Grant Title: **Phase IV: Deploying ESE Pilot Information Programs for State and Local Government in the Northeast, the Education Community and the Commercial Sector**

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1. INTRODUCTION

This *Summary of Research* report is a final report which summarizes significant accomplishments achieved during NASA grant NAG13-00044 entitled "Phase IV: Deploying ESE Pilot Information Programs for State and Local Government in the Northeast, the Education Community and the Commercial Sector", for the period of September 27, 2000 through September 26, 2004. All activities under this grant have been successfully completed.

It has been requested by NASA reviewers that the material contained herein also be considered in view of NASA's twelve national priority areas. During the grant period, the nature of the Earth Science Enterprise (ESE) Application Program has been significantly amended (two major restructurings). These amendments have been reviewed at several meetings, including a national gathering held in Washington DC. Additional meetings have occurred with NASA officials at headquarters and at IAGT offices as the newly emerging programs have become defined.

The work described herein is considered "cross-cutting", meaning that it has relevancy to several of the national priority areas. The time period covered requires that the twelve national priority areas initially articulated by NASA be considered. (Subsequent NASA revision has eliminated "community growth" as a focus area. It is not clear how this area might be treated in the future NASA organizational structure, but it is noted that the work reported herein includes clear potential for application to the previously defined community growth area, as well as most of the other application areas.) As indicated in the accompanying figure, activity reports throughout this report can be "mapped" to the priority areas.

Figure 1. Mapping of Phase 4 Grant Activity to NASA National Priority Areas

	Carbon Management	Public Health	Energy Management	Aviation	Water Management	Homeland Security	Coastal Management	Disaster Management	Agricultural Efficiency	Invasive Species	Ecological Forecasting	Air Quality
Phase 4 Grant Activities	◖	●	●	○	●	●	●	●	●	◖	●	◖

● Indicates direct applicability

◖ Indicates potential applicability with additional effort

○ Indicates no current applicability

2. PROGRESS, MILESTONES AND SCHEDULES

2.1 Cost Center 1: Governmental, State, Local, Regional and Tribal Activity

2.1.1 Support NASA and Formalize Partnerships

The Northeast Affiliates (NEAF) is a group comprised of the GIT coordinators of 14 states, created by RACNE to advance the use of remote sensing and geospatial technologies on a regional governmental scale. These states include Connecticut, Indiana, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont and Wisconsin.

1) Regional Workshops. This task consists of conducting Regional Workshops, and providing support for state-based workshops.

- Two Regional Workshops were successfully completed (Spring 2002, Fall 2004). Both were very well attended. The Spring 2002 workshop was reported on previously. Key themes for the Fall 2004 workshop focused on outreach strategies for application of remote sensing and GIT technologies by federal, state, local and regional governments in homeland security, water resource management and community growth. Workshop attendees numbered approximately 100 and included representatives from: NASA, USGS, NOAA Coastal Services Center, Department of Homeland Security, US EPA, US Department of Housing and Urban Development, FGDC, US Department of Transportation, National Academy of Public Administration, Center for International Earth Science Information Network, all 14 NEAF state representatives, local government representatives from each state, National Association of Counties (NACo), NSGIC and NYC Office of Emergency Management. For the Fall 2004 workshop, RACNE was successful in acquiring funding co-sponsorship from USGS, the NOAA Coastal Services Center and FGDC which was used in addition to NASA grant funds to expand the scope of the workshop.

- State based remote sensing workshops were successfully conducted in each of the 14 NEAF states. The workshops were so successful that many of these states are planning on continuing these workshops on an annual basis.

2) Baseline State GIT conditions.

- Utilizing the 14 state network assembled through the Northeast Affiliates, RACNE continues to collect and share information on status and progress of the application and utility of GIT technologies and data. Quarterly networking teleconferences occur, where such information is updated and lessons learned are shared between the states.

- Each state in the NEAF has completed a remote sensing application project with RACNE. These projects were defined to focus on evaluation of GIT technology for use by state and local governments, and to extend the baseline application of the technology in each state. At the Fall 2004 workshop previously mentioned, each state presented the results of their project in order to share lessons learned and seek opportunities for leveraging each others work.

3) Identification of potential collaborators.

- Over the course of the grant period, numerous collaborations have been created in order to assist the advancement of GIT technologies. These range from government agencies (federal, state and local), educational institutions, professional associations and commercial companies. The impact of these collaborations (and the names of some of the collaborators) is mentioned throughout this report through the conducting of workshops, the execution of GIT application projects, the creation of a certified GIS degree program at Cayuga Community College, establishment of 2+2 degree programs in GIS with regional universities, the placement of student interns in businesses and government organizations, as well as the continuing creation of opportunities for expanding application of GIT technologies in government and industry. The successful creation of these collaborations has laid a strong foundation for future activities and long term sustainability of RACNE/IAGT.

- In addition to the multi-state NEAF group and multi-federal agency collaboration that resulted in the Fall 2004 workshop already mentioned, one other major collaboration deserves special mention as it has served to directly provide guidance from state, local, regional and industry organizations in the execution of this grant work and is continuing to play a vital role in other funded work. An extensive group of about 35 federal, state, local and regional organizations charged with watershed management have agreed to join in a collaboration with RACNE to provide insight into their technical, regulatory and operational requirements for development of a decision support system which will bring GIT technologies in to the mainstream of their watershed management operations. These organizations include: Agricultural Consulting Services Inc.; American Farmland Trust, Northeast Regional Office; Army Corps of Engineers, Auburn Field Office; Canandaigua Lake Watershed Council; Cayuga County Environmental Management Council; Cayuga County Soil and Water Conservation District; Cayuga County Water Quality Management Agency; Cayuga Lake Intermunicipal Organization, Technical Committee; Chemung County Soil and Water Conservation District; City of Auburn; Cornell Cooperative Extension; Cornell University, Community and Rural Development Institute; Finger Lakes Lake Ontario Watershed Protection Alliance/Water Resources Board; Genesee/Finger Lakes Regional Planning Council; Hobart William Smith, Finger Lakes Institute and Faculty; Natural Resources Conservation Service; Nature Conservancy, New York, Central and Western Chapter; New York State Department of Environmental Conservation; New York State Department of Environmental Conservation, Region 7 Headquarters; New York State Department of Transportation; Owasco Watershed Lake Association; Southern Tier Central Regional Planning and Development Board; State University of New York College of Environmental Science and Forestry; Syracuse Department of Water, Water Quality Management; Tompkins County Planning Department; Tompkins County Soil and Water Conservation District; United States Geological Survey; Upstate Freshwater Institute; Wayne County Planning Department; Wayne County Soil and Water Conservation District.

4) Initiate, fund and support collaborative projects in the NorthEast.

- The NorthEast Affiliates Group (NEAF) was used as the group to target for creation of collaborative projects focused on the application of GIT technologies for government use. Each of the 14 states was budgeted $20,000 for such a project. All states have successfully completed their project work. The results were presented and shared at the Fall 2004 workshop described in section. The titles of the projects are:

  - Development of a Protocol to Classify and Map Phragmites australis in the Tidal Marshes of the Lower Connecticut River from Quickbird Multispectral Imagery,

  - Using Color Infrared Ortho Photography To Locate Underground Tile Drains,

  - Planning in 3 Dimensions: Using Statewide Imagery and Elevation Data with GIS Data,

  - Developing a State Wide Incident Management System,

  - Septic System Drain field Assessment Using Remote Sensing: Assessing the Efficacy of, QuickBird 2.4 Meter, 4 Channel Multispectral Data,

  - Applying Web Mapping Technologies to Distribute Remote Sensing Data,

  - A Proposal To Evaluate Lidar Technology To Assist In Delineating Floodplains In New Hampshire,

  - NJ Geographic Information Network (NJGIN) Property Identification Tool,

  - International Land Use and Land Cover Data for Northern Border Security,

  - Remote Sensing in support of the Location Based Response System (LBRS),

  - Integrating the Digital Earth into Television Weather Reporting, Agricultural Extension and Tax Parcel Mapping on the Web,

  - Measuring Impervious Surfaces in RI Land Cover using Remote Sensing,

  - Using High Resolution Multi-Spectral Imagery in the Identification of Impervious Surfaces, and

  - Coastal Erosion on the Great Lakes: Using Remote Sensing and Geovisualization for Public Education.

5) Remote sensing data for governments.

- During the grant period an extensive set of remote sensing data has been collected and made available to the 14 state governments through the NEAF group. Over 300 Gb of publicly available data has been collected including: ALI; ASTER; AVHRR; AVIRIS; GOES; Hyperion; Landsat 5 & 7 (TM, ETM+); triplicate scenes of North American Landscape Characterization (NALC) Landsat imagery with digital elevation models; SRTM. IAGT has a MODIS collection system, on its roof, and so collects data daily from the Terra and Aqua satellites. IAGT maintains a 30 day archive of all 14 standard MODIS data products. This results in approximately another 150 Gb of data maintained and refreshed monthly. IAGT also has acquired 650 Gb of EarthSat GeoCover mosaics through the NASA Scientific Data Purchase Program.

- With this large and growing collection of remote sensing data, a mechanism for making this data available to government users was needed. In order to better share and distribute the ASTER, Landsat 7, NALC and MODIS imagery and accompanying metadata, a customization of existing NASA RODIN technology was accomplished to develop the Image Data Acquisition and Sharing (IDAS) Tool. The development of the IDAS is now complete and IAGT has distributed the tool to the North East Affiliates (NEAF) group for their use in accessing the data.

6) NASA Ambassadors.

RACNE has participated extensively in public and professional meetings and conferences in order to inform and promote NASA's technology, achievements and vision. Over the past four years we have participated in a broad range of groups and events (reported in previous reports), examples include:

- The Northeast Affiliates Group (a group of persons responsible for GIT in each of 14 Northeastern United States),

- Classroom Cabinet meetings (The Classroom Cabinet is a group of teachers representing several grade levels who meet to develop, test, and implement our educational initiatives.),

- Meetings involving watershed management stakeholders,

- GIS Day open houses at Cayuga Community College,

- Technology Days at Cayuga Community College,

- Cayuga County Chamber of Commerce activities,

- College fairs and career days,

- "GIS Camps" and other special classes for students in a variety of grade levels, including BOCES New Visions students and incoming liberal arts student at Cayuga Community College,

- Local events such as: Family Fun Day; Auburn Summer Celebration; TomatoFest; Conservation Night and others,

- Conferences on Remote Sensing Education (CORSE) (2000-2004),

- The Northeastern Local, Regional, and State RS/GIT Outreach Workshops (one held in October 2000 and one held in October 2004),

- Remote Sensing conferences in the 14 Northeast Affiliate states,

- New York State GIS Conferences,

- ASPRS Conferences,

- Imaging Sensor Technology Exchange Workshop, Rochester, NY,

- Watershed Conference in Tuscan, AZ,

- EarthScope Conference, Denver CO,

- New York State Great Lakes Wetlands Conference, Rochester, NY,

- GIS/SIG 13th Annual Spatial/Digital Mapping Conference "Earth Matters," Henrietta, NY,

- "Stormwater: Phase II - How is it Working?," Matamoras, PA,

- New York State Remote Sensing Symposium, Oneonta, NY,

- Soil and Water Conservation Society Annual Meeting, St. Paul, MN,

- Survey and GIS Summit 2004, San Diego, CA, and

- over the past four years members of our staff have provided presentations and tours to members of many special interest groups such as: high school guidance counselors; college bursars and administrators; the Amateur Radio Association; the Rotary Club, senior citizens groups and others.

- IAGT and Cayuga Community College staff were presented with awards at a special awards ceremony in Albany, NY in December 2003 recognizing the successful and unique technology transfer partnership developed between NASA, IAGT/RACNE, Cayuga Community College, and Cayuga County. The award was presented by the State University of New York, the largest public college/university system in the country. NASA HQ was provided with their plaque by IAGT.

2.1.2 Understand, Disseminate and Advocate GIT in Government While Strengthening SLRT Capacity to Utilize GIT

1) Baseline current satellite data conditions in local governments.

- RACNE collaborated with ICREST at the University of Missouri to design and conduct a survey to help establish baseline data on remote sensing data use by local governments.

- A report prepared for the American Society for Photogrammetry and Remote Sensing entitled "10-Year Industry Forecast" was recently completed (it is joint effort between NOAA, NASA and ASPRS). RACNE participated in the study development through Mr. Charles Mondello who is a co-author of the report. RACNE contributed in the areas of state, local and regional remote sensing data and requirements for the industry forecast.

- Over the duration of the grant, extensive interaction with local governments and organizations designed to facilitate their work (for example the National Association of Counties with which a strong collaboration was established) was used to develop an understanding of the status of use of satellite data in their organizations. The usage was very limited, and the characterization of that use was used by RACNE to define and shape the definition of remote sensing projects funded with the 14 NEAF states. RACNE required that each proposal directly incorporate local government needs into the project and provide benefit at that level in order to help strengthen these organizations capacity to utilize geospatial technologies and data. The successful completion of the projects helped to increase the awareness and understanding at the local government level as to the value and utility of GIT.

2) Participate in and represent local governments in national and regional initiatives.

- RACNE representatives participated in and represented local governments in national and regional initiatives, advocating local perspectives and issues concerning remote sensing and GIT. Presentations were made at many initiatives over the four year grant period (and reported previously), including for example:
  - NACo GIS Committee meetings,
  - NACo Annual Conferences,
  - Statewide Service Learning Geographic Information Technologies Training/Conferences,
  - Quality Coasts Conferences (NYS Department of State),
  - Cayuga Lake Monitoring Group,
  - New England GIS Conference-Remote Sensing Workshop,
  - NEAF State Remote Sensing Workshops (14, one in each state),
  - The New York State Coordinating Body meetings,
  - The New York State GIS Conference,
  - The state Remote Sensing Workshops for the NorthEast Affiliate states,
  - GIS Special Interest Group of Central New York.

3) Conduct investigation of state and other programs to aid local GIT development.

- Through networking and outreach via the NEAF, RACNE has continued to develop an understanding and extensive view of the GIT programs being conducted across the 14 state regional area. The Fall 2004 GIT/Remote Sensing workshop provided a unique opportunity for local governments to get involved and explore the use of GIT technology in their domains. Networking conducted via quarterly teleconferences with all the NEAF member states has matured into a network of GIT professionals sharing their current GIT programs, lessons learned, and new perspectives on the use of GIT technology for multi-level governmental application.

- Through participating in activities with the National Association of Counties (NACo), RACNE continues to develop extensive reach into local government and to develop access network to assist in bringing these technologies to their aide. An IAGT employee is located on site at NACo in Washington, DC. This relationship greatly facilitates outreach to local government.

- Working with the Local Government Advisory Committee and via participation in NYS based GIS Coordinating Body, RACNE shares lessons learned from federal and state level GIT programs to aide local GIT development.

4) Develop replicable models and implementation plans for GIT institutionalization and capacity building within and among local governments.

- RACNE has provided training and support to the Cayuga County Sheriff department in the development of their capabilities to integrate GIT into their operations and

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investigations. GIT support for accident mapping was provided, and training was conducted for Sheriffs department staff to transition the capabilities into their organizations.

- The Cayuga County Office of Real Property Services has operated as a key partner over the life of the grant. RACNE has sponsored student interns from Cayuga Community College's GIS program to assist the County in integrating and applying GIT technology, and developed and implemented a GIT data distribution program for local government that the County then further implemented with local governments in the county.

5) Provide targeted assistance in NYS.

- RACNE has provided significant assistance in New York State, with continuing participation in the GIS Local Government Advisory Committee (LGAC), in the preparation and dissemination of "Who's Who of GIS Contacts and Activities in NY's Local Governments", and the completion of "Who's Who of Remote Sensing Contacts and Activities in NY's State and Local Governments".

6) Establish and facilitate annual meetings of the Local Government Advisory Committee.

- The Local Government Advisory Committee (LGAC) is a subgroup of the NYS GIS Coordinating Body. The CEO, Robert Brower, has in the past held a position as chair of that organization. As reported previously, Mr. Brower's term as chair ended. Now, IAGT staff participate in several Coordinating body subgroups, and continue to make significant contributions to the continually expanding GIS activities in New York State.

7) Develop and implement a targeted informational campaign for local government.

- A range of informational materials about NASA, RACNE and related remote sensing and GIT data applications has been produced. A monograph series is used to capture and communicate the importance of NASA technologies and the relevance to the challenges of society today. A technical newsletter is published quarterly by IAGT and distributed to a growing list of GIT professionals interested in the work of the enterprise. IAGT will continue to distribute informational materials and technical newsletters be yond the period of this grant as part of its on-going GIT outreach activities.

8) Design and seek support for local government GIT training.

- Over the four year period of the grant, several Americorp workers have worked with RACNE to apply GIT technologies to local government needs. These workers came to RACNE via coordination with NYS Education Department and the Cayuga County Soil and Water Conservation District, and the Mid-Hudson Institute for Service Learning in Ulster County, NY.

- Work supporting the Cayuga County Sheriff department in providing field training for GPS data collection and subsequent data processing has been accomplished. This hands-on training has made GIT technologies of real value to public safety organizations.

- A training project for large volume GIT data deployment (including Pictometry high resolution aerial photography which was part of a RACNE developed reference data

set) was conducted by RACNE in support of the Cayuga County Office of Real Property Services to move high resolution aerial photography data and processing software out to local governmental units across the county. With the RACNE developing the approach, technology and implementation plan, and then providing hands-on training for the County and participating in the first deployment for support, the County was able to begin implementing the program on their own, delivering extensive new data sets and software processing capabilities to local government users.

2.1.3 Develop and Deploy Prototype Data Applications and Information Tools for Targeted State, Local and Regional Needs

1) Virtual Management Operation Center (VMOC) Prototype development.

- Work on development of a prototype Virtual Management Operations Center (VMOC) software application was successfully completed during the grant period, using the Finger Lakes watershed as the subject area. The developed VMOC integrates 2-d and 3-d visualization technologies into a web-deployed interactive visualization and analysis tool. Extensive GIT data sets (including satellite data, LIDAR, and other remote sensing data) and environmental parameter data (e.g. hydrology, bathymetry, geomorphology) have been integrated and fused (under efforts on the following task) and have been incorporated into the prototype. These data are then overlaid onto terrain model that can be used in three dimensional interactive visualizations. The successful completion of this work has provided a prototype capability that is being used under a new NASA grant for RACNE entitled "Preserving the Finger Lakes for the Future: A Prototype Decision Support System for Water Resource Management, Open Space, and Agricultural Protection".

2) Emergency Management reference data set development.

- Work was successfully completed on acquiring, assessing and integrating sets of various data across NYS for use in emergency management (and other, as appropriate) applications. These data sets include LIDAR, Landsat, NALC, ASTER, high resolution aerial photography (color and color IR), hydrology, bathymetry, geomorphology, and public infrastructure and related data. Data has been reviewed for quality and accuracy, and where required, transformed to a format suitable for viewing and integration with other data and/or use in GIS and three dimensional visualization software.

- A software training tool has been developed in coordination with regional public safety organizations (police and fire) to utilize these extensive data sets and showcase the value of GIT for incident command and control training. This tool is currently being used in Criminal Justice class instruction at Cayuga Community College, and the technology is playing a central role in a regional government/educational institution initiative to apply the technology for Homeland Security applications. The tool was used in regional emergency management training exercises at which IAGT provided technical support.

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3) Prototype application development supporting NYS Environmental Quality Review Act (SEQRA).

- RACNE worked with the NYS Department of Environmental Conservation on development of a prototype environmental impact projection tool that is based on the spatial data provisions of the New York State Environmental Quality Review Act (SEQRA). A limited functionality prototype tool was successfully created earlier in the grant period. Regulatory requirements for SEQRA have changed and been in flux for some time. In order to accommodate this, RACNE transitioned the prototype capabilities/requirements into the VMOC development activity reported on in previous tasks to provide a flexible visualization and analysis tool for DEC to use. DEC has participated in evaluation and application of the VMOC during the grant period, and is benchmarking its use for further regulatory work as part of their current Flood Plain Mapping initiative with FEMA.

2.2 Cost Center 2: Educational Activity

2.2.1 Conduct Educational and Work Force Development Activity

1) Develop Educational Programs.

- A GIS program was established at Cayuga Community College with the technical support of RACNE staff in the development of curriculum and teaching materials. The program has been successfully accredited by the NYS Education department, and was one of the first accredited associate's degree programs in GIS in the country. RACNE has supported the promotion of this program extensively over the grant period by hosting visits from regional high school students and guidance counselors, and participating in regional Career Days at local schools.

2) Build CCC GIT programs.

- In addition to having helped establish and continuing to promote the college's GIS degree program, RACNE/IAGT continues to work with CCC to help build the GIS degree program. Activities include:
  - o Support for maintaining the state of the art GIS lab facility CCC uses to teach their GIS student classes.
  - o Technical support for development of the CCC web site to incorporate GIT technologies and attract new student interest.
  - o Sponsoring of several student internships every semester for CCC GIS program students to provide hands on experience in applying the knowledge they are learning in the classroom to real world problems.
  - o Creation and execution of a "Jobservation" program to allow any GIS student to visit IAGT and look over the shoulder of a GIT professional and see how GIT is being applied across a broad range of projects and activities in a professional work environment.

- RACNE also assisted CCC in establishing the Ralph Standbrook Scholarship Fund (administered by Cayuga Community College Foundation), a GIS student scholarship fund targeted at providing financial assistance to students furthering their education in the GIT field.

3) Develop university partnerships.

- RACNE/IAGT continues to develop partnerships with universities to identify opportunities for educational and/or project opportunities to advance the adoption of geospatial technologies. Such institutions include SUNY College of Environmental Science and Forestry, SUNY Oswego, SUNY Cortland, Cornell University, Rochester Institute of Technology, Columbia University (CIESIN), Syracuse University and William Hobart Smith.

4) Prepare a "Who's Who in GIT" report.

- RACNE completed a "Who's Who in GIT" for New York State as previously reported.

5) Develop K-12 educational program.

- The Conference on Remote Sensing Education (CORSE) has successfully been conducted each year over the life of the grant. This program brings in K-14 teachers and assists the teachers in developing lesson plans for integration of remote sensing, geographic information systems and global positioning system technologies back into their respective curricula when they return. Each year, 75-100 teachers have participated from across the United States (with strong emphasis on NYS teachers).

- Approximately 20 lesson plans were developed in partnership with two area high school teachers. The lesson plans were designed to utilize GIT technologies as the enabling mechanism for instruction, and are specifically designed to meet NYS Education Department standards for lesson plans. Lesson plans were developed supporting general science and specifically Earth Science, and are targeted across a range of K-12 levels.

- Successful GIS Day events have been conducted at CCC, with over 350 area K-12 students attending the event each year. Lots of hands-on opportunities were provided to students to get a real feel for how GIT is used. A strong participation from area middle schools has been traditional, with a new special track added the last year of the grant specifically targeting high school students interested in further exploring GIT as a career option.

- A course on GIT technology applications is taught each year at the BOCES center to the Project Advance students. Hands-on activities complemented lecture materials to give the students a well rounded introduction to the technology.

6) Establish a GLOBE franchise partnership.

- As reported previously, due to changes in the GLOBE program, work was stopped on this task. Effort was redirected to provide funding supporting the highly successful CORSE 2003-2004 conferences. CORSE is primarily attended by K-12 teachers, and crosses multiple disciplines.

7) Provide information to the public and media.

- An IAGT/RACNE web site is continuously updated and expanded, and is used as a delivery mechanism for informing partners and the public. Some extensions of the site provide demonstrations on 3-D interactive visualizations, some direct access to remote sensing and/or other GIT data, while others provide information on activities of the organization and the GIT community.

- A Remote Sensing for Decision Makers workshop was developed and conducted at the Annual Remote Sensing Symposium held in Rochester, NY by the American Society for Remote Sensing and Photogrammetry (ASPRS) on April 17, 2003. Both and Introductory and Advanced courses were taught. It was a well received effort, increasing awareness of the capabilities of remote sensing technologies for key decision makers. The courses will likely be repeated in the future. A brief description of each course follows.

  o **Introduction to Remote Sensing** Workshop 1 is an introduction to current satellite remote sensing systems and activities. The lecture portion consisted of an overview of remote sensing concepts, and a presentation was given showing examples of current generation sensors (including both government and commercial satellites), data types, imagery examples, and software. Also included was a presentation on how these imagery sources can be used in various applications. Live demonstrations included how to obtain data from current sensors, how to process some of these data in ArcView 3.2 Image Analysis, and how these data may be used in conjunction with other GIS data for various applications.

  o **Advanced Remote Sensing** Workshop 2 is devoted to the use of NASA remote sensing data. This workshop was designed for those who have had some experience using satellite image data and were seeking to better understand how NASA imagery can be incorporated into workflows and practices. (New users of remote sensing were also welcome to this workshop, but was is suggested they first attend Workshop 1, if possible.) The lecture portion consisted of an overview of advanced remote sensing concepts, methods for acquiring data, NASA data formats, image processing softwares, and potential data applications. In the live demonstrations, Landsat data was used as a basis for working with other NASA data types such as ASTER and MODIS. Topics covered included data acquisition, georectification techniques, and feature extraction. ArcGIS, ENVI and ERDAS were also demonstrated for image processing purposes.

- Monographs and newsletters focused on specific projects or subjects continue to be developed and distributed as a mechanism for reaching a broad audience. Examples include: CORSE Monographs, Newsletter to Science Teachers, Work Cooperative Program.

- Participation in public and professional meetings and conferences plays a key role in outreach to the public. Such activities were summarized previously in this report.

8) Sponsor CORSE 2001 conference.

- The CORSE 2001 conference was completed and reported on in previous reports.

9) Sponsor follow-up CORSE activities.

- CORSE conferences have been successfully conducted each year of the grant. On average, 75 – 100 attendees participate from a broad range of K-14 levels and across multiple disciplines. It has been a goal of the conference to transition to a self sustaining funding model, not relying on NASA grant funding for operation. For CORSE 2004, a planned change was made which withdrew the offer of sponsored funding support for conference attendees (other than approximately 6 sponsored attendees who had sponsorship from the Mid Hudson Institute). The conference was still a great success, with approximately 70 attendees, down only slightly from previous years. The main difference was that a larger percentage of attendees came from the central New York area than in previous years. It is the hope of RACNE/IAGT that future years will see similar successes of the CORSE program.

2.3 Cost Center 3: Commercial Activity

2.3.1 Strengthen Economic and Business Development

Significant progress has been made by RACNE/IAGT in the development and continued advancement of the commercial component of its mission. A series of initiatives have been conducted in an ongoing effort to foster the development of ancillary commercial geographic information technology (GIT) activity that is responsive to a range of client opportunities across the spectrum of government, education and private sector markets.

To strengthen its economic and business development capacity, IAGT has focused considerable attention on the following activities: Development of business partnerships; Identification of target markets; Development of test projects for economic development opportunities; Development of prototype spatial information technology products; Development of strategic business and marketing plans; Investigation of various business models; and Evaluation of GIT business opportunities. These activities, collectively, represent an essential component in IAGT's effort to achieve its goal of financial self-sufficiency and sustainability.

Contributing to this effort is Spatial Logic LLC, a wholly owned subsidiary established by IAGT to facilitate partnering with a wide range of other entities involved in geospatial information technologies. Spatial Logic's activities, by design, compliment IAGT's ongoing creation of end-to-end prototype applications. When IAGT's prototypes are determined to have commercial potential, they can be marketed through Spatial Logic.

Spatial Logic has also focused effort to develop, implement and evolve commercial business models and marketing plans related to the application of GIT technologies. To support this effort, the following reports have been assembled: "Spatial Logic Business Plan", "Target Companies for Potential Business Relationship with Spatial Logic", and "Concept to Commercialization

Process". Spatial Logic opens up opportunities for IAGT to identify and develop government, commercial and education markets, thereby increasing its potential to create a diversified, sustainable revenue stream to support the objectives of the enterprise.

Reporting on specific tasks follows. Tasks 1 and 2 are combined for reporting purposes.

1) Develop informal partnerships, and

2) Identify target industries, are combined for reporting purposes as the partnerships and industries are so closely related. Brief representative examples of partnerships and industries advanced through relationship development and execution of pilot projects are summarized following.

- Skyline Software Systems: Spatial Logic is a distributor of the full line of Skyline Terra Suite products featuring innovative, state-of the-art, three dimensional flyover capabilities. IAGT is also a Certified Skyline Software Trainer offering formal instructional courses to a range of Skyline customers.

- Pictometry: Spatial Logic entered into a Teaming Agreement with Pictometry International Corporation related to the sale of high resolution aerial imagery products and services used for a variety of planning and evaluation applications.

- Systems Development Group (SDG): IAGT established a contractual relationship with SDG resulting in the development of a product allowing the end user to keep track of scanned real property documents with corresponding images from a Pictometry image warehouse.

- Pinebush Industries: Spatial Logic entered into a Reseller Agreement with Pinebush Industries for the sale of a line of large format high speed printing software.

- Innovative Technologies, Inc. (ITI): IAGT and ITI are exploring collaborative opportunities in the area of watershed and public safety monitoring systems development that include acquisition, processing, archiving, and distribution of remotely sensed data.

- Cornell University Theory Center: IAGT established a collaborative effort with Cornell Theory Center and Skyline Software Systems to explore the feasibility and potential value of enabling Skyline three dimensional visualization technology to function within a virtual reality CAVE environment.

- Calmar Research Corporation: IAGT is exploring the potential for collaborative opportunities with Calmar Research Corporation in the areas of surface transportation and environmental research.

- DigitalGlobe: IAGT is exploring an opportunity to enter into a contractual agreement related to the production of storm water or pervious/impervious mapping products for DigitalGlobe customers. In addition, an agreement has been reached with DigitalGlobe whereby Spatial Logic will serve as a reseller of satellite imagery products captured by DigitalGlobe.

- Spatial Innovation!: Within Spatial Logic, IAGT established Spatial Innovation! as a wholly owned subsidiary. The Company's mission is to transform spatial information into innovative visual products for business, media, education, tourism, and art. A marketing strategy is in place and to date a limited edition of Earth Imagery Art has been created and released by Spatial Innovation!

- Agricultural Consulting Services, Inc. (ACS): IAGT has worked with ACS, the largest agricultural land management consulting company in New York State, on a pilot project focused on permit applications and environmental management requirements related to CAFO facilities. A prototype product/service was developed enabling automated measurement of parameters soil loss parameters from GIS and remote sensing data. Commercial potential is under evaluation.

- Cornell Cooperative extension: IAGT provided three-dimensional flyover imagery for Cooperative Extension project focused on the promotion of stream and lake bank stabilization and erosion remediation within a prototype project area of Cayuga County, NY.

- Wineland Consulting, Inc.: IAGT collaborated in development of a GIT product/service that assists vineyard management with the potential to significantly improve crop yield. The prototype enables two and three dimensional mapping, visualization, analysis and measurement capabilities for the vineyard, while addressing a variety of site characteristics including topography and drainage, soil type, crop variety and acreage, and assessment of adjacent fields for suitable expansion. Commercial potential is under exploration.

- Highland Golf Club: IAGT developed a three dimensional interactive product integrating high-resolution LIDAR data converted to a digital elevation model, Pictometry aerial photography, and soils data, as well as transportation route information to create a capability for planning, analyzing and developing maintenance activities for golf courses. Commercial potential is under exploration.

- Sterling Lakeshore Park and Nature Center: IAGT served as consultant to William McDonough and Partners employed to work on the Sterling Lakeshore Project to identify compatible economic development initiatives within the 3,000 acre site with 2.5 miles of Lake Ontario shoreline. IAGT provided assorted digital land cover files and related data, including a three dimensional interactive visualization prototype product to support efficient and environmentally sensitive land use planning.

- DestiNY USA: Spatial Logic created and interactive three dimensional visualization application for DestiNY USA, a proposed major tourism/recreation/retail destination project in Syracuse, NY. The presentation product, including color aerial orthoimagery at various resolutions, color overlays, GIS layers, and hotlinks to various web pages, was created to depict parcels slated for potential development and to convey the DestiNY vision. The prototype project is a site evaluation and selection tool that can be adapted by Spatial Logic for application to other proposed economic development initiatives.

- Bon Ton Roulet: IAGT developed a three dimensional flyover of the the Bon Ton Roulet Bike Tour through the New York State Finger Lakes Region. The prototype product provided riders with information about the kinds of views, landscapes, and terrains that they would encounter during the tour, as well as indicated points of interest they would pass along the route. Elements of this project will be applicable for similar events.

- Underwater Technologies: IAGT worked collaboratively with Underwater Technologies. Inc. to fuse that company's underwater mapping technologies with Skyline Software. Future commercial applications are under consideration.

- VMOC: Developed by IAGT, the Virtual Management Operation Center (VMOC) product is a two dimensional-three dimensional visualization tool enabling analysts, planners, and decision makers to have a more detailed and informed understanding of the geospatial aspects of the situation or locale under consideration. The VMOC functionality will have widespread utilization in many IAGT initiatives.

- Tourism Initiatives: Three prototype spatial technology information/visualization products were developed by IAGT that are each intended to increase tourism interest and visitation rates in specific geographic regions and points of interest. The products were developed using Skyline technology and focused on the Finger Lakes Region, the Niagara Falls Region, and Ogdensburg, NY. Further commercial potential is under exploration.

- Site Selection: In cooperation with the City of Auburn and Cayuga County Industrial Development Agencies, IAGT developed a prototype GIT application project to demonstrate the use of spatial data and three dimensional interactive visualization technologies to support economic development focusing on business recruitment and facility site selection. The prototype has feature applicable to other site selection initiatives and commercial potential is under exploration.

- Additional prototype spatial technology information/visualization products are at various stages of development. These prototypes are in concert with the application themes articulated by NASA's Applications Division of the Earth Science Enterprise, including the "Disaster Preparedness" and "Water Management and Conservation" themes. In the ongoing development of these prototypes, IAGT places particular emphasis on incorporating mechanisms through which the information/visualization products can be integrated into a range of decision support systems.

3) Examine programs and administer RACNE Data loan funding.

- A Data Loan/Grant funding program was developed and implemented under a previous NASA grant with RACNE (Phase 2). This task supplied funding to administer and operate the program. The program has been a complete success, supplying remote sensing data to all 14 of the NEAF states.

4) Develop and help grow private sector opportunities (SPATEC).

- The effort to grow the Spatial Technology Enterprise Center (SPATEC), while meeting with considerable success in early reporting periods, met a serious impediment and all

work ceased (as reported previously). Lattimore Hall, the cornerstone of the effort, was found to have serious mold problems, and caused the entire effort to be halted. Lattimore Hall was critical to the development of the activity, as it offered both a facility and a revenue generation capacity unique to the joint business and technology objectives of SPATEC. At that time, effort shifted to the creation of Spatial Logic, which is focused on development of commercial business models for application of GIT technologies.

5) Investigate state GIT Council.

- After significant consideration, it has been determined that the creation of a new organization would not be practical to accomplish this activity. Rather, RACNE continues to work with existing organizations in NYS that are charged with GIS and GIS-related missions.

6) Develop a test project for economic development (see also Tasks 1 & 2 earlier in this section).

- DestiNY USA: Spatial Logic created a three-dimensional visualization application for DestiNY USA, a proposed $2.2 B tourism/recreation/retail destination project in Syracuse, NY. The application included color aerial orthoimagery for the entire state at varying resolutions, color overlays, GIUS layers, and hotlinks to DestiNY web pages, and included a fully interactive interface allowing users to "fly around" the scene. The presentation was created to depict parcels slated for potential development and to convey the DestiNY vision.

- In previous reporting periods, a project was conducted to develop a GIT application to support site evaluation and selection to support NYS economic development initiatives (in this case it was specifically for siting of a chip fabrication plant).

- Other pilot projects supporting economic development were conducted under this grant, and are summarized in the previous tasks 1 and 2 of this section.

7) Develop prototype spatial information technology products (see also Tasks 1 & 2 earlier in this section).

- After investigations in the agricultural market, an opportunity was identified for application of GIT technology to create a product/service that would assist agricultural land management. Specifically, permit applications for and management of CAFO facilities require that land which holds the cattle have certain characteristics in order to meet environmental management requirements. In conjunction with the largest agricultural land management consulting company in NYS, Agricultural Consulting Services (ACS), a prototype product/service was developed that enabled automated measurement of parameters of the RUSLE (Revised Universal Soil Loss Equation) from GIS and remote sensing data.

- Exploration of the wine/vineyard industry (one of the largest industries in NYS) resulted in identification of an opportunity for application of GIT technology to create a product/service that would assist vineyard management and potentially significantly improve crop yield. In conjunction with the owner of a Finger Lakes vineyard owner

(King Ferry vineyard), a prototype GIT product/service was developed. The product/service enables two and three-dimensional mapping, visualization, analysis and measurement capabilities for the vineyard. It was used to development prototype products for the King Ferry vineyard which includes topography and drainage, soil type, crop variety planter and acreage, while also enabling assessment of adjacent fields for suitability for expansion of the vineyard.

- A review of golf course development and management practices identified another opportunity for application of GIT technology. Based on the reference data sets collected for Cayuga County, a three dimensional interactive product prototype was created for a local golf course (Highland Park, Auburn, NY). This prototype integrated high-resolution LIDAR data converted to a digital elevation model, high resolution Pictometry aerial photography, soils data and surrounding transportation route information, to create a capability for planning, analyzing and developing maintenance activities for golf courses.

2.4 Cost Center 4: Technological and Institutional Capacity

2.4.1 Develop and Maintain the RACNE's Capacity In Policy, Planning, Institutional and Technical Areas

In addition to the task oriented information provided in this section, the following Section 3 of this report provides a more detailed summary on organizational status.

1) Investigate business models.

- RACNE has continued to develop, implement and evolve business models for enterprise development. A corporate structure has been developed to facilitate creation of a diversified revenue stream for the enterprise. Strategic and tactical plans have been developed, and implementation is proceeding applying these plans to develop a long term, stable organization that can continue to deliver positive economic impact to the region.

2) Develop strategic, business and marketing plans.

- Strategic, tactical and marketing plans continue to be developed and evolved by RACNE annually. The key objective is a focus on accomplishing the mission of the organization and accelerating the application of geospatial technologies in the government, commercial and education markets.

3) Evaluate GIT business opportunities.

- RACNE continues to evaluate business opportunities across the spectrum government, commercial and education markets.

4) Establish and maintain physical and technological infrastructure.

- With the completion of the new James T. Walsh Regional Economic Center at Cayuga Community College, the organization has moved to new facilities. Equipment required to bring the facility operational was acquired, and specifically, a computer network

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facility was implemented to provide high speed internet access, GIT software capability, and extensive image and data storage and distribution capabilities to support the organizational goals.

- The opportunity to leverage funds and accelerate the impact of existing programmatic activity was approved by NASA and undertaken by the RACNE during the final quarter of the grant period. As required by applicable grant regulation, the RACNE, after advising of this intent in the previous annual report, submitted a budget amendment and supporting material that was reviewed and found to be in keeping with program purposes. (Please see page 24, "The Regional Application Center for the Northeast (RACNE) Annual Report for the period September 27, 2002 to September 26, 2003). The budget amendments allowed acquisition of property adjacent to the college and existing facility for future training and other activity in support of RACNE programs. The amendment also allowed participation in a renovation project that will expand the opportunity to utilize decision support tools to stakeholder groups, including State and Local Government in the Northeast, the Education Community, and the Commercial Sector. The amendments provided funds so that an existing theatre will become a multiple-use facility by retrofitting seating configurations, lighting, screen, sound systems, and supporting infrastructure to allow the use of geospatial decision support tools (DST). When not used in this way, it will continue to function as it now does, as a theatre facility used by the college community for various purposes, in service to the college and the larger community in which it is located. The installation of electronic seats will allow interactive training of various community/user groups on DST. This activity will in turn accelerate the application of various NASA data sets, combined with a range of satellite assets including but not limited to ASTER, Landsat, MODIS and GOES. DST developed by various federal agencies and other entities will be combined with IAGT Virtual Management Operation Center (VMOC) technology and offered in the multi-purpose facility. The new facility will seat an estimated 450 people and allow interactive involvement by 100 at a time. The training capacity of RACNE/IAGT will be greatly improved and thus the long term potential to sustain activity past the life of the grant is also enhanced. It is expected that groups representing water management, precision agriculture, emergency management, and homeland security interests will all use the facility.

5) Establish high quality reference data set.

- A high quality reference data set has been developed that covers Cayuga County. This set includes such data as: high resolution LIDAR, satellite imagery (including GOES, AVHRR, MODIS, Landsat, ASTER, aerial photography (including panchromatic, color, color infrared, orthophotography and obliques), soils data, hydrology, and geomorphology.

6) Recruit and hire staff.

- The organization continues to recruit and hire high quality staff to support its activities and accomplish its mission. At the end of this reporting period, there were 52 full time staff.

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3. ORGANIZATIONAL STATUS

## 3.1 RACNE/IAGT Organization: the Enterprise

The organizational enterprise reported last year has continued to grow and mature during the reporting period. As indicated in previous reports, the RACNE transferred the responsibility for grant administration and management and program deployment to the Institute for the Application of Geospatial Technology (IAGT). At the close of the reporting period, IAGT employed 52 people on a full time basis.

Also as reported previously, IAGT was the sole owner of two limited liability companies, SPATEC LLC and Spatial Logic LLC. It is noted however that SPATEC has subsequently been dissolved.

3.2 Space: The James T. Walsh Regional Economic Center

The building was occupied by IAGT in June 2003, and by additional tenants in the Business and Industry Center and the Work Force Development Center in late summer. NYS Department of Labor occupants also now occupy the building. This co-location of technical, educational and workforce development organizations has already lead to direct collaboration on geospatial workforce development initiatives. The following pictures provide a glimpse of the facility.
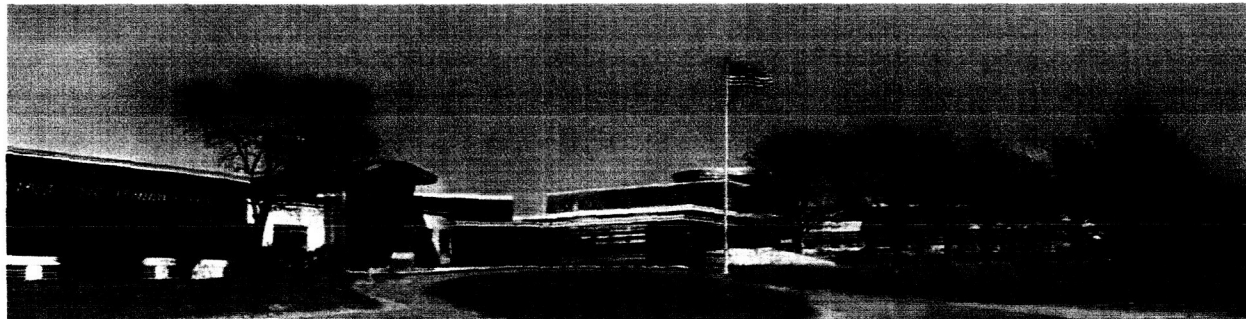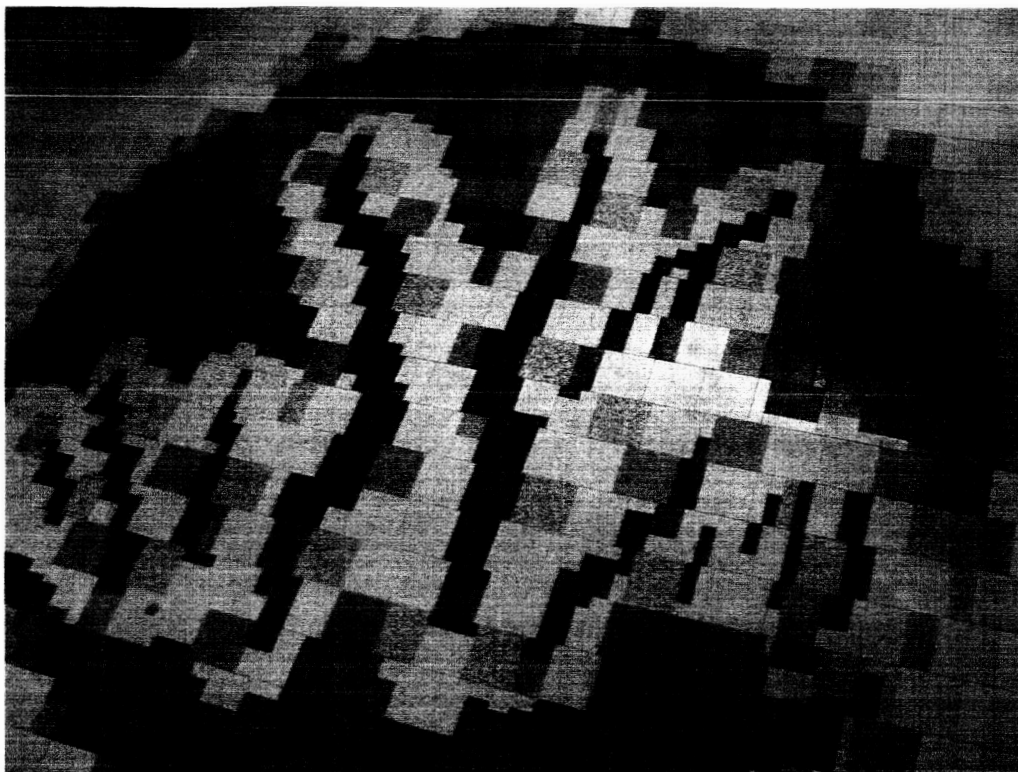

Photograph of the James T. Walsh Regional Applications Center (REC) building on the Cayuga Community College campus.

Photograph of the front entrance to the new REC building.

Photograph of spiral staircase in the REC building leading up to the new IAGT offices on the second floor.

Photograph of REC building atrium floor with tile mosaic depicting a "Landsat view" of the Finger Lakes from space.

Photograph of the reception area of IAGT's offices on the second floor of the new REC building.