improvements in GI for producers and users. Software tools will be developed and deployed to help automate the conflation process and thereby increase efficiency and improve productivity.

Decision Aids for Geospatial Intelligence - Develop tools, techniques and methodologies for analysis and representation of geospatial and related intelligence data. The development of dynamic software tools will significantly improve the battlefield commander's ability to more accurately and efficiently plan and execute on the modern battlefield.

Smart Geospatial Intelligence - Empower users to perform timely, accurate, and precise feature extraction and change detection via multi-modal data sources. The NTA conducts and manages certain projects initiated and funded by NGA technology and acquisition organizations, which provide the specific requirements, direction, and financial support for the programs. Involvement in these activities provides the NTA insight and involvement into technology needs, issues, and solutions of the Intelligence Community at large and is mandated in the NTA Charter.

Multimodal Data Extraction Technology - Create and implement software, techniques, and methodologies to automate/semi-automate the ability of geospatial analysts to rapidly and accurately extract and attribute geospatial intelligence from new and/or multi-imagery sources to meet the requirements for military operations and homeland security applications.



Sources: a. Northrop Grumman Corp., b. Environmental Criminology Research Institute, c. Impact Science Corp., d., e. Swiftsure Spatial Systems, f. Leica Geosystems, Inc.

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Temporal Geospatial Information Exploitation

Temporal Geospatial Data Management and Exploitation Needs



Rosettex Partner: Swiftsure Spatial Systems
Sponsoring Agency: NGA

This IA&E study defined a next generation, temporal geospatial data management and exploitation product, and a roadmap to meet DoD and IC needs to manage and exploit datasets with temporal attribution for specific user requirements. The effort expanded to include the civil community's (e.g., Federal Emergency Management [FEMA], the Department of Homeland Security [DHS]) critical needs. The resulting report described the community needs, the tools, techniques, and products available in the commercial market and academic research environment to meet these needs, as well as the technology gaps that must be addressed via NTA investment. *This project was completed in September 2004.*

Temporal Geospatial Conceptual Schema for ISO TC211



Rosettex Partners: Swiftsure Spatial Systems
Sponsoring Agency: NGA

Swiftsure Spatial Systems developed conceptual schemata for spatiotemporal object types and their spatiotemporal relationships for NGA to submit to ISO TC211 for comment and adoption. The conceptual schemata described models of data structures and provided the basis for technical specifications, commercial products and further standards development for the international geosciences community. *This project was completed in April 2006.*

Accelerating Commercial Development of a Temporal Geospatial Capability



Rosettex Partner: Swiftsure Spatial Systems
Sponsoring Agency: NGA

Swiftsure Spatial Systems provided technology assessment support for commercial development of temporal geospatial capabilities by designing an architectural infrastructure to permit applications to move from the laboratory to operational use with minimal disruption. This IA&E activity developed a framework for improved management and exploitation of time-varying geospatial information in the US Government. *This activity was completed in November 2005.*

Temporal Evaluation and Assessment (TEA)



Rosettex Partner: Northrop Grumman Information Technology
Sponsoring Agency: NGA

The TEA project paved the way for improved management and exploitation of time-varying geospatial information in the US government. TEA supported prototyping and architecture validation to test components and interfaces for a spatiotemporal capability and familiarizes operational users with the possibilities of using the time-varying elements of geospatial information in their analysis. The resulting environment was made available for continued use in prototyping, software evaluation, integration, and testing of leading edge software tools for specific use cases based on IC and US Forces requirements related to the collection, management and exploitation of time varying information. *This activity was completed in August 2006.*

Exploitation of Multi-Temporal Multi-Source Intelligence



Rosettex Partner: Swiftsure
Sponsoring Agency: NGA

Under this IA&E activity Swiftsure assisted NGA in accelerating commercial development of temporal geospatial infrastructure capabilities being undertaken by Rosettex and its partner Northrop Grumman/TASC. The study objectives were to attract and develop partnerships with key users and stakeholders for demonstrations of the temporal tools, demonstrate applications to show the rapid movement of technology from the laboratory to operations with minimal disruption, and provide a persistent framework for delivering improved exploitation of time-varying geospatial multi-source intelligence in the US Government. *This activity was completed in July 2006.*

Conflation Tools Development

Geospatial Conflation Tools Development

Rosettex Partners: Swiftsure Spatial Systems, USM

Sponsoring Agency: NGA



Swiftsure
Spatial Systems Inc

The Geospatial Conflation Tools Development project addressed the requirement to: (1) define a conflation product and an investment plan to meet NGA needs to manage multiple datasets, and (2) determine the tools required to generate the best geospatial data based upon specific user requirements. A needs assessment was performed with a dual focus: (1) core conflation algorithms and techniques, and (2) system and interoperability requirements to ensure that the conflation functionality could be staged effectively with open interfaces to data sources. In addition, commercial products and research capabilities were surveyed to create an inventory of existing capabilities. The results were published in a report that described the needs assessment, market survey, product requirements definition, and investment plan. *This project was completed in March 2003.*

Technology Assessment and User Needs Support to NTA Conflation Activities

Rosettex Partner: Swiftsure Spatial Systems

Sponsoring Agency: NGA

Swiftsure
Spatial Systems Inc

In 2003, the NTA completed a geospatial data conflation tools study that identified and assessed NGA's supply-side or data producer conflation requirements, commercial conflation capabilities, near-term conflation tool opportunities, needs for development of end-user, consumer or demand-side conflation requirements, and development of a conflation roadmap. As a follow-on to that study, the NTA conducted a study to identify demand-side conflation requirements, supported NGA test and evaluation of several conflation tools, and began a spiral development of conflation tools based on the developed roadmap. This IA&E study supported all three of these efforts by identifying product-independent, demand-side conflation requirements, providing unbiased technical support to NGA's Test and Evaluation of existing conflation tools, and providing independent subject matter expert support to the NTA's conflation tool development. *This activity was completed in February 2005.*

Conflation for Feature Level Database (FLDB)

Rosettex Partner: Intergraph

Sponsoring Agency: NGA

INTERGRAPH
Mapping and Geospatial Solutions

The development of prototype conflation tools for use in NGA's immediate and future architecture has helped automate the conflation process, thereby increasing geospatial intelligence data production efficiency and productivity. This project implemented Intergraph Corporation's developmental conflation technology and included the following activities: (1) deployed existing Intergraph conflation and data management tools into NGA's Geospatial Intelligence Applications Testbed (GIAT) laboratories for evaluation, (2) enhanced, matured, and extended Intergraph's existing Feature Linking and Best Map capabilities, (3) deployed the updated tools into NGA's GIAT laboratories, and (4) made recommendations to address NGA's long-term conflation needs. *This project was completed in August 2004.*

Automated Edge Matching

Rosettex Partner: Intergraph

Sponsoring Agency: NGA

INTERGRAPH
Mapping and Geospatial Solutions

Intergraph developed the initial tools to help NGA address conflation of vector data to produce integrated databases and datasets under the completed NTA Conflation for Feature Level Database (FLDB). This project augmented the initial capabilities with software to consistently match the edges of adjoining datasets. The tools developed under this program will be included in future releases of Intergraph's mapping and image processing product suites. *This project was completed in April 2006.*

Conflation Research Hub (CRH)

Rosettex Partners: ImageLinks
Sponsoring Agency: NGA



NGA's near-term geospatial intelligence analysis and production requirements include conflation of vector datasets of varying resolution and accuracy to produce integrated databases usable for intelligence purposes. The development of software to conflate datasets for NGA can be encouraged by making the CRH available for use by software developers. ImageLinks (now part of Radiant Blue Technologies) worked with the Open Source Software Institute (OSSI) to standup the initial CRH. The goal of the CRH was to stimulate the enhancement, extension, and maturation of conflation technologies using an open source approach. The objectives of this project were to: (1) establish a CRH web site, (2) contract with the OSSI and initial open source software developers of conflation technology to establish initial conflation infrastructure and technology on the CRH, (3) coordinate and develop a Phase 2 plan to bring in additional participants, contributors, and funding mechanisms to expand conflation capabilities, and (4) make recommendations for addressing NGA's long-term conflation needs via open source software. *This project was completed in February 2004.*

Decision Aids for Geospatial Intelligence

Populations at Risk User Requirements Definition and Demonstration

Rosettex Partner: Swiftsure Spatial Systems
Sponsoring Agency: NGA



The purpose of this IA&E activity was to define and demonstrate functional management, processing, and visualization requirements to strengthen the capability of US Government agencies to more accurately estimate and make effective use of sub-national population information, particularly for areas at potential risk throughout the world. This activity was coordinated with the Humanitarian Information Unit of the US Department of State, and was a critical element of a National Research Council (NRC) study funded by the Department of State, DIA, CIA, and NASA. The NRC study focused on improving demographic data, methods, and tools to better identify at-risk groups susceptible to natural and man-made disasters, and to improve the decision making process on humanitarian intervention, disaster relief, and development assistance. *This project was completed in December 2005.*

Geographic Profiling for Military Applications

Rosettex Partner: Swiftsure, ECRI
Sponsoring Agency: NGA



Geographic Profiling is a tool used by police to investigate and solve serial crimes. Through specialized, sophisticated analyses of geographic patterns of similar crime activities, criminals may inadvertently reveal their home base neighborhoods and locations. Geographic profiling has potential applications in the military and IC for locating the bases of perpetrators of covert attacks. This study developed geographic profiling procedures for these military and IC applications. Using a core group of domain experts to guide the effort and assess its effectiveness, the study defined a suite of key objectives for the military and IC use of geographic profiling, and extended an existing commercial software system to meet the objectives. *This project was completed in October 2005.*

GeoINT Service and Product Delivery Strategic Vision

Rosettex Partner: PRTM Management Consultants LLC
Sponsoring Agency: NGA



This IA&E study provided technology assessment and subject matter expertise to support the NGA executive team efforts to develop a strategic vision and business plan for the implementation of web services, technologies, and associated processes that make NGA products and services available via a web-enabled, service-oriented architecture to support evolving customer demand and national strategies. *This project was completed in February 2006.*

Submarine Tracking Analysis

Rosettex Partner: Peterson Technology, LLC, Digital Harbor
Sponsoring Agency: NGA



This IA&E activity defined a next-generation technical capability with the potential to improve submarine tracking and targeting. The goals of the effort were to: (1) document a series of tradecraft processes to assist analysts in refining domain methodology, (2) document a Tradecraft Ontology that models the domain, including processes, rules, events, and patterns, (3) offer tradecraft management a run-time exposure of these processes to measure and quantify the success and patterns of the tradecraft, (4) evaluate the operational efficacy of next-generation user interfaces to allow the analysts to exploit the ontology, and (5) assess the utility of allowing users to query the ontology for informational relationships that may have been previously unknown or challenging to determine. *This project was completed in March 2005.*

Multiple Visualization Analysis

Rosettex Partner: Peterson Technology, LLC, Digital Harbor,
Sponsoring Agency: NGA



Most multiple analytic visualization tools today require data migration between tools and juggling of multiple applications to visualize data such as network topography, perform selection and filtering, and use logical and physical network templates. This project examined the visualization aspects and developed coordinated multiple visualizations using the Digital Harbor PiiE enterprise software platform to merge visualization applications into a single operating environment. *This activity was completed in February 2006.*

Statistical Specific Emitter Source Identification (SESI)

Rosettex Partner: Raytheon

Raytheon

This IA&E study assessed the technological feasibility of Raytheon's statistical approach to the SESI problem, making use of a machine learning method based on certain statistical techniques to extract signal details useful for SESI on modern emitters. Raytheon implemented an environment that allowed subject matter experts to evaluate the technical feasibility and potential performance of the proposed solution. *This activity was completed in March 2006.*

Dragonfly Specific Emitter Source Identification (SESI)

Rosettex Partner: Northrup Grumman ESL



This IA&E study assessed the technological feasibility of Northrop Grumman's approach to the SESI problem, creating and analyzing a signals database from live collections of known emitter types. A feature set was defined, on which the ability to separate emitter signals was demonstrated and assessed. *This activity was completed in March 2006.*

Cultural Geospatial Graphic Representation

Rosettex Partner: Swiftsure Spatial Systems
Sponsoring Agency: US Army Corps of Engineers, Topographic Engineering Center



This initiative focused on the methods and techniques needed to portray the interactions between people, information, alliances, events, and the physical landscape. The goal was to find the best possible approaches to graphically represent diverse types of cultural information within GeoINT products to meet specific needs of different user communities for different types of missions. The result of this task was a "Summary and Future Path" briefing which described existing practices, key requirements addressed and not addressed, rationale for the draft graphic representation mockup, feedback from focus groups, other promising techniques that were not mocked-up, and recommendations on the next steps. *This assessment was completed in August 2008.*

Geographic Profiling in Counterterrorism

Rosettex Partner: Texas State University - San Marcos
Sponsoring Agency: Disruptive Technology Office



The complexity of operational planning is a point of weakness for terrorist organizations. Such organizations operate with resources dedicated to the day-to-day work of recruitment, cell-building, and funding and material management, and they must maintain their presence in foreign countries. Specialized support may be required either from knowing accomplices or from unknowing outside sources. The geography of terrorist activities, therefore, is not random, but rather is structured with the underlying patterns and logic needed to accomplish specific organizational goals and objectives. The exploitation of this vulnerability through the development of a better understanding of the geospatial and social networks of terrorist cells, their training and planning processes, and their intended targets was the major goal of this project. This project collected data sets, examined the most relevant analytic methods to use, performed data analysis, and developed, demonstrated and evaluated a Geographic Prioritization Model for predicting future terrorist activities. The results were presented in a report on geographic profiling support for counterterrorism analysis. *This project was completed in September 2008.*

Facilitating Strategic Analysis of Computer Modeling

Rosettex Partner: CIESD
Sponsoring Agency: Disruptive Technologies Office



Rosettex and its partner, CIESD, examined current analytical problems using social science risk analysis theories, and implemented a replicable process through which social science scholars, computer modelers, and analysts effectively and efficiently collaborated via a series of facilitated workshops. The workshops' objectives were to define mechanisms and pathways by which social science theories and computer modeling could be integrated to benefit the analytical needs of the Intelligence Community. The final phase of the project applied these mechanisms and pathways to a real world case study to demonstrate the benefits of the approach. The case study examined the nexus between a given country's leaders and the domestic business community, state-managed enterprises, and organized crime, modeling the extent to which these groups tacitly or actively influence the workings of their government and their conduct of international commerce. *This project was completed in September 2008.*

Pattern Recognition for Social Networks

Rosettex Partner: Intelligent Power & Energy Research Corporation (IPERC)
Sponsoring Agency: US Army Corps of Engineers, Topographic Engineering Center



The goal of this activity was to investigate alternate approaches, techniques and methods in the modeling of social networks (those networks that can map social behavior and predict behavior of groups of persons in diverse cultures). The study leveraged existing theoretical work to develop pattern recognition models designed to handle complex problems in the domain of mechanical systems. The mechanical systems approach envisioned a network model made up of smaller pattern-recognition networks which preclude the need to develop sophisticated models based on fixed algorithms. A key concept of the approach was that large, complex networks can be successfully subdivided into smaller, more manageable pattern-recognition networks, and then chained together to fabricate a larger network. The final output from this activity was a series of reports that detailed the use of Deterministic Models and Link Methodology to sub-divide and manage Pattern-Recognition Networks. *This project was completed in September 2007.*

Evidential Reasoning in a Geographic Context

Rosettex Partner: Swiftsure Spatial Systems
Sponsoring Agency: US Army Corps of Engineers, Topographic Engineering Center



This initiative focused on and evaluated evidential reasoning approaches and techniques to improve situational awareness and intelligence analysis via an improved understanding of the cultural landscape. The first phase of the activity investigated separate research areas; the second phase defined an operational concept to utilize the promising techniques discovered during phase one and also identified systemic challenges affected by any gaps discovered during phase one. This effort's final output was a research plan to address those gaps. *This assessment was completed in June 2007.*

Smart Geospatial Intelligence

Open Source Extraordinary Program

Rosettex Partner: ImageLinks
Sponsoring Agency: NGA



ImageLinks (now Radiant Blue Technologies) investigated and proposed an organizational structure and an action plan for applying Open Source Software methodologies to Government programs. Specific emphasis was placed on evaluating the PostGIS open source project and investigating mechanisms whereby Government requirements could be met through collaboration with existing Open Source teams. *This project was completed in March 2003.*

Custom Military Overlay Editor/Military Analyst Implementation

Rosettex Partner: ESRI
Sponsoring Agency: NGA



Environmental Systems Research Institute, Inc., (ESRI) provided services supporting the enhancement of their Military Analyst® software to meet NGA's need for military unit location map production using MIL-STD 2525B symbology, as well as fulfilling the need for complex data queries, reporting, and unit tracking analysis. ESRI completed enhancements of the current Custom Ground Order of Battle/Military OverLay Editor (MOLE®), a Military Analyst® application that included capabilities for complex data queries, map production, and reporting, and is implementing these applications at NGA facilities. In addition to the new symbology, the enhanced MOLE® application integrates several separate databases, applications, and processes into a single, scalable geospatial intelligence system. The project established a foundation for NGA to disseminate the information using World-Wide Web technology and to conduct historical and temporal unit analysis. *This project was completed in July 2004.*

Precision Geopositioning from Airborne Tactical Imagery

Rosettex Partner: Purdue University
Sponsoring Agency: NGA



The Precision Geopositioning from Airborne Tactical Imagery project had three thrusts: (1) the development of a tightly integrated navigating and electro-optical imaging system for accurate geopositioning, targeting, and navigation, (2) development of an error model for the target location determination problem from tactical synthetic aperture radar (SAR) imagery, and (3) performance of a prototype feasibility analysis to support current and future DoD/IC requirements. The project provided information for enhancing current tactical imaging systems and provided input to the design of next generation tactical imaging systems. *This project was completed in February 2004.*

Hyperspectral/Panchromatic Data Fusion for Improved Imagery Exploitation

Rosettex Partners: CMU, Leica Geosystems
Sponsoring Agency: NGA



Significant improvements in the exploitation of hyperspectral imagery have been demonstrated by simultaneous, semi-automated analyses of both panchromatic and hyperspectral imagery, and in the fusion of information to provide accurate surface material and man-made structure information for further analysis. This project reduced data acquisition while improving geospatial database content through development of the MaterialMap® system. MaterialMap® integrated automated and semi-automated cartographic feature extraction systems with multi-/hyperspectral imagery and elevation data to improve the overall performance of the feature extraction processes, while adding important surface material attribution to the extracted features. *This project was completed in March 2004.*

IAQAVOD Transition



Rosettex Partners: Lockheed Martin - M&DS
Sponsoring Agency: NGA

The objective of this project was to prepare, install, and test semi-automated software to perform the functions of Automated Quality Assessment (AQA) and Vertical Obstruction Detection (VOD) on imagery. The initial semi-automated software was then enhanced for fully automated operation and installed at an NGA production facility. *This project was completed in March 2004.*

Smart Geospatial Editing Toolset (SET)



Rosettex Partners: Leica Geosystems
Sponsoring Agency: NGA

Many image exploitation and feature extraction software algorithms identify features of interest in an image but produce lines and polygons using basic raster-to-vector conversion. The resulting vector objects usually require extensive manual cleanup and editing. The objective of SET was to attempt to reduce manual editing requirements by introducing intelligence to the raster-to-vector conversion and the process of making corrections to existing vector objects. Although the goal was to automate the SET operations as much as possible, SET determined that the user was usually required to assist the editing process by providing the system information, such as initial starting vertices, intermediate vertices, and positive/negative confirmations. *This project was completed in July 2006.*

Near Eye Display for Geospatial Intelligence



Rosettex Partner: Impact Science & Technology (IST)
Sponsoring Agency: NGA

As technology advances and sensor systems increase their resolution, NGA and its clients must have better capabilities to rapidly display and comprehend ever-increasing volumes of intelligence data for near-real-time decision making. This prototype system demonstrated the feasibility of creating a near eye display system that uses tiled, near-to-eye micro-displays to bridge the gap between existing high-end graphic displays and the human visual system. Near eye display systems have the potential to provide ultra-high resolution stereo displays to decision makers as needed to help ensure continued high lethality and survivability for US forces. IST designed and developed a prototype near eye display to meet NGA requirements, and NGA subject matter experts evaluated the performance of the prototype system. Based on the results of this evaluation, the NTA has the technology data needed to develop a plan for a follow-on version of the display. *This project was completed in April 2006.*

NGA/S Commercial and Airborne Performance Analysis Tools User Needs and Technology Assessment



Rosettex Partner: BearingPoint
Sponsoring Agency: NGA

NGA's systems must accommodate data from multiple sources to facilitate an end-to-end perspective of all available sensors. Integrating commercial and airborne performance analysis enables a holistic evaluation of source from sensors such as airborne, commercial, foreign, and traditional mission partners. The goal of this IA&E activity was to provide the NGA Source Directorate with an assessment of emerging and commercial technologies that could be used to support commercial and airborne performance analysis. To perform this user needs and technology assessment, five areas of study and analysis were addressed including: (1) definition of product/user needs, (2) identification of vendor/institution, (3) research of vendor offerings, (4) evaluation of specific products, and (5) comparative analysis, summarization, and reporting. *This activity was completed in April 2006.*

NSGI Automation Capabilities Needs and Technology Assessment

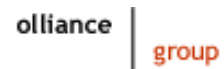
Rosettex Partner: BearingPoint
Sponsoring Agency: NGA



This assessment effort supported the NGA/InnoVision Automation Portfolio Management and Technical Team's efforts to identify, evaluate, and champion capabilities for automating the production of Geospatial -Intelligence. BearingPoint (now part of Deloitte Consulting) investigated geospatial intelligence functional and system requirements, concepts of operation and potential commercial solutions, and prepared a report that described: (1) the existing and forecasted National System for Geospatial Intelligence (NSGI) analytic and Tasking, Planning, Exploitation, Dissemination (TPED) decision support automation requirements and their proposed implementation priorities with rationale, (2) existing and forecasted hardware/software solutions that would satisfy the prioritized requirements, and (3) gaps or limitations of existing and forecast commercial hardware/software concerning the ability to meet current and future NSGI automation support requirements. *This study was completed in November 2006.*

Enterprise Architecture Management System

Rosettex Partner: Olliance
Sponsoring Agency: NGA



The objective of this study was to understand the software lifecycle options using Open Source Software (OSS) approaches for interagency/interdepartmental Federal Government Information Technology applications. The case study used the EAMS as the reference with support from Housing and Urban Development (HUD), US Department of Agriculture (USDA), Department of Labor (DoL), and others within the EAMS working group. The case study has been made available to other Defense and Intelligence Community users who may be considering the use of OSS approaches for their own developments. *This activity was completed in April 2003.*

Earth Gravitational Model (EGM) Prototype Development

Rosettex Partner: Stinger Ghaffarian Technologies (SGT)
Sponsoring Agency: NGA



The DoD World Geodetic System 1984 (WGS 84) provides the common coordinate reference system for DoD and NATO operations. The geoid surface associated with WGS 84 is derived from the WGS 84 EGM and is used by NGA as the global mean sea level datum to which heights are referenced. The accuracy of the "mean sea level" datum used by NGA is a function of the accuracy of the WGS 84 EGM. In 2000, NGA began development activities to dramatically improve the quality of the next WGS EGM, leading to the establishment of a 15 cm global RMS error goal for a new EGM. NGA's analysis determined that a five minute resolution model of the geoid would be required to achieve the specified target geoid accuracy and decided to develop a spherical harmonic model to degree and order 2160. The new EGM 2008 and auxiliary models, developed and refined by SGT working closely with NGA analysts, were presented at the European Geosciences Union meeting held in Vienna, Austria in April 2008. *This project was completed in April 2009.*

Imagery Wide-area Softcopy Search Technology Assessments

Rosettex Partners: Sarnoff, USDC
Sponsoring Agency: NGA



This IA&E study provided technical support to the NGA Softcopy Search (SCS) Program to seek, obtain, and evaluate cutting edge display technologies that promised to satisfy display technology requirements documented in the SCS Capability Requirements Specification. The activity provided the SCS Program with requisite information to make informed decisions on display technologies and a technology development plan to achieve its program goals in a timely and cost effective manner. *This activity was completed in April 2004.*

GKB Prototyping Support

Rosettex Partner: Gartner
Sponsoring Agency: NGA



The Geospatial-Intelligence Knowledge Base (GKB) is one of two major elements of the Integrated Information Environment (IIE) and is an integrated data repository that supports seamless access to geospatial and intelligence data through the customer self-serve portal. With the GKB, analysts and users have a data environment that supports analysis across geospatial and intelligence layers, enables spatial and temporal inference analysis, and promotes research and pattern recognition with data mining and information relevance tools for discovery of previously unconnected information. DoD/IC customers and decision makers leverage the GKB to provide situational context. IIE data manipulation and visualization tools enable these capabilities. This activity provided advanced information technology assessment and design consultation in the establishment of the GKB. *This project was completed in May 2006.*

Enhanced Exploitation of Wide-Area Persistent Surveillance Data

Rosettex Partner: Pixia Corp.
Sponsoring Agency: OSD-ATL, Rapid Response Technology Office RRT0



Wide-area persistent surveillance provides significant benefits to the Defense and Intelligence Communities in areas such as improvised explosive device (IED) detection, force protection, critical infrastructure protection, and wide area event surveillance. The massive volume of data generated by the wide area sensors, however, severely limits both the number of analysts that can concurrently access data located on a centralized server and the amount of data (size of view port) that each analyst may visualize. Data volumes are expected to grow exponentially as the number of sensors collecting data and the resolution of those sensors increases. With the help of MIT's Lincoln Labs, this project independently evaluated the use of technology developed by PIXIA to address these problems. The test results met or exceeded all of the performance benchmarks including rapid storage and retrieval capability of 20 clients concurrently accessing processed wide-area persistent surveillance data from a single network attached storage (NAS) device at the maximum supported viewer frame rate. The result demonstrated a 2500% increase in server efficiency. Tests also demonstrated uncompressed large screen displays playing sensor data at full resolution, as well as storage and retrieval of staged raw sensor data with real-time viewing. The technology is being transitioned into operational systems through JFCOM/JTC-1. *This activity was completed in May 2008.*

Film Scanning Assessment

Rosettex Partners: Cipher Systems, LLC
Sponsoring Agency: NGA



NGA offices have millions of historical black and white transparency film-flats (TFF) in thousands of file cabinets to which their analysts must have ready access for GeoINT analysis. Limited capability exists today within NGA to digitize images from TFFs and synchronize such scanned imagery with today's National System for Geospatial-Intelligence (NSG) databases, libraries and GeoINT business processes. This activity assessed alternatives and tradeoffs of technology in the commercial marketplace for scanning film on demand or in bulk, and thus support the elimination of stored films in the NGA New Campus East (NCE) workspace. This effort assessed the hardware and software available for capturing imagery and related metadata directly from film and linking that information to current GeoINT business systems and processes, thus making historical imagery more easily accessible to the NGA workforce. The activity focused on a comparative assessment of digital imagery and related metadata-capture devices including a limited number of barcode readers, transparency, film scanners, and digital camera devices. *This activity was completed in December 2007.*

Geospatial Architecture Assessment



Rosettex Partner: SRI International
Sponsoring Agency: NGA

This activity considered the system components and architecture required to stand up a nascent imagery, mapping, and geospatial intelligence capability. Although this specific capability was intended for use by the Iraqi Directorate of Imagery and Mapping Intelligence Affairs (DIMA), the general recommendations were applicable to any organization whose mission is to collect, analyze and disseminate imagery and mapping intelligence or one seeking to build such a capability based on world-leading technologies, best commercial practices and standards-based architectures. The final report proposed a complete system architecture assessment following the Reference Model of Open Distributed Processing (RM-ODP). The resulting architectural assessment considered many complex challenges from several architectural viewpoints, ranging from higher-level enterprise and information viewpoints to specific engineering and technology viewpoints. Recommendations included: (1) adoption of the National System for Geospatial-Intelligence Spatial Data Infrastructure (NSG SDI 1.0), (2) enforcement of an information model and workflow to manage metadata and feature data extraction, (3) reliance on standards-based service interfaces (with allowance for insertion of emerging technology as appropriate), and (4) reliance on n-tier distributed processing frameworks as well as the use of robust and scalable storage and dissemination solutions. *This project was completed in March 2008.*

Automated Target Recognition



Rosettex Partner: Visual Learning Systems (VLS)
Sponsoring Agency: NGA

NGA has a need for Automated/Assisted Target Recognition (ATR) technology to assist analysts in performing target detection, recognition, and identification more accurately and efficiently in an automated or semi-automated environment. Despite years of ATR technology development focused on using 3-D modeling, ATR has not yet progressed to the point where fully autonomous exploitation is viable throughout the NGA and the Intelligence Community. The NTA sought to extend and apply recent automated feature extraction advances and techniques to the problem of ATR using VLS' Feature Analyst[®] software product. This project investigated the target detection phase of the ATR process by enhancing and modifying the current Feature Analyst[®] software to find targets in regions of interest. Phase I concentrated on Ground Order of Battle targets in panchromatic imagery. Phase II investigated later steps of the ATR-target recognition, identification, and classification process as well as the use of motion imagery. VLS (now part of Overwatch Systems Geospatial Operations) delivered an ATR Prototype system to NGA for use as a demonstration capability for the software developed during the project. *This project was completed in June 2009.*

Geospatial Analysis and Reporting Conceptual Framework (GARCON-F)



Rosettex Partner: BBN Technologies
Sponsoring Agency: NGA

NGA's Office of Basic and Applied Research pursues research and development activities to revolutionize the imagery analysis and reporting process. The GARCON-F project developed techniques for representing the essential elements of analytical reporting to enable both automated computer analysis and legacy-style reporting. GARCON-F focused on developing a working prototype that demonstrated the benefits of moving intelligence reporting from a paradigm characterized by analysts looking at imagery and other sources and producing narrative text reports with embedded graphics, to a paradigm where analysts tag the data with relevant features, events, and conjectures in a form computers can organize and classify. Using GARCON-F, reports are grounded with facts, judgments, and conjectures classified according to a network of connected ontologies and concepts. This resulting web of entities and events has inherently more explicit meaning or semantics, and thus becomes another source of information that can be mined for intelligence. *This project was completed in July 2009.*

eChart Tools and Product Prototyping

Rosettex Partner: TerraGo Technologies
Sponsoring Agency: NGA



NGA supports the DoD user community's distribution and exploitation of GeoINT including maps, charts, and images in GeoPDF format. This project addressed the initial development of specific prototype geospatially-enabled PDF products and exploitation tools for the community's efforts to standardize GeoPDF products, promote exploitation support applications development, and facilitate the use of GeoPDF products in critical operational systems. The outcome of this project was the development of product specifications and prototyping of the initial Iraq Urban Atlas of Baghdad and Iraq Country Atlas of Al-Anbar North for evaluation by NGA. *This project was completed in July 2006.*

GeoPDF Atlas Prototype

Rosettex Partner: TerraGo Technologies
Sponsoring Agency: NGA



This project addressed the advanced development of standardized GeoPDF Urban and Country Atlas prototype PDF products and exploitation capabilities to support community efforts to deploy consistent GeoPDF products, promote exploitation support applications development, and facilitate the use of GeoPDF products in critical operational systems. In addition to prototype atlas products, the project developed a product implementation guide with a detailed description of the key process steps and activities associated with development of the prototypes, and provided enhanced commercially available viewer software to support assessment of products by operational users. *This project was completed in December 2008.*

LIDAR 3D Products Study and Demonstration

Rosettex Partner: TerraGo Technologies
Sponsoring Agency: NGA



NGA Support Teams deployed within various agencies and combatant commands create geospatial intelligence products to aid decision makers in solving problems. Often these products, intended to provide situational awareness, are limited to 2D maps embedded into PowerPoint presentations. NGA believes that an interactive 3D product using Adobe® Reader will allow for a broader dissemination of the derivative products in a much simpler display format. This format has powerful geospatial viewing and exploitation capabilities that do not currently exist in PowerPoint presentations. The goal of this project was to study the feasibility of displaying combined GeoPDF® and LIDAR data sets in Adobe® Reader. To accomplish this task, two major technical areas were addressed: (1) rendering of PDF graphics in .U3D format, and (2) extending the Adobe® Reader 3D viewer functionality to include display of 3D surfaces along with functions such as 3D coordinate display and measurements of distance, area, and slope. Functional capabilities to address these areas were presented to NGA through a series of demonstrations. *This activity was completed in May 2009.*

Support to GeoINT Data Strategy Campaign

Rosettex Partner: PRTM
Sponsoring Agency: NGA



The GeoINT Data Strategy Campaign study provided the NGA with information, insight, and recommendations for pursuit of a geospatial intelligence data strategy for the National System for Geospatial Intelligence (NSG). This information was used by NGA to develop architectures, prioritize technology initiatives, and invest in system development with goals and objectives designed to solve strategic transformation issues of the needs of NGA's user community. A comprehensive collection of sources and activities were used in the assessment including trade magazines and journals, existing requirements documentation, the Internet, and attendance at conferences and meetings in CONUS & OCONUS. The results were documented as a strategic transformation proposal to NGA senior management. *This study was completed in February 2006.*

OGC Web Services Architecture Implementation Profile for NGA

Rosettex Partner: Open Geospatial Consortium (OGC)
Sponsoring Agency: NGA



The NGA's National Center for Geospatial Intelligence Standards (NCGIS), through efforts such as the Open Geospatial Consortium's (OGC) Interoperability Program, works to accelerate development of its standards and others based on commercial software development. These standards are crucial to implementation of certain phases of NGA's information technology infrastructure modernization program. As a part of the 4th OGC Web Services Testbed Activity (OWS-4) effort, the NTA sponsored the development of an OGC Web Services Architecture Implementation Profile for NGA to encourage industry vendors to develop, test and validate interface specifications. These interface specifications are expected to lead to commercial products suitable for use by NGA, its customers, and the broader federal geospatial community. *This project was completed in May 2007.*

Multimodal Data Extraction Technology

COTS Multisensor Fusion Tools

Rosettex Partners: Leica Geosystems, AlphaTech
Sponsoring Agency: NGA



ALPHATECH, Inc.



NGA has a need to support the rapid extraction and update of mission-specific feature datasets from multi-source and spectral imagery. Similarly, NGA has stated requirements for assisted feature extraction/assisted target recognition (AFE/ATR) technology in order to aid imagery and geospatial analysts in building foundation feature datasets from multi-source and spectral imagery. To address these needs, an add-on module, based on neural network image processing and pattern learning and recognition models was developed by AlphaTech (now part of BAE Systems Advanced Information Technologies) and integrated into the commercial ERDAS IMAGINE™ 8.7 product. This module was made available at no cost to over 5,000 users within the IC and DoD. *This project was completed in April 2004.*

SAR Automated Data Extraction Study and Processing Software Evaluation

Rosettex Partner: Vexcel (a Microsoft Company)
Sponsoring Agency: NGA



Vexcel Corporation, acquired by Microsoft in 2006, conducted an IA&E study that provided NGA with a technical assessment of state-of-the-art automated data extraction (ADE) technology as it pertains to synthetic aperture radar (SAR) systems and supplied a roadmap for potential R&D in this subject area. ADE was defined to include automated feature extraction, change detection, automated/assisted target recognition, and automated registration. *This project was completed in January 2004.*

Civilian SAR for Geospatial Intelligence

Rosettex Partner: Vexcel (a Microsoft Company)
Sponsoring Agency: NGA



NGA believes that new techniques developed using civilian systems exploiting long coherent data archives show great potential for intelligence applications. Vexcel Corporation has developed commercial systems to automate image formation, coherent processing, and analysis of civilian SAR data, including mosaicking and mapping of images over large, continental-scale regions. Under this project, NGA analyzed use of the Vexcel system on SAR data, explored specialized techniques for data interpretation, compared results with known intelligence information, and documented the resulting interpretation process. The commercially available Vexcel processing software was augmented with semi-automated interpretation capabilities and improved visualization tools to support NGA requirements. *This project was completed in December 2004.*

MultiSource Fusion Experiment Support

Rosettex Partner: Lockheed Martin
Sponsoring Agency: NGA



NGA systems must accommodate data from multiple sources to facilitate holistic target characterization. This effort supported NGA's assessment of a SAR data source and its contribution to multisource fusion. The activity involved the collection of data to simulate several targeting scenarios, processing of the resulting data to support evaluation, support to NGA in the evaluation of results, and the capture and documentation of the lessons learned in conducting the collection and evaluation support activities. *This activity was completed in April 2006.*

Vertical Obstruction Detection

Rosettex Partner: Leica Geosystems
Sponsoring Agency: NGA



NGA has a requirement to automatically identify vertical obstructions while minimizing the number of false positives for populating their Digital Vertical Obstruction Database. Prototype Vertical Obstruction Detection software for ERDAS IMAGINE was developed, and its capabilities evaluated and documented. The activities and results of this project were detailed in the Vertical Obstruction Detection Final Report. *This project was completed in September 2006.*

Persistent Exploitation of Persistent Sensing (PEPS)

Rosettex Partner: SRI
Sponsoring Agency: DARPA



This IA&E study identified issues and approaches for a proposed research program relative to evolving large-area long-term tactical video surveillance sensor platforms. In accordance with established DARPA standard practices, Rosettex and SRI International developed the vision and scope for the proposed research program, defined the technical challenges, identified potential approaches, studied potential operational concepts and parameters, and defined militarily relevant applications for the work. Relevant research efforts and architectures were studied and compared as candidates to support the PEPS initiative. The results were presented in the form of a report and summary briefing to DARPA sponsors. *This project was completed in December 2006.*

Advanced Spectral Tool Development

Rosettex Partner: Northrup Grumman
Sponsoring Agency: NGA



NGA conducts research and development on a wide range of advanced spectral tools to address the Agency's need to exploit current and future spectral imagery data sources. This project developed several new thermal models that used temperature regimes of identified key components to support imagery exploitation in specified scenarios, and tested and documented the thermal models for potential integration into the National System for Geospatial-Intelligence (NSGI). *This project was completed in April 2007.*

Map Feature Text Extraction

Rosettex Partner: Pennsylvania State University Applied Research Lab (PSU/ARL)
Sponsoring Agency: NGA



The problem of text extraction from maps has been widely addressed in the defense and intelligence communities, yet it remains a significant automation challenge. Text appears in multiple sizes and colors, overlaps with other text and geographic features, and appears in arbitrary orientations. Although a great deal of research has advanced the field, there are still many unanswered challenges. To constrain the problem and aid in the testing of the text extraction prototype system, PSU/ARL focused on nine different styles of maps in a combination of three languages and three map types: topographic, urban, and geopolitical. PSU/ARL developed an enabling technology tool set for text detection and processing in the ESRI commercial ArcGIS® framework to address these problems. PSU/ARL also incorporated and tested optical character recognition software in the work process to determine its flexibility and its capability to improve text extraction. PSU/ARL worked with the NGA to implement and test a prototype of NGA's tool set. *This project was completed in November 2007.*

Geo-Match Multilingual GNDB Prototype Project

Rosettex Partner: University of Maryland - Baltimore County (UMBC)
Sponsoring Agency: NGA



The Geographic Names Data Base (GNDB) maintained by NGA is recognized by the United States Board on Geographic Names as the premier international source for geographic names. The GNDB is multilingual, maintaining 5.5 million place names in various languages, but generally only records one language per country with entries recognized as the official US Government place names. In many parts of the world, the same geographic entity may be called by multiple names depending on the language, nationality, and cultural identity of the writer or speaker. For example, the capital of Poland is called Warszawa (Polish), Warsaw (English), Warschau (German), and Varsovie (French). The current GNDB implementation has limits in its utility to support users requiring translations between various languages and dialects to match locations. This limitation has proven to be a pressing issue for intelligence operations in areas of the world where quickly identifying places for analysis, planning, and targeting is complicated by the various geographic name forms appearing in raw intelligence feeds. This project developed a prototype system for evaluation by NGA that will improve the utility of the GNDB by rapidly transliterating and matching names mentioned in audio feeds and reports for analysts in the field, and improving the accuracy and utility of the database in general. The activities and results of this project were detailed in the Geo-Match Final Report. *This project was completed in September 2007.*

BRIDGE Map & Gazetteer OCR

Rosettex Partner: University of Maryland
Sponsoring Agency: NGA



The University of Maryland (UMD) has a number of enabling technologies for text detection, segmentation, and custom trainable optical character recognition, as well as for user interface design. UMD worked with the NGA to address these problems for automated and semi-automated acquisition of text resources from gazetteers and maps. This effort completed three complementary activities: (1) cleanup and delivery of a prototype digital Cambodian Gazetteer, (2) installation and training of the UMD Bilingual Resource and Dictionary Generation Environment (BRIDGE) system for resource acquisition, and (3) basic research and implementation of a semi-automated system for map text detection, segmentation and recognition. *This project was completed in October 2007.*

Multi-Source and Multi-INT Fusion Assessment



Swiftsure
Spatial Systems Inc



Multisource

Rosettex Partner: SRI International, Pennsylvania State University, Multisource,
Swiftsure Spatial Systems

Sponsoring Agency: NGA

The NGA InnoVision Advanced Development Office Analysis and Applications Division (IDA) is responsible for developing the "InnoVision Multi-Source and Multi-INT Fusion Portfolio Roadmap." As part of that effort, IDA must (1) assess and document the current state of Multi-Source and Multi-INT Fusion and (2) project the development of related technology for the next 5-15 years. This activity supported IDA efforts by assessing current and future industry GeoINT fusion-related activities through a two-step process: (1) a panel discussion to identify and define further Multi-Source and Multi-INT Fusion research and development efforts, and (2) a detailed survey to (a) review information from recent trade shows, conferences and IC/DoD fusion efforts, (b) identify key industry actors in the fusion area, and (c) conduct detailed research to characterize these activities and technologies. The results of these two activities were provided to NGA in the "Multi-Source and Multi-INT Fusion Panel Report" and the "Multi-Source and Multi-INT Survey Report." *This project was completed in July 2009.*

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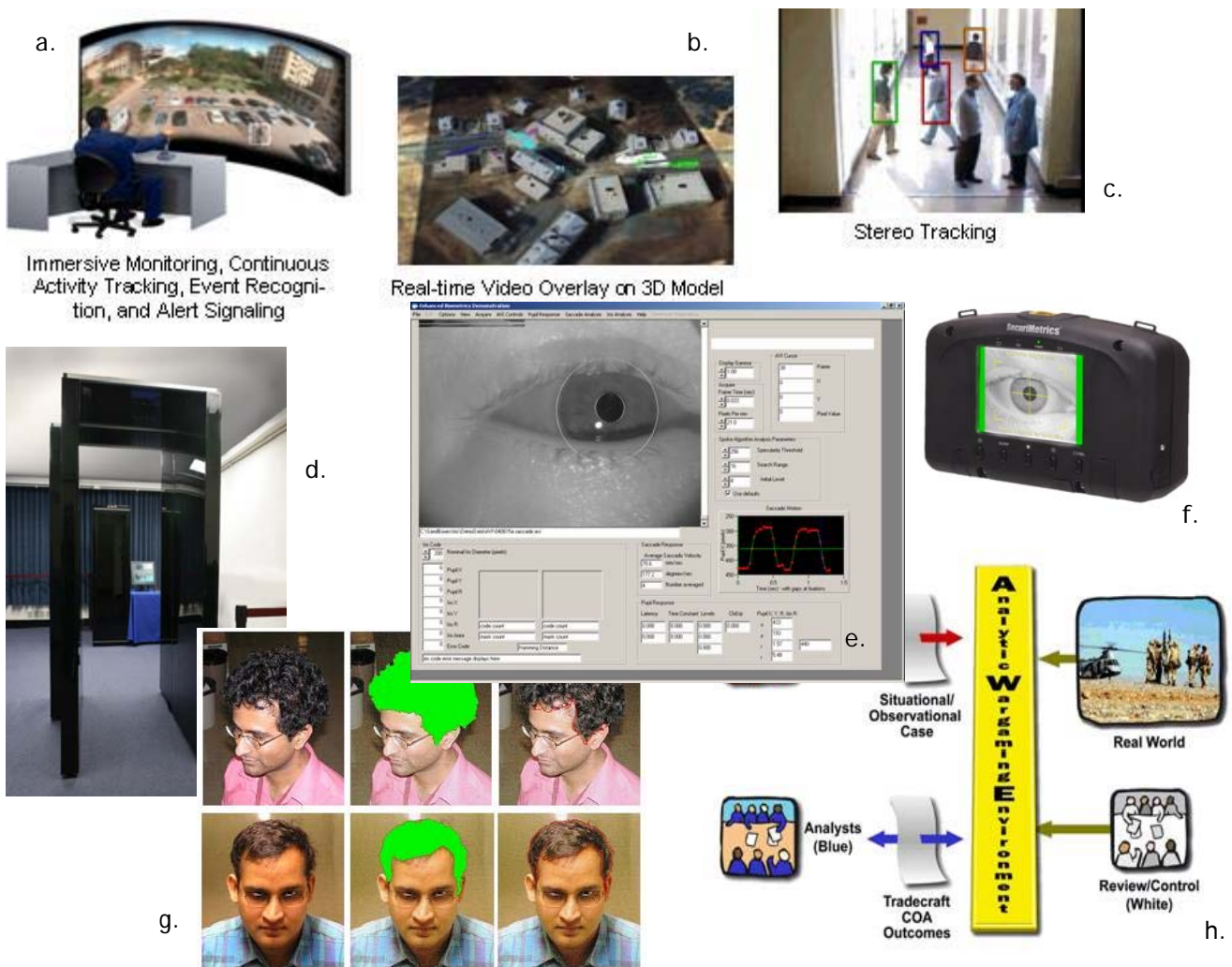
Information Processing, Analysis, and Management (IPAM) Projects

The focus of IPAM initiatives was to discover, initiate, and accelerate the development of commercial applications for the processing, analysis, and management of large volumes of disparate and distributed data at various stages of the data processing cycle for improved capabilities, products, and services that lead to rapid understanding and effective decision making. IPAM technical challenge areas included:

Biometrics - Exploit commercial-off-the-shelf (COTS) biometrics and develop tools and systems to accurately and unambiguously locate, identify, and track individuals. COTS biometrics are becoming more widely available. Government agencies that are charged with prosecuting the war on terror abroad and protecting the safety of US citizens at home are interested in improvements to COTS biometrics that will provide a differential advantage over potential adversaries.

Still and Motion Imaging - Enhance airborne still and video processing, and develop and prove products for video compression, stabilization and event recognition. This includes integration of information from multiple sources and modalities beginning with geospatially related sources.

Collaborative Production and Analysis - Enable the ability of physically and geographically dispersed individuals and to collaboratively work together and share information. The emphasis of these efforts is to develop web-based infrastructures, multi-level security (MLS) architectures, systems that track processes, transactions, and data flow for analyzing collaboration among work groups, and more.



Sources: a-e. Sarnoff Corp., f. SecureMetrics, Inc., g. SRI International, h., Oberon Associates

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Biometrics

Biometrics - Human Security and Fitness for Duty

Rosettex Partner: Sarnoff
Sponsoring Agency: NSA



As COTS biometrics systems have become more widely available, US Government agencies in charge of protecting sensitive Government assets are identifying potential applications for COTS biometric tools. This project developed the means for assessing fitness for duty in the context of a biometric identification system. The project demonstrated that measurements of a subject's pupil response to a light stimulus and the ability of a subject to track a moving stimulus (saccadic motions) provide good indications of a person's fitness to perform job-related functions. The demonstrated system used these biometric indicators to differentiate normal, individual reactions from those under adverse influence of substances such as alcohol or over-the-counter medication. *This project was completed in August 2004.*

Iris on the Move

Rosettex Partner: Sarnoff Corporation
Sponsoring Agency: NGA



Iris recognition is one of the most reliable means of identifying an individual based on biometric information. Existing iris recognition systems require persons of interest to remain stationary and self-position themselves in front of the iris recognition device. These constraints have limited extensive deployment of iris recognition systems. This project developed a system to perform iris recognition while a subject walks towards a portal, such as a doorway or an airport metal detector. In Phase 1 of the program, system specifications were developed and a design study was performed. An image-capture and iris recognition testbed was implemented to evaluate feasibility of the approach in limited conditions using 10-20 subjects. Phase 2 of this effort was conducted under the Insight Program. *This project was completed in November 2004.*

INSIGHT Program

Rosettex Partner: Sarnoff Corporation
Sponsoring Agency: NGA



This project continued the prototype developments started under the prior Enhanced Biometrics and Iris on the Move programs, and guided them to the next level of maturity. The program had three major activities: 1) Long-range Acquisition, 2) Pan-Tilt-Zoom Technologies, and 3) Integrated Recognition Prototype. Building on robust prototypes already in the laboratory, previous tasks: matured the Fitness for Duty capabilities and resolved some of the technical issues that limited the prototype's commercial potential; and developed a full Iris on the Move prototype system that was implemented for field testing (in which an individual looked at a TV screen or similar device while walking toward a portal such as an airport metal detector). Final work on the prototype integrated several more existing biometric technologies into a single prototype and demonstrated the ability to perform non-invasive personal identification using iris recognition in unconstrained, uncontrolled environments. *This project was completed in August 2009.*

Hair Recognition

Rosettex Partner: SRI
Sponsoring Agency: NSA



The goal of this project was to develop and demonstrate techniques for using properties of people's hair to help identify individuals while tracking them in a sentient environment system. The approach characterized 2-D and 3-D properties of hair, such as texture, color, and shape, under varying illumination, orientation, and scale, and then evaluated the contribution of these properties to the reacquisition of individuals. *This project was completed in December 2005.*

Speaker Recognition Workshop

Rosettex Partner: Virginia Center for Innovative Technologies (CIT)
Sponsoring Agency: ITIC



The Intelligence Technology Innovation Center (ITIC) Biometrics Program sponsors advanced research, development, testing, and evaluation of biometrics collection and exploitation technology to support IC requirements. An important component of this program was advancing the state of the art in speaker identification tools and technologies. Rosettex and its partner CIT assisted ITIC by helping to define requirements, assess current technology capabilities and gaps, and develop ITIC's investment roadmap for speaker identification tools. Rosettex and CIT performed an IA&E study of current and emerging speaker identification technologies, and evaluated their utility to meet ITIC objectives. Rosettex and CIT identified the leading edge speaker identification researchers and developers, who were contacted and invited to participate in a highly focused speaker identification workshop conducted by Rosettex and CIT. The results of the study and the workshop were used to develop a set of recommendations to be used in turn to develop the ITIC speaker identification tools roadmap. *This activity was completed in March 2006.*

Biometrics Exploitation Tools Assessment

Rosettex Partner: Virginia Center for Innovative Technologies (CIT)
Sponsoring Agency: ITIC



Rosettex and its partner, CIT, assisted ITIC by helping to define requirements, assess current technology capabilities and gaps, and develop ITIC's investment roadmap for biometrics exploitation tools. CIT performed a study of current and emerging biometrics technologies, and evaluated their utility to meet ITIC biometrics objectives. Rosettex and CIT identified the leading edge biometrics researchers and developers, who were then contacted and invited to participate in a highly focused biometrics exploitation government and industry tools workshop. The results of the study and the workshop were used to develop a set of recommendations that in turn will be used to develop the ITIC biometrics exploitation tools roadmap. *This activity was completed in March 2006.*

BioInstrumentation R&D Investigations

Rosettex Partner: Massachusetts Institute of Technology
Sponsoring Agency: ODNI/IARPA



Rosettex and its partner, MIT, organized a conference in February, 2007 on the topic of BioInstrumentation to assess R&D work in the domain and to forecast the maturation of contributing technologies. The conference brought together world-class leaders in the field of modern instrumentation for high throughput research. Topics covered included high sensitivity measurements in biological environments with specific applications to biodefense, micro- and nano-fabrication, and de-novo biomaterials synthesis, as well as specific topics in chemistry and computer modeling. *This project was completed in May 2007.*

Identity Technology Discovery and Reporting (ITDAR)

Rosettex Partner: Northrop Grumman



The ITDAR IA&E activity provided its sponsor information, insight, and recommendations on commercial technology trends and advances in state-of-the-art research and development for identity management capabilities, algorithms, processes, and systems. The assessments focused on the near and mid-term future, and were used to develop specific research and development programs with goals and objectives designed to address the needs of the intelligence community. *This project was completed in December 2006.*

Sentient Video Environments Prototyping

Rosettex Partner: Sarnoff, SRI
Sponsoring Agency: NSA



In the post 9/11 world, the need for enhanced security around sensitive facilities has become much more critical; however, existing methods and technologies are often not adequate or cost effective. New technologies and methods must be developed and applied to provide an intelligent, accurate, and automatic system - a sentient-like environment. The Sentient Environment projects developed and demonstrated a technical capability to provide total situational awareness and monitoring of a site using a blanket of stereo and monocular video cameras and other sensors. This project was a multi-phased effort. Phase 1, completed in November 2004, developed an infrastructure for a sentient environment that was installed at the UNISYS biometrics evaluation center, which demonstrated tracking persons in controlled facilities, visualization, and initial reacquisition techniques. Phase 2 prototyped significant enhancements to the Phase 1 capabilities and integrated system and data feeds from other sources. *This project was completed in February 2006.*

Handheld Interagency Identification Detection Equipment (HIIDE) Follow-on Program

Rosettex Partner: SecuriMetrics Corporation
Sponsoring Agency: ITIC



This project provided a comprehensive operational test and evaluation (OTE) of the baseline prototype HIIDE, developed by SecuriMetrics (now part of L-1 Identity Solutions), to determine its ability to meet the needs of different partner agencies and organizations. Specific objectives included: (1) ensuring that HIIDE was certified for 10 print collection capability, (2) determining the feasibility of integrating other peripherals such as certified 10 print fingerprint collection devices with the HIIDE, (3) developing an export version with safeguards for data collection, (4) developing and integrating a Government-off-the-shelf (GOTS) Electronic Fingerprint Transportation System (EFTS) capability, (5) determining the feasibility of developing and integrating voice collection capability, and (6) determining the feasibility of integrating longer range face recognition capability. The OTE resulted in field deployable units now serving US forces in -theatre. *This project was completed in April 2007.*

Robust Arabic Speaker ID

Rosettex Partner: SRI International



Speaker identification (SID) research and development have long been directed at developing algorithms for commercial, English language based applications in banking, credit card, and other service businesses endeavoring to provide cost-effective means to answer customer questions by phone. Since the advent of the Global War on Terrorism, the need has arisen to port or adapt English-oriented algorithms to Arabic languages. This project prototyped algorithms oriented toward Arabic languages in uncontrolled environments. *This project was completed in April 2007.*

Intrinsic Speaker

Rosettex Partner: SRI International
Sponsoring Agency: NGA



Research in automatic Speaker Identification (SID) for non-commercial applications has focused on cross-channel issues for several years. One example is when a speaker must be recognized on a cell-phone using a landline phone-based model. While this focus has improved performance, it ignores a key remaining error source for SID systems: the internal (intrinsic) variations of the speech signal itself. This effort researched the effect of speech variation on state-of-the-art SID systems. It showed which features and algorithms are most robust to the internal speaker variations (ISV), and developed algorithms to estimate the instantaneous "intrinsic" state of an unknown speaker. After showing that these algorithms worked effectively, it determined the correlation between estimated ISV differences and SID error rate. *This project was completed in August 2009.*

Far Field SID

Rosettex Partner: Carnegie Mellon University (CMU)
Sponsoring Agency: NGA



Researchers in automatic Speaker Identification (SID) have focused recently on problems such as recognizing a speaker on a cell phone using a landline telephone-based model. The result has been improved algorithm performance. However, key problems such as far-field speaker recognition and SID in the presence of noise have been set aside. When speech data is collected by microphones located more than a few inches away from the speaker, room acoustics and noise sources become important and, in a room with lively acoustics, echo and multi-path propagation become key concerns. This work developed algorithms to accomplish three objectives: (1) degrading clean speech signals using commercially available or publicly available software, so that they more closely resemble speech as encountered in naturally reverberant rooms, (2) processing incoming speech signals to compensate for the environmental distortion, and (3) developing more robust recognition algorithms that can better cope with mismatched conditions. *This project was completed in August 2009.*

Session Variability Compensation (SVC)

Rosettex Partner: IBM Corporation
Sponsoring Agency: NGA

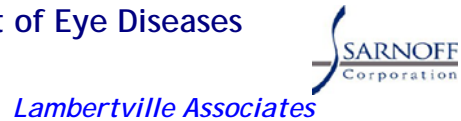


The focus of this project was to analyze speech collected by distant microphones - those located more than a few inches away. In the scenario of interest, room acoustics and external room noise sources become important, e.g., if we have lively acoustics, echo and multi-path phenomena become key concerns. While the current ability to transform data from certain kinds of cell phones into data usable for a landline phone is impressive, it provides little insight into handling this less predictable live microphone data. Current generation speaker verification algorithms most often fail because of mismatches between training data and recognition data. In the scenario of interest, training data can be from a landline phone, a cell phone, or a live microphone recording, while the usual recognition setting will be a live recording. This project's developed an understanding of the difference in channel/noise level, and the change in speech style and vocabulary between the training and recognition settings. *This project was completed in August 2009.*

Still and Motion Imaging

CAD Tools for Early Detection and Management of Eye Diseases

Rosettex Partners: Sarnoff, Lambertville Associates,
University of Texas Medical Branch at Galveston



UTMB

This project demonstrated dual use of technology from medical and defense related sciences. The Computer Aided Diagnostic (CAD) Tools for Early Detection and Management of Eye Diseases Project developed prototype software tools for registration, fusion, and analysis of multiple retinal image types for eye disease treatment. The project included four major tasks: (1) the development of software tools for cross-modalities registration of 2-D retinal imagery and the exploration of integration of Optical Coherence Tomography toward recovery 3-D retinal maps, (2) the study of current application of pattern recognition capability in detection and classification and the investigation of the ability to detect lesions by applying Hierarchical Pyramid Neural Networks, (3) the expansion of previously developed slitlamp mosaicking capabilities to acquire very high-resolution digital video and integration of the information extending super resolution and super fusion, and (4) the development of a prototype tool to generate high-resolution images from a set of low-resolution images. *This project was completed in January 2004.*

Assessment of Current and Emerging Commercial Video Motion Mining Technology

Rosettex Partner: BearingPoint, SAIC
Sponsoring Agency: NGA



This study, conducted by BearingPoint (now Deloitte Consulting) and supported by SAIC, identified and defined a set of emerging commercial video motion mining technologies under development that are most potentially applicable to private industry and Government needs. The results were documented in a Video Motion Mining Assessment Report which included a technology timeline and roadmap. *This activity was completed in April 2003.*

Motion Mining Tailored to Functional Domain

Rosettex Partners: SRI, Sarnoff, Virage
Sponsoring Agency: NGA



In 2001, the NTA investigated motion mining techniques applicable to aerial platforms and sensors. In 2002, this project expanded on the achievements of the initial program: (1) Virage, Inc. (now part of Autonomy) was included as a commercial technology partner to enable video archiving and retrieval transition of motion mining techniques to a commercial system that can be evaluated by users, and (2) the experimental focus of the program was expanded to include physical security applications in addition to the aerial surveillance applications. A demonstration system, populated with operational video and motion mining data to illustrate the power of motion mining queries in larger databases, was delivered to NGA and project stakeholders. Application software, processed video, and a web browser plug-in were developed and made available to potential users to explore the benefits of motion mining. *This project was completed in February 2004.*

Advanced Motion Imagery Capabilities for DoD and the Intelligence Community



Rosettex Partner: Sarnoff
Sponsoring Agency: NGA

The Advanced Motion Imagery Capabilities (AMIC) project supported the motion imagery community through research and development of video systems incorporating advanced, best-of-class technologies, as required to meet the needs of motion imagery collection, transmission, processing and exploitation processes. To provide long-term vision and direction, a technology roadmap was prepared to document the technology path from current technology to advanced systems and capabilities. Within the guidelines of the roadmap, multiple technology options were identified for investigation and development to achieve the targeted advancements in capability. This program also addressed quantitative quality metrics for determining the level of motion imagery resolution required for specific exploitation tasks. The compression efficiency and computational complexity of the new Joint Video Team (JVT) (with and without Global Motion Compensation) video compression standard was compared with MPEG-4 (with Global Motion Compensation) when applied to UAV reconnaissance motion imagery. A testbed prototype system for testing various forms of video compression was developed. The results of this evaluation are helping the DoD/IC determine if the adoption of MPEG-4 is the best next step, or whether the DoD/IC should focus its efforts on making JVT the next DoD/IC standard for motion imagery. *This project was completed in March 2005.*

Distributed Common Ground System (DCGS) JPEG 2000 User Needs and Technology Assessments



Rosettex Partner: ITT Systems Division
Sponsoring Agency: NGA

The first phase of this IA&E activity supported the Joint Photographic Experts Group 2000 (JPEG 2000) DCGS migration by performing user needs and technology assessments, and by developing a strategy to effectively and efficiently transition Air Force and Army DCGS elements from legacy compression algorithms to the JPEG 2000 image compression standard. The activity supported the user needs and technology assessments required to expand on preliminary DCGS JPEG 2000 migration planning efforts to address the differences in the Air Force and Army DCGS architectures. This included addressing unique system and maintenance requirements, and deploying reference implementations of applications to assist DCGS elements in the transition to JPEG 2000. The second phase of the assessment supported the migration of JPEG 2000 into the Distributed Common Ground System (DCGS), focusing on assisting JPEG 2000 profile development, accessing the motion imagery compression needs of the DCGS architecture, investigating a JPEG 2000 hardware solution for latency reduction, verifying libraries ability to ingest JPEG 2000 airborne data, and supporting a community demonstration. *This project was completed in August 2007.*

Wavelet-Based Target Detection (Project REVEAL)



Rosettex Partner: ITT Industries Space Systems Division
Sponsoring Agency: NGA

Project REVEAL supported NGA by performing research, evaluations, assessments, and demonstrations, and making recommendations for advanced wavelet-based processing for target detection in large geographical areas, target identification and tracking, and advanced visualization and data fusion. The ability to autonomously search large geographical areas for high-interest targets is an emerging demand. The images associated with these searches typically have large frame dimensions. The image data are archived into databases for future processing or distributed to central locations to meet more immediate needs. Given that the *a priori* knowledge of military target locations and other regions of interest is usually unknown, the process of retrieving and searching such large images can be a difficult and time-consuming task. The magnitude of the search through multitudes of data can overwhelm processing systems and impede analysts who need to quickly identify and track high-interest objects. Project REVEAL developed improved technology needed for these multiple, high-volume searches. *This project was completed in December 2006.*

Collaborative Production and Analysis

Innovative Fusion Capabilities

Rosettex Partner: University at Buffalo
Sponsoring Agency: NGA



This project developed an integrated, simulation-based toolkit for the design and analysis of agile, adaptive, decentralized, fusion-based tracking systems whose overall intelligence integration integrity (i.e., formal correctness) can be assured. The most important intellectual outcome of the project was knowledge related to the engineering of decentralized fusion (intelligence integration) systems for target tracking and identification, i.e., for achieving mission-effective estimates of the composite track picture for network centric warfare applications. The results were a collection of reports and briefings, and a flexible, integrated simulation environment for use as an aid for the design of such complex systems. *This project was completed in December 2005.*

Innovative Framework for Understanding Integrated Intelligence

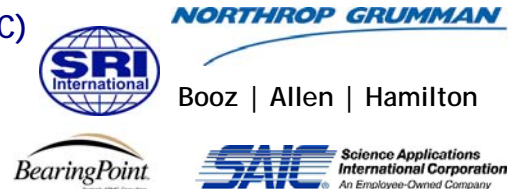
Rosettex Partner: Pennsylvania State University Applied Research Lab (PSU/ARL)
Sponsoring Agency: NGA



PSU/ARL has been developing an application framework for data understanding and applying it to emerging integrated intelligence analysis challenges to develop measures of performance. This project demonstrated a new human-centered approach to intelligence integration that uniquely leverages the analyst's fundamental ability to process both visual and language-based information. The approach permits analysts to effectively combine their visual pattern recognition skills for analyzing information, with their language skills for reasoning about evolving situations. The objective was to demonstrate a measurable increase in data understanding and productivity by the intelligence analyst. This project leveraged research in multi-source data fusion, pattern recognition, automated reasoning, and visualization performed by PSU for the DoD and NASA. *This project was completed in February 2005.*

Joint Integrative Analysis and Planning Center (JIAPC) Collaborative Environment

Rosettex Partner: SRI, BearingPoint, Booz-Allen Hamilton,
Northrop Grumman TASC, SAIC
Sponsoring Agency: STRATCOM



The Joint Integrative Analysis and Planning Capability (JIAPC) supports the DoD Information Operations (IO) Roadmap by providing the United States Strategic Command (USSTRATCOM), and by extension each Combatant Command, with integrated IO effects-based targeting, analysis, and planning capability. JIAPC fielded a unified capability for Holistic Target Characterization (HTC) by fusing target intelligence and other data across multiple domains to provide options for IO input to course of action development. This project designed, developed, implemented, and demonstrated a prototype JIAPC that fulfilled the need for an integrated information operations analysis and planning capability by October 2004. The objective was met by implementing a "system of systems" prototype that provided an environment for collaboration among four key centers of excellence. *This project was completed in January 2005.*

Future Intelligence Requirements Environment (FIRE) Database Support Study

Rosettex Partner: Gartner
Sponsoring Agency: NGA



This IA&E study assisted the NGA Frontiers Office in selecting the underlying database for the FIRE system. The project's final report recommended database management systems technologies to maximize the operation of the FIRE database in terms of data entry, reliability, maintainability, accessibility, cost, and risk. *This activity was completed in July 2003.*

Integration of Geospatial Analysis and Visualization Tools with WISDOM

Rosettex Partner: BBN
Sponsoring Agency: NGA



This project integrated the geospatial analysis tools and visualization aids of the BBN OpenMap™ toolkit to provide time-location history, geo-political entities, geographic features, attributes and imagery. The WISDOM tool, integrated by Orincon Sygenex (now part of Lockheed Martin Corporation), provided local data mining, link, and pattern analysis tools for counter-terrorism applications. The resulting combination of OpenMap™ and WISDOM enhanced the user's ability to identify potential terrorist threats in a geospatial context with no cost increase to the end user community. Since the OpenMap™ software has been distributed via an Open Source Software (OSS) license, it supports other Community users as well by providing a common capability that can be easily integrated in any number of operations support capabilities. *This project was completed in November 2003.*

Assessment of Current and Emerging Commercial Multi-INT Fusion Technology

Rosettex Partner: Gartner
Sponsoring Agency: NGA



This IA&E study investigated commercial tools, technologies, techniques in data mining and analytics, and metadata and normalization tools, as employed in non-defense applications such as business, finance, medicine, and manufacturing. Gartner compiled the information in the report based on literature searches, interviews with industry analysts, vendors and users, and other subject matter experts. The study applied Gartner's "Hype Cycle" analysis methodology to advise on where investments should be made in Multi-INT related technology, and presented taxonomy of metadata. Recommendations were made for best practices, processes, and investment opportunities. The study supported NGA activities aimed at exploiting the synergy or fusion of data and information acquired from multiple sources and in multiple representations to make decisions or take actions. *This activity was completed in April 2003.*

NGA Information Relevance - User Needs Assessment

Rosettex Partner: Syntek
Sponsoring Agency: NGA



This IA&E study performed a user needs assessment of the IC's most critical information relevance needs. Information relevance is central to decision making superiority as it enables the delivery of the most pertinent information when needed in real time. The deliverable from this effort, an Information Relevance User Needs Report, was used as input into the spiral development of the prototype system located in NGA's Geospatial Intelligence Applications Testbed (GIAT) laboratories. This effort was expanded to support JWID 2004 and other Community-wide demonstrations. *This activity was completed in April 2004.*

IED Technology Assessment and Red Teaming

Rosettex Partner: Applied Minds
Sponsoring Agency: JIEDDO



This assessment assisted JIEDDO in adopting weapons systems technologies and strategies that are more anticipatory and less reactive in nature by deepening the understanding of the likely evolution of technology-countermeasure competition. In this effort, Applied Minds supported the sponsor's Technical Gaming Team Process by conducting classic "red teaming" of technologies and systems under development for fielding. This work has resulted in the assessment of a wide range of counter-IED (C-IED) systems. In all, 23 initial assessments were done on 22 separate systems. The assessed systems covered all categories in the C-IED taxonomy, with the largest number being in the Active-Disruption category. *This activity was completed in May 2009.*

Information Relevance Technology

Rosettex Partner: ObjectFX, Saffron
Sponsoring Agency: NGA



Information relevance is central to decision making superiority. Commercial industry already selectively applies tools and methods to produce measurable benefits for decision makers across their enterprises. The premise of this project was that these same technologies provide measurable increases in the relevance of information being sent to or accessed by intelligence analysts, warfighters, national security policymakers, and others in the lifecycle of defense related information. This project established an Information Relevance Prototype in a geospatial context to serve as a framework for evaluating commercial capabilities including indexed and associative data mining and information management methods such as knowledge management, content management, and customer relationship management, with metrics for relevance. The prototype was subsequently evaluated and integrated into multiple DoD/IC environments for further application specific testing and evaluation. *This project was completed in March 2005.*

Collaborative Production Technology Assessment

Rosettex Partner: BearingPoint, Virginia Tech
Sponsoring Agency: NGA



Congressional inquiries have openly confirmed that the lack of collaboration across the IC contributed directly to a lack of national preparedness. Within the context of the National System for Geospatial Intelligence (NSG), there is a critical need for producers of geospatial intelligence (GI) to effectively collaborate across the NSG enterprise in real- or near real-time. In order to enable a transformation of the collaborative business processes within the IC, it is necessary to understand GI workflow collaboration objectives with respect to the analysis activities of the DoD/IC. This study, conducted by BearingPoint (now part of Deloitte Consulting) and supported by Virginia Tech, addressed the representation of a collaborative GI production environment and the tools needed to add value to various intelligence products. The report also addressed the management of the change process, including the tracking of change agents, storing products at various stages, and notifying relevant participants of their roles and responsibilities within the production process. The collaboration tools supported the processing of geospatial data, including imagery, inter-process communications, and work products of a wide variety of data types. *This activity was completed in March 2004.*

GIAT Multi-INT Prototype

Rosettex Partner: SPADAC, Inc.
Sponsoring Agency: NGA



The NGA Geospatial Intelligence Advancement Testbed (GIAT) is engaged in a number of projects supporting Multi-INT analysis using SIGINT and GeoINT. A key NSA project focused on developing advanced Multi-INT analytic tradecraft using analysis of massive amounts of metadata is Project Fossway. Engaging a multidisciplinary and co-located government and contractor team of highly trained geospatial analysts and technologists, its mission is to develop and implement innovative interdisciplinary strategies that narrow the search space for key terrorism-related and other targets. Fossway employs a wide variety of tools, technologies, and academic disciplines to accomplish assigned tasks, and has enjoyed significant success in developing business processes and technology, and in performing multidisciplinary analysis to drastically improve the probability of locating terrorism-related and other targets and areas of operations. The objective of this project was to support the warfighter by using the Fossway capability to provide next generation prototype intelligence products focused on specific problems and areas of interest to guide the allocation of limited resources in the search for terrorist targets. This effort also continued the development of methods and tools that improved the efficiency of the analysts and enhanced the accuracy of identification of "hotspots" or precise areas of target activity. *This project was completed in March 2008.*

Analytic Wargaming Environment (AWE) Technology Prototype

Rosettex Partners: BearingPoint, Edge Technologies, Oberon



The Analytic Wargaming Environment (AWE) Technology Prototype (ATP) was designed to enhance analytic processes through wargaming. Success from traditional armed forces wargaming included tactical and operational awareness, coordination and training, and process improvement with specific warfighting superiority results. With similar interest, this ATP serves the analytic community beginning with NSA to achieve the benefits of wargaming. In support of this project, BearingPoint (now part of Deloitte Consulting) gathered collaborative perspectives from senior analysts and wargaming practitioners on the utility of applying gaming to analysis, and surveyed related off-the-shelf technical capabilities. The subsequent development and integration efforts of the ATP by Edge and Oberon achieved an infrastructure that would ensure that NSA analysts could apply their tradecraft within their normal working environment while participating in wargaming for process improvement. NSA continues to mature the capability in its production environment. *This project was completed in October 2005.*

TechData Reuse Across Information Linked Systems (TRAILS)

Rosettex Partner: Ecosystems
Sponsoring Agency: NGA



This IA&E activity provided a technology assessment of Ecosystems' commercial product capabilities as a potential solution to support a shared data environment for NAVSEA's electronic Performance Support System (ePSS). A technology assessment team evaluated concepts for a shared data environment for ePSS, as embodied in an initial prototype developed and demonstrated by Ecosystems. The result of this activity was an assessment of Ecosystems' capabilities as a core technology supporting technical data reuse within the NAVSEA ePSS environment. *This project was completed in November 2005.*

Crosspoint Collaboration User Needs and Tech Assessment

Rosettex Partner: University of Virginia
Sponsoring Agency: NGA



The University of Virginia designed a web-based, next-generation collaborative environment called Crosspoint. Based on a service-oriented architecture, it allows a user to describe a problem, define the information end-states needed to resolve the problem, and efficiently locate subject matter. Collaborators then form virtual short-term crisis action teams or longer-term communities-of-interest teams to pursue a solution. An operational Crosspoint environmental analyst assists such teams in locating and acquiring data and information, performing analyses and developing products and visual presentations. The environment preserves informational artifacts to permit after-action reporting, follow-on testing, and situation monitoring. The project leveraged lessons learned from successful social networking sites, assessed the vision and requirements, performed a market and technology review, prepared the system design document, and demonstrated proposed back-end services for the Crosspoint environment. *This activity was completed in January 2009.*

Analyst Knowledge Capture



Rosettex Partners: Carnegie Mellon University (CMU), Computer Science Dept.
Sponsoring Agency: ODNI/IARPA, VACE Program

The Analyst Knowledge Capture project developed an integrated oral history system based on CMU's unique Informedia technology to capture intelligence analyst derived information, extend it with automatically derived metadata, preserve it, and make it accessible and useful for subsequent review and interrogation. The base technology, Informedia, supports combined speech, image and natural language understanding to automatically transcribe, segment and index linear video for intelligent search and image retrieval. The project sought to improve the dynamic extraction, summarization, visualization, and presentation of distributed video, automatically producing "collages" and "auto-documentaries" that summarize documents from text, images, audio and video into one single abstraction. The project used feedback from analysts to create greater end-user benefit and to improve user interfaces according to best human computer interface practices. *This project was completed in November 2008.*

Digital Technology Infrastructure (DTI) Projects

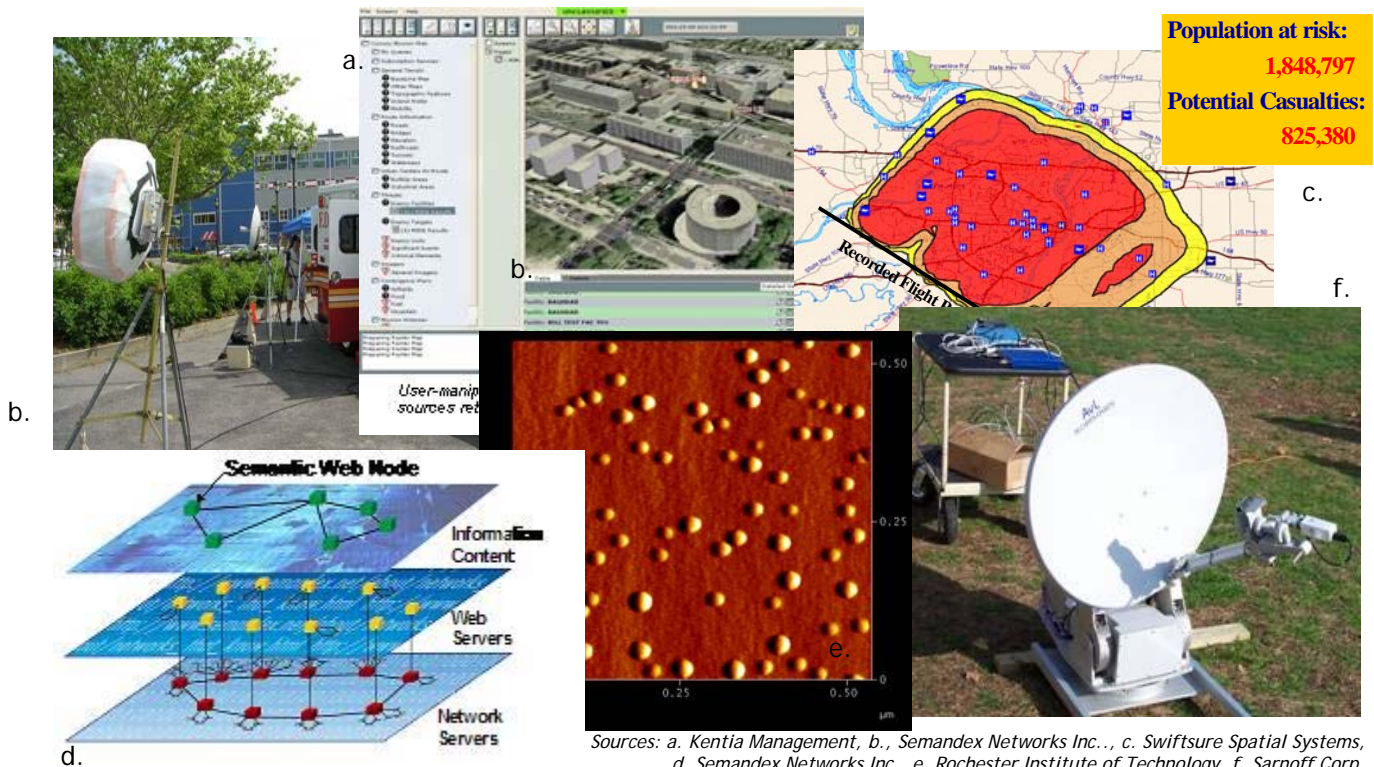
The focus of the DTI initiatives was to discover and accelerate the development of commercial digital infrastructure technologies such as telecommunications, storage, and computing to meet near-term and future defense and intelligence systems requirements. Specifically, DTI projects address emerging and future distributed computing and communication technologies that will facilitate revolutionary approaches in designing and building future Defense and Intelligence systems. DTI technical challenge areas included:

Deployable Command and Control - Engineer, implement, and transition into operational use technologies that provide significant capabilities for distributed and deployable command and control, targeted to Joint Task Force Commanders.

Mobile GeoINT Dissemination - Provide effective access and rapid dissemination of intelligence data to mobile first responders and national users including technology for devices, architectures, communication techniques, and integration of these elements into operationally relevant environments. The overall goal is to provide a broad range of operational and intelligence data to mobile users in urban environments. Intended users include civil emergency response personnel, Homeland Security, intelligence analysts in the field, Special Operations and DoD components.

Digital Asset Management, Storage and Display - Provide timely access to large volumes of information in diverse environments. As data collection platforms increase in number and become completely digital, the ability to manage these digital assets, access them in real time, and take direct tactical action become paramount. Improved technologies to access and display vast amounts of information in tactical environments are also in great demand by Government users.

Materials, Micro-electronics and Nanoscience - Support DoD/IC interests in properties of materials to support revolutionary advances in key infrastructure components such as storage, telecommunications, networking, computer processing, and displays, to include micro-electronics and nanoscience. The emergence of materials and nanotechnology as a major science and technology research topic has sparked substantial interest byfrom the intelligence communityIC because of their potential uses in intelligence operations, and threats if used by adversaries.



Sources: a. Kentia Management, b., Semandex Networks Inc., c. Swiftsure Spatial Systems, d. Semandex Networks Inc., e. Rochester Institute of Technology, f. Sarnoff Corp.

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Deployable Command and Control

Information Services on a Semantic Network

Rosettex Partner: Semandex Networks Inc.
Sponsoring Agency: NGA, USMC



Semandex demonstrated the utility of XML-based content routing system enhancement of command and control systems by delivering timely, accurate, and complete information across echelons. Data was accessed from a variety of service and intelligence databases and was fused with responses to operator queries to translate the disparate data into actionable information for collaborative planning, course-of-action analysis, and preparation of logistics and deployment estimates. The routing system was deployed on CONUS classified networks, and was demonstrated across an international coalition network for Joint Warrior Interoperability Demonstration 2003 (JWID-03). It was then deployed with Marine Corps units supporting Operation Iraqi Freedom. *This project was completed in December 2004.*

Marine Expeditionary Force Intelligence Analysis System (MEF-IAS) Semandex Technology Transition Initiative Program

Rosettex Partner: Semandex Networks Inc.
Sponsoring Agency: USMC



An outstanding operational requirement for the Marine Expeditionary Force Intelligence Analysis System (MEF-IAS) is to provide operators fully integrated access to locally produced tactical intelligence, along with theater and national intelligence for the Network Operations CONOPS. To address this requirement, the MEF-IAS Program selected the MarineLink system developed by Semandex Networks Inc., under the Information Services on a Semantic Network NTA project. This system prototype supports the Rapid Response Planning Process (R2P2). Initial integration of the prototype into a realistic environment was completed in late 2003, with positive results. The Marine Corps System Command subsequently accelerated the Fleet User Evaluation (FUE) testing process. The First Marine Expeditionary Force (I-MEF) in Iraq conducted the FUE, and generated requirements for operational enhancements to feed a continuous spiral development effort. During the I-MEF FUE, the technology has demonstrated that it can dramatically reduce search time for intelligence and course of action analysis and development. This project supports additional deployment of the prototype system to other Marine Expeditionary Forces during the transitional period, until the US Marine Corps assumes operational fielding of the system in 2007. *This project was completed in April 2007.*

Robust Adaptive Platform to Optimize Responsiveness (RAPTOR)

Rosettex Partners: Sarnoff, Semandex, GTRI
Sponsoring Agency: NGA



The Robust Adaptive Platform Technology for Operational Response (RAPTOR) program delivered a capability to allow multiple decision makers in a Joint Task Force command environment to achieve and maintain customized battlespace situational awareness from a common operational database, regardless of their physical location. RAPTOR technologies have transitioned into operational programs such as Deployable Joint Command and Control (DJC2). *This project was completed in June 2003.*

Deployable Joint Command and Control (DJC2)

Rosettex Partners: Sarnoff, SRI, Semandex, ISPA, Kentia, ATINAV, GTRI, LinkTank, OSSI
Sponsoring Agency: US Navy



The DJC2 Program is an effort to field modular, expandable, deployable Joint C2 Headquarters for use by regional combatant commanders and Joint Task Force (JTF) commanders. During Phase I, the NTA provided industry-based system engineering and integration support to the CSS DJC2 Joint Program Office (JPO). For Phase II, the NTA provided technology assessments, specialized expertise in emerging technology, and technology insertion approaches for the DJC2 program. *This project was completed in August 2005.*

Transition Plan - Communications Programs

Rosettex Partners: Sullivan-Haave, Syntek, Sarnoff
Sponsoring Agency: OASD-NII

Sullivan-Haave



This project supported the development of a comprehensive communication program transition plan leading to a DoD-wide packet-switched IP network capability. The project surveyed DoD terrestrial and satellite communications programs to collect their technology baselines, schedules, and resources. The final report provided a series of time-phased recommendations, some of which were adopted by the Assistant Secretary of Defense, Network and Infrastructure Integration (OASD-NII). *This project was completed in March 2004.*

SATCOM on-the-Pause and on-the-Move Terminal Development

Rosettex Partner: Sarnoff
Sponsoring Agency: NGA



USSOCOM has a standing requirement for substantial bandwidth operating at 384 Kbps and higher to support command and control to the most forward areas on the battlefield virtually anywhere in the world. The proliferation of Small News Gathering (SNG) terminals has shown promise for use within USSOCOM. These systems are currently available in two case configurations that must be unpacked and set up prior to accessing the satellite. This project completed the first phase of a larger DoD effort by using the basic technology described and repackaging it into a small, vehicular mounted system to eliminate the requirement to unpack and set up a terminal system. The resulting prototypes were used by USSOCOM to develop procurement standards for operational units and are in use today by the US Army to support exercises. *This project was completed in December 2004.*

SaffronWeb Technical Assessment

Rosettex Partner: Saffron Technologies
Sponsoring Agency: NGA



The SaffronWeb product, including information relevance capabilities developed under a separate NTA project, was evaluated in two environments: (1) the DoD/IC Research and Development Experimental Collaboration (RDEC) and (2) the NGA prototyping environments. One of RDEC's significant objectives was to introduce the IC to new, advanced software technologies that could improve the efficiency and effectiveness of intelligence processes. To help expose the software technology within the IC, RDEC created a set of processes to help it move from a loosely constrained unclassified test environment into a classified experimental setting with real users and data. Within NGA, SaffronWeb was evaluated for use in sensor performance analysis and planning in support of Tasking, Processing, Exploitation & Dissemination (TPED) applications. In both environments, users/user systems interacted with SaffronWeb as part of, or in parallel with, their normal workflow. Users assessed the performance of SaffronWeb against a pre-defined set of metrics and reported on its performance. These results were then evaluated as part of a longer-term effort to quantify the value of this tool for analysts and other users. *This activity was completed in December 2005.*

SOCOM Needs and Technology Assessment (SONATA)

Rosettex Partner: K3 Enterprises
Sponsoring Agency: NGA



SOCOM continually evaluates technologies with potential for rapid deployment to meet the critical needs of operational forces. This activity supplemented SOCOM and associated operational elements with advanced technology assessments across the set of user needs identified by SOCOM in support of their primary operational missions in the areas of wireless communications solutions, energy propagation for communication and other purposes, information technologies, C4ISR, biometrics, and technology performance and suitability for specific operational scenarios. *This activity was completed in December 2006.*

Caleb II

Rosettex Partners: K3 Enterprises, Saffron Technology,
Basis Technology, Horizontal Fusion

Sponsoring Agency: Combating Terrorism Technical Support Office
(CTTSO)



Caleb II addressed the Central Command (CENTCOM)/Joint IED Defeat Organization (JIEDDO) priority for US and Coalition partner warfighters to obtain the ability to decide and act at the tactical level to kill, capture, or exploit insurgent targets directly or indirectly involved in Improvised Explosive Device (IED) activity. Exploitation must be done prior to actual IED attacks, at the time of our forces' choosing. The project's objectives were to: (1) deliver prototypes of capabilities supporting the Caleb-II Associative Targeting Fusion Cell ("AT Cell"), (2) provide prototypes of new, computer-based training modules for disconnected sustainment training in the field, and (3) provide coordination, planning and integration functions across the various Rosettex partners, forward-based units exercising the operational test of the prototype capabilities, the prototype system integrator, and the sponsor community. The project combined the investment of the US Special Operations Command (USSOCOM), the Army Rapid Equipping Force (REF), the Naval Post Graduate School, and the US Special Warfare Center and School in addressing the critical problem of stopping IED attacks. *This project was completed in September 2009.*

Transition of Semantic Web Network to DoD Commands

Rosettex Partner: Semandex Networks Inc.



Semantic web networking is an XML-based content routing system that enhances Command and Control by delivering more relevant and complete information from across Intel Community and Operational databases in real time. OSD/TTI funded the NTA transition of the Semantic Web Network to the US Marine Corps in 2005 as "aXiom" and, based on the success of the Marine Corps with this technology, an additional transition to the US Army and Special Forces was ordered. This project supports the evaluation of the aXiom Semantic Web Network as part of an experimental cell at Ft. Bragg, NC, with transition paths to Special Forces and US Army operational units in-theater. Fielding of the aXiom capability was accomplished by the Caleb II program. *This project was completed in June 2008.*

Mobile GeoINT Dissemination

Smart Dissemination Networks User Needs and Policy Alignment

Rosettex Partner: Kentia Management Group, Potomac Institute

Sponsoring Agency: NGA

Kentia Management Group



This activity supported the DTI Smart Dissemination Networks Project. Exercises and studies gained an understanding of critical user needs and policy impacts and interactions. Under this activity, the NTA conducted a Command Post Exercise in early 2004 at the University of Missouri that explored policy impacts on operations and requirements in a homeland security emergency context. The tabletop exercise simulated two bioterrorism attacks and one explosive event occurring simultaneously in Missouri and Kansas, examined the reactions of federal, state, and local authorities, determined where policy issues were evident, and made recommendations for corrective actions to the issues. *This activity was completed in December 2004.*

Scatterable Media Technology Assessment

Rosettex Partner: Gartner

Sponsoring Agency: NGA



This IA&E study provided USSOCOM with novel ideas for integration of COTS/GOTS capabilities to satisfy their operational need to disseminate information into denied territory. The study described an integration approach, outlined anticipated contributions to Psychological Operations (PSYOP) mission, and estimated the overall costs for up to a three-year effort. *This project was completed in December 2004.*

Smart Dissemination Networks Infrastructure for Urban Emergency Management

Rosettex Partners: Thirteen/WNET, Sarnoff, EDS,
KenCast, Grey Island, Asgard, SMI Defense, NextNet,
TeraLogics
Sponsoring Agency: NGA



The Smart Dissemination Networks Project initiated a robust program during in 2003 to address some of the difficult technology and policy issues involved in Emergency Incident Communications. The technology part of this program prototyped a two-way wireless broadband communications capability building on licensed television spectrum and equipment. During the first phase of the program in FY03, Smart Nets implemented a custom, line-of-sight communications capability to vehicles. In the second phase in FY04, this was replaced by a commercial "WiMax-ready" (802.16e) capability as the communications backbone, providing non-line-of-sight connectivity to mobile vehicles and responders, including reliable two-way video from vehicles and handheld units to and from the command center. Additional applications running over this backbone included Automatic Vehicle Location and Tracking, Incident Command applications requested by users, and remote connection and incident management from New York to a site in Washington using the Defense Information Systems Agency's (DISA) Global Broadcast Service (GBS). The New York Police Department (NYPD) and the Fire Department of New York (FDNY) in New York City tested this capability for operational use as part of the follow-on GUARD program. *This project was completed in July 2005.*

GUARD Program Geospatially-Aware Urban Approaches for Responding to Disaster

Rosettex Partners: Thirteen/WNET, Raytheon, NextNet Wireless, Inc.,
KenCast, Inc., Grey Island Systems International, Inc.,
Cranite Systems, TeraLogics, Open Geospatial Consortium, Inc.,
Penn State University Applied Research Laboratory
Sponsoring Agency: NGA



From 2003-2007, the GUARD Program prototyped an increasingly mature two-way, mobile broadband capability for emergency responders using commercial communications equipment and spectrum licensed to public broadcaster Thirteen/WNET New York. Experience shows that within a typical emergency response region there will be a number of distinct implementations to serve the local responders' needs. The GUARD philosophy is that a set of nationally connected, regionally-based capabilities provides the best approach to link independent implementations for a comprehensive emergency response. For the GUARD Program, the Rosettex team built directly on the prior Smart Dissemination Networks demonstration prototype in New York City, both as initial operational prototype for the city, and as an implementation model, demonstration, and test capability for the nation and local communities across the country. GUARD operates on a model of information sharing in a distributed, heterogeneous communications environment. The resulting prototype system opened communication from a remote command center via satellite, through a terrestrial wireless hub to mobile vehicles and dismounted users with standard laptops and hand held PDAs. Demonstrated applications included two-way video and data, location-based information retrieval, and distributed command and control. The capability has been transitioned to operational use in New York City. Activities to expand this nationally relevant, regional model to other communities have resulted in a second prototype effort in St. Louis, MO, a demonstration in Las Vegas, NV, and discussions with groups in the state of Mississippi for additional deployment. As a result of these efforts, the GUARD/Smart Nets architecture is positioned as a nationally relevant, regional model for emergency response. *This effort was completed in May 2007.*

Software Defined Radio Technology Assessments

Rosettex Partner: Sarnoff
Sponsoring Agency: NGA



NTA partner companies have been actively involved in Software Defined Radio (SDR), and specifically the Joint Tactical Radio System (JTRS). Sarnoff has played a leadership role as technical advisor to the Deputy Assistant Secretary of the Navy (DASN/C4ISR) for the Maritime Cluster (Cluster 3) of JTRS. Time-critical studies have led to innovative and novel ways to leverage commercial and consumer technology for JTRS, and have identified critical technical risks and mitigation approaches for Cluster 3 of JTRS. A particularly important question for the JTRS program was the technical feasibility of combining Cluster 3 (Maritime) and Cluster 4 (Airborne), and whether this combination could achieve technical synergies and savings for the Government. The technical study conducted under this task identified the potential set of common core components and helped justify the merger of these two program clusters. *This project was completed in March 2004.*

PSYOP Handheld Device Evaluation

Rosettex Partner: K3 Enterprises
Sponsoring Agency: SOCOM



This project evaluated the use of both commercial wireless handheld devices customized to the needs of deployed SOCOM PSYOP forces, and the organic communications resources to coordinate with operational command headquarters. The commercial handheld devices, which utilize the full Windows XP Operating System with over 20GB removable hard drive space, fit into an ammunition pouch and weigh less than one pound. Communication resources consisted of a vehicle-mountable rack deployed as the base station using secure WiFi to the handheld device, wireless reachback from the vehicle to a fixed site using WiMax technology, and a reachback link from the fixed site to Headquarters via either satellite or WiMax link. Testing was conducted at the Naval Postgraduate School (NPS), used existing reachback communications capability there. Rosettex contracted with a delivery team to provide the equipment, integration, and support, and also set up an evaluation team to work in close cooperation with SOCOM PSYOP to establish setup and test plans, conduct tests at the NPS, and select a device type to go forward in pre-operational field trials to be conducted by SOCOM PSYOP personnel. *This project was completed in May 2007.*

PSYOP Prototype Operational Test & Evaluation

Rosettex Partner: K3 Enterprises, Western DataComm
Sponsoring Agency: SOCOM



Psychological Operations or PSYOP teams currently embedded with operational forces must rely on capabilities of the operational force for communications and they have no mobile secure computing devices to support PSYOP-specific applications. The result has been poor communication with occasional negative consequences in terms of understanding or delivery of approved PSYOP messages. This project employed commercial off-the-shelf (COTS) technology in a prototype configuration specifically designed for PSYOP use to deliver direct organic communications and the ability to run a full suite of PSYOP-specific applications in mobile handheld devices. This capability had been developed in a prior project phase executed via NTA and was ready for technical upgrade, resolution of identified technical issues, and prototype operational tests (TRL 7). Three major issues were addressed: (1) direct PSYOP communication and access for deployed personnel, (2) near-term availability, and (3) full capability devices. The project updated candidate handheld devices and organic reach-back capability to correct previously identified technical issues, expanded the capability of the system to support additional operational requirements such as cryptographic protection, and conducted additional testing, leading to prototype operational testing in the field. The final activity included a formal Military Utility Assessment (MUA) and an interim Technology Demonstration. *This project was completed in November 2008.*

Image Processing Architecture in Support of Mobile Users with Limited Support Technology (Mobile IPA)

Rosettex Partner: University of Virginia (UVa)
Sponsoring Agency: Disruptive Technologies Office



This project explored a range of technology options available to address the specific information content needs of warfighters equipped with minimum technology support capabilities from enterprise systems. To accomplish this goal, two technical problems were investigated: (1) technologies to convert user services that require too much processing to less processing-intensive solutions, and (2) technologies that reduce the communications capabilities required from users. To address these issues, the University of Virginia Systems Technology Integration Laboratory (STIL) infrastructure was used to design and prototype software for computing utility functions and specialized image processing functions. The system configuration of the STIL permitted initial experimental work to serve as a first proof of concept. *This project was completed in August 2007.*

Emerging Wireless Technologies (EWT) Technology Assessment

Rosettex Partner: Virginia Tech
Sponsoring Agency: DTO



This study examined the state-of-the-art of wireless communications with particular attention to national and international commercial standards for security issues, and potential concepts of operation as they pertain to the problem of disseminating national intelligence data and information to the modern warfighter. A key objective of this effort was to produce technology roadmaps describing in detail the direction of modern wireless communications technologies in the near term (next 3 years) and midterm (3-5 years), with a clear indication of those technologies and associated standards that have the greatest potential for increasing the timeliness, reliability, usability, and relevance of the national intelligence data and information disseminated to the modern warfighter. *This assessment was completed in April 2007.*

Prototype For Rapid Dissemination of Imagery to Support Hurricane Response

Rosettex Partner: Pixia Corporation
Sponsoring Agencies: NGA, USGS



The U.S. Geological Survey (USGS) has provided public access to imagery data sets through an FTP server and through the USGS Emergency Response Hazards Data Distribution System (HDDS). Although these delivery mechanisms have met the basic needs of many data users, they have yielded less than optimal results in terms of ingest time, user performance, and scalability. An immediate need existed for the development of a faster and more user friendly interface that could effectively support the broad suite of geospatial data products required by the growing response community. Pixia Corporation has developed a commercial digital imaging solution that focuses on rapid storage and retrieval of images for end user access. The technology provides a fast response time for viewing large amounts of geospatial data both locally and via a web service, and addresses the improvements required by the USGS to better enable emergency responders to receive and view data quickly. This project assessed and documented performance of the Pixia commercial solution in the USGS HDDS environment. The NTA supported this project to gain insight into potential military persistent surveillance applications of the Pixia solution for the NGA. *This project was completed in May 2007.*

JEM Tactical Radio Technology Assessment

Rosettex Partner: K3 Enterprises, Inc., LVC Corporation
Sponsoring Agency: USSOCOM-SOAL-PMC3, PM Radio Systems



This IA&E effort assessed the embedded Blue Force Tracking (BFT) function in the new commercially produced Joint Tactical Radio System Enhanced Multi-Band Integrated Tactical Radio (JEM) to determine if it has direct military utility for operational use or requires modification to be acceptable. A Limited User Test (LUT) was conducted at Ft. Bragg, NC in a realistic scenario environment with evaluators employing the BFT-enabled JEM in simulated tactical vignettes, including Mobile Reconnaissance, Point Reconnaissance (on foot), and Actions on Objective (insertion, DA raid, and extraction). The results of this effort were used by USSOCOM to develop transition paths for incorporation of the radio in operational use. *This assessment was completed in September 2008.*

COASTS White Cell Assessment

Rosettex Partner: K3 Enterprises
Sponsoring Agency: Naval Postgraduate School



The Cooperative Operations and Applied Science & Technology Studies (COASTS) Program is a Naval Postgraduate School (NPS) test and evaluation program. COASTS assesses both NPS and third party prototype weapon systems technologies in realistic exercise environments to meet mission needs as defined by collaborating US military commands. In support of COASTS, this activity provided independent technology and user needs assessment support and technical guidance for future COASTS prototyping roadmaps by leading the assessment control cell (known as "White Cell") for COASTS experiments in Thailand. Assessments focused on technologies including BioRAPIDS (biometric capability) and Flexible Architecture Sensors and Topology License Plate Recognition (FAST LPR). Deliverables from this effort included after-action technology and user needs assessment reports and recommendations. *This project was completed in October 2008.*

Digital Asset Management, Storage and Display

Long-Term Imagery Archiving Roadmap

Rosettex Partner: BearingPoint
Sponsoring Agency: NGA



As new collection systems come on-line, they will provide orders-of-magnitude increases in the amount of imagery information NGA must manage. NGA requires concomitant orders-of-magnitude improvements in the underlying data storage technology supporting the USIGS holdings. Most images are currently held on tape, and it appears that key vendors will exit the field and that archival data will have to be migrated to new media. This BearingPoint (now part of Deloitte Consulting) study helped NGA to proactively address its data archival needs through evaluation of COTS image archiving solutions and examination of the various solutions that may be applied to NGA's data. *This activity was completed in July 2003.*

Pixel Processor Study

Rosettex Partner: PriceWaterHouseCoopers
Sponsoring Agency: NGA

PWC CONSULTING

A business of PRICEWATERHOUSECOOPERS

This study, conducted by the Price Waterhouse Coopers Consulting Group (now part of IBM Consulting), evaluated available commercial pixel processors against requirements for holographic storage devices and provided recommendations regarding purchase and/or development of a pixel processor to support the InPhase holographic storage device development. *This activity was completed in September 2002.*

Holographic Data Storage Media and Peripheral Development

Rosettex Partner: InPhase Technologies
Sponsoring Agency: NGA



InPhase Technologies' holographic storage systems promise to deliver capabilities that far exceed those of current storage technologies. InPhase has developed a high capacity, high transfer rate holographic data storage system for data archival and professional video uses. The NTA supported development that implemented automated manufacturing methods for producing holographic recording media. The outcome of this effort was a commercial process for holographic recording media produced via a process capable of being scaled to high-volume. The storage capacities and data transfer rates of the InPhase systems enter the market where the performance of traditional optical technologies leave off and continue with a growth path that serves the storage needs of the 21st century. A follow-on effort developed an interface between the holographic storage system and a host system, optimized the storage system's performance for data archival applications, and minimized the effort required to integrate the drive into the storage architectures. InPhase began to market the holographic storage system in 2005. *This project was completed in September 2004.*

Asynchronous Data Delivery and Updating System (ADDUS)

Rosettex Partner: SRI International
Sponsoring Agency: Defense Intelligence Agency



The concept behind ADDUS arose from end-user complaints about the complexities, difficulties, and level of effort required in updating data on their local tactical workstations. DOD systems frequently have several data files originating from multiple organizations that are updated on different schedules and are made available to users via different means. In operational surveys, users consistently identified the need for the capabilities similar to COTS products, such as anti-virus packages, tax preparation programs, and the Windows operating system, to immediately distribute data and software updates across the globe without requiring direct user involvement. ADDUS implemented the proven commercial update paradigm in a manner tailored to the unique complexities of DOD, distributing files in any data format with specific differencing algorithms tailored to the data type. This project packaged existing government ADDUS capabilities as a commercial-like product such that the server and client can be installed and configured by a typical system administrator without developer involvement. *This project was completed in February 2009.*

Data Retention and Processing Strategies

Rosettex Partner: Center for Innovative Technology
Sponsoring Agency: IOMG



Rosettex and Virginia's Center for Innovative Technology (CIT) sponsored, organized, and led a study of current and emerging storage technologies, evaluating their utility to meet Intelligence Community objectives. This included identifying leading edge storage researchers, developers, experts and consultants and inviting them to participate in a highly-focused storage exploitation tools workshop. Rosettex and CIT summarized the results of the workshop and developed a set of recommendations for the project sponsor's Storage Exploitation Roadmap for very large storage retention and processing demands anticipated in the 2010-2012 time frame. *This activity was completed in November 2007.*

Display Monitor Evaluation and Assessment

Rosettex Partners: Sarnoff, United States Display Consortium (USDC)
Sponsoring Agency: NGA



Under this IA&E activity, Sarnoff and USDC assisted NGA and its clients in the selection and testing of monitors to determine the displays that could be certified for Community analysis and production workstation needs and collaboration tasks. A series of evaluation reports was delivered to NGA. *This activity was completed in June 2005.*

Display Evaluation for CRT Replacement

Rosettex Partner: Colfax Group
Sponsoring Agency: NGA

Colfax Group

This activity assessed the technology display requirements for replacing current CRT-based units, specifically the inherent human factors for future analysis and broad GeoINT display requirements. It also evaluated specific display devices at NGA sites. The evaluation looked at the most promising existing and emerging display technologies (e.g. LCD, OLED) as part of a focused development with a small number of display technology providers. Newly-developed capabilities or enhancements that resulted from a related prototyping project were evaluated and verified by Rosettex with participation of the NGA. The program developed specific recommendations for suitable CRT replacements that meet future GeoINT requirements of analysts working with NGA and the broader DoD/IC community. *This activity was completed in June 2009.*

Materials, Micro-electronics and Nanoscience

Flexible Organic Electronics Technology Assessment

Rosettex Partner: CACI
Sponsoring Agency: NGA



The commercial marketplace has directed much research into flexible organic electronics technologies that provide active control circuits for organic light-emitting diodes (OLEDs) in flexible displays. DoD wanted to expand this research to examine the potential for flexible organic electronics that go beyond this application area and achieve flexible, printable memory and microprocessors. This study aided in guiding investments by identifying the technology gaps in the organic electronics industry research that must be filled for DoD to develop more advanced flexible organic electronics applications. In the long term, the resulting report will help determine the viability of organic electronics to support an even greater number of critical technologies in the information assurance field. The IA&E study included an investigation focused on understanding material interactions, as well as research and development conducted by commercial semiconductor ink manufacturers for higher mobility inks. *This assessment was completed in September 2006.*

Nanostructured Space Photovoltaics: Quantum Dot Enhanced Advanced Multi-Junction Space Solar Cells (NanoPV)

Rosettex Partner: Rochester Institute of Technology
Sponsoring Agency: NRO



The new satellite intelligence and surveillance systems put tremendous pressure on power systems designers. The ability to make satellites smaller, with more functionality, while maintaining view factor severely constrains the necessary photovoltaic (PV) arrays. These conditions put a premium on absolute solar cell efficiency. To meet these needs, this effort proposed to use nanostructured approaches for the development of the next generation of high efficiency PV solar cells for space. The overall objective of the program was twofold: (1) incorporate nanotechnology in state-of-the-art photovoltaic devices to provide a near-term power conversion efficiency improvement and (2) leverage the activities performed in the first area to enable the demonstration of ultra-high efficiency intermediate band solar cell (IBSC) photovoltaic devices. Ultimately, the effort demonstrated a triple junction InGaP/GaAs/Ge solar cell with InAs quantum dots with a significantly increased efficiency. The technology is easily transferable to commercial solar cell vendors and increases the efficiency of the solar cells they produce. *This project was completed in August 2009.*

Interactive Parallel Computing in Support of Research

Rosettex Partner: Mathematical Sciences Research Institute (MSRI)
Sponsoring Agency: Disruptive Technologies Office



Rosettex and its partner, MSRI, brought together a diverse group of world-class mathematical researchers and students to assess the current state of practical parallel algorithms that support interactive research in algebra, geometry, and number theory, and to suggest ways forward for their study and formulization. Discussions covered new algorithms to exploit parallelism, specific problems likely to benefit from dramatic speedups from parallelism, and strategies to encourage implementation of these ideas. *This assessment was completed in February 2007.*

NanoBiotechnology for Defense Applications Workshop

Rosettex Partner: University of Maryland, College Park
Sponsoring Agency: ODNI/IARPA



In November 2007, the NTA, together with IARPA, the University of Maryland and the Naval Research Laboratory conducted a two-day workshop exploring Nanobiotechnology for Defense Applications to serve as a venue for the planning of future IC investments in this area. This interdisciplinary workshop brought together individuals from academia, government, and industry to discuss the latest developments in nanobiotechnology. The workshop featured plenary presentations from esteemed scientists on a broad range of topics including smart materials, autonomous systems, sensors/actuators, bio-inspired energy, and bio-device interface. A report and technology development roadmap summarized the proceedings and recommendations from workshop. *This project was completed in March 2008.*

Single Wall Carbon Nanotube Electrodes

Rosettex Partner: Rochester Institute of Technology (RIT)
Sponsoring Agency: NGA



This project demonstrated the exploitation of the remarkable electrical and physical properties of Single Wall Carbon Nanotube (SWNT) Electrodes in the production of electrodes for chemical energy conversion applications. The project leveraged the ability of RIT's NanoPower Research Lab to produce extremely high quality materials and utilize their first-class characterization facilities to: (1) perform a detailed set of calibrated experiments for measuring the lithium storage capacity and ultimate charge/discharge rates of high purity "Buckey" paper electrodes in a lithium ion battery, and (2) examine the suitability of these same electrodes as gas diffusion media in a PEM fuel cell. *This project was completed in June 2007.*

PERIODIC Phase II Workshop

Rosettex Partner: University of New Mexico
Sponsoring Agency: ODNI/IARPA



The PERIODIC Phase II Workshop analyzed and reported on the theory, methodology and technology requirements to optimize, simulate, design, and fabricate a beta prototype, integrated, optical-digital, low profile array-based imaging system. The workshop approach included research and development analysis involving mathematical and engineering technology to investigate methods to optimize and fabricate an array camera system with low cost and enhanced re-configurability. The results of the analysis were presented and discussed at workshop events held in the Washington, DC area. The workshop participants included subject matter experts and other project stakeholders from major universities including The University of New Mexico, Wake Forest University, Catholic University of America, and others. *This activity was completed in January 2008.*

CMOL CrossNets Applications

Dr. Konstantin Likharev

Rosettex Partner: Dr. Konstantin Likharev
Sponsoring Agency: ODNI/IARPA

The recent invention of the area-distributed CMOL interface (in which advanced CMOS circuits are complemented by a layer of simple (two-terminal) nanodevices integrated into a nanowire crossbar) makes the practical demonstration of first hybrid integration circuits in just a few years a plausible goal. Recent detailed calculations showed that such hybrid circuits may be the basis of several revolutionary digital systems including terabit-scale memory chips and gigagate-scale logic circuits with unprecedented performance and manageable power consumption. Even larger opportunities are available in the field of mixed-signal neuromorphic networks. Numerical estimates show that such "CrossNet" circuits may become the first hardware capable of challenging the human cerebral cortex in density, far exceeding it in speed and at reasonable power. This project conducted several multi-day workshops with world renowned experts in theoretical neurobiology, machine learning, and nanoelectronics to explore both short- and long-term applications (e.g. complex pattern recognition for artificial vision, intelligent cognitive systems, etc.) for this emerging technology. *This activity was completed in December 2008.*

CMOS/Nanoelectronics Hybrid Proof-of-Concept

Rosettex Partner: Hewlett-Packard Labs (HPL)
Sponsoring Agency: ODNI/IARPA



Semiconductor/Nanowire-InterConnect (SNIC) technology combines silicon complimentary metal-oxide semiconductor (CMOS) elements with a nanoscale crossbar and switch connection fabric to produce an extremely capable hybrid computational system. At the beginning of this effort, SNIC was still mostly a theoretical construct, but several of the components of the technology have now been demonstrated by HPL. The active component density of SNIC is estimated to be at least one order of magnitude higher than that of Field Programmable Gate Arrays (FPGA) built using the same CMOS technology. SNIC may also have significantly lower power dissipation, higher computational throughput, and better tolerance of manufacturing defects in the circuit and transient faults during operation than a same generation FPGA. The project provided a proof-of-concept SNIC electronic circuit by designing, building, and testing two generations of simple SNIC versions, and then demonstrated the viability of the technology to advance the performance of CMOS by the equivalent of three-to-four circuit generations without having to shrink the size of the transistors in the circuit. *This project was completed in September 2009.*

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Rosettex Technology & Ventures Group

Translating Science into Solutions
