Semi-Annual Progress/Technical Report for

Great Lakes Observing System (GLOS) Coordination

Award Number: NA05NOS47311666

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Reporting Period: June 1 – November 30, 2006

This reporting period is for the first half of the second year of a three-year grant period. During this reporting period, the Great Lakes Commission (GLC), acting as the Secretariat for GLOS and in conjunction with the newly-formed GLOS Board of Directors, met all of its obligations under the grant. This progress report provides detailed information to support this fact.

1) Project Summary

The Great Lakes Observing System Regional Association (GLOS-RA) is a non-profit corporation registered in the State of Michigan, established to advance the goals and objectives of the U.S. Integrated Oceans Observing System (IOOS) across the Great Lakes – St. Lawrence River system. IOOS in turn is the U.S. oceans, coastal and Great Lakes component of the Global Earth Observing System of Systems (GEOSS). Further information on the GLOS can be found at: http://www.glos.us/.

The GLOS-RA is committed to providing integrated, in-situ, and remotely-sensed information and numeric modeling about the Great Lakes, their interconnecting waterways, the St. Lawrence River, their tributaries and airsheds. The GLOS user community includes researchers, managers, educators and others engaged in government, commerce, education, and science about the system. The GLOS-RA is also committed to promoting education and outreach to Great Lakes stakeholders about conditions and trends within the system and to informing policy makers and legislators about emerging issues and critical data requirements.

The GLOS-RA is expected to include membership from a wide variety of stakeholders across the region, including federal, state and municipal governmental agencies, Native American communities, academic institutions, commercial ventures, non-governmental organizations and end users of the region's resources.

2) Progress and Accomplishments

Work on the project has been on schedule throughout this reporting period.

- **RA Organizational Structure**

The GLC has continued to coordinate interagency and user involvement to initiate the GLOS-RA and its inaugural GLOS Board of Directors. The Board was constituted in April 2006. Listed below are the Officers and Directors of the GLOS-RA with their current titles and most recent affiliation.

Officers
Chairman - Mr. Bill Werick, retired Planner, U.S. Army Corps of Engineers, Culpepper, VA
Vice Chairman - Dr. Frank Kudrna, Kudrna & Associates Consulting Engineers, Chicago, IL
Treasurer - Dr. Alfred Beeton, Scientist Emeritus, NOAA Great Lakes Research Laboratory, Ann Arbor, MI
Secretary - Dr. Jeffrey Boehm, Vice President, John G. Shedd Aquarium, Chicago, IL
Directors
Dr. Gerald Galloway, University of Maryland, College Park, MD
Mr. Mark Grazioli, retired Principal, Wade Trim Consulting Engineers, Grosse, Ile, MI
Mr. Philip Keillor, retired Coastal Engineer, WI Sea Grant, Madison, WI
Dr. Gail Krantzberg, McMaster University, Toronto, ON
Mr. Dale Phenicie, Council of Great Lakes Industries, Peachtree City, GA
Dr. Harvey Shear, University of Toronto, Mississauga, ON
Dr. Richard Stewart, University of Wisconsin-Superior, Superior, WI
Mr. Nelson Thomas, retired Laboratory Director, U.S. Environmental Protection Agency, Duluth, MN

The GLOS Board has impressive experience in dealing with Great Lakes issues, including economic development, industrial pollution control, municipal water system operations, ecological protection, binational coordination, public education and tourism, project plan formulation and implementation, information management and stakeholder conflict resolution. The GLOS-RA is well positioned to address the diversity of needs of the Great Lakes – St. Lawrence River system.

During this report period, the Board conducted its first Annual Conference in Ann Arbor, MI on June 19-20, 2006 and an in-person meeting in Chicago, IL on November 13-14, 2006. Monthly conference calls of the Board were also conducted during intervening months.

The June 2006 Annual Conference included presentations on the status of key observing system components, regional data management activities and education/outreach approaches. During its meeting, the Board formerly adopted bylaws for the organization. These bylaws are available at: http://www.glos.us/pdf/BylawsFinalDraft.pdf.

The GLOS Board, however, deferred decisions on membership classes and due structures until such time as a consensus evolved on what roles, responsibilities, benefits of membership would entail. The Board also decided that it needed to develop its own collective perspective on system priorities, value-added products to develop and what its role should be within the Great Lakes – St. Lawrence River community.

During the Board meeting on June 20, 2006, Mr. Roger L. Gauthier of the GLC staff was appointed as the Interim Executive Director for GLOS. He will be responsible for managing conduct of a variety of data, communications, budgetary, administrative, and staff oversight assignments. The responsibilities of the GLOS Executive Director are outlined in the GLOS Bylaws. The GLC would continue to provide staffing for the GLOS Secretariat through June 30, 2008, as a function of the current planning grant. The GLC is the recipient of funding for the GLOS-RA through that date. A draft Memorandum of Agreement between the GLOS Board and GLC management is currently under review by both parties.

During this meeting, the GLOS Board established a committee structure, which includes committees for finance/auditing, personnel/elections, advocacy, membership, education/outreach, research and binational coordination. Each committee would be led by a Director. This committee structure is outlined in the GLOS Bylaws. The Board also determined that the GLOS-RA would create a Program Review Panel (PRP) made up of representatives of its membership to provide input to the Board on establishing short-term (annual) and long-term (two to five year) resource allocation priorities. The PRP has not yet been constituted, but will be elected from RA membership at the next annual meeting, scheduled for April 2007.

The Board met again on November 13-14, 2006 to define its goals for product development and procedures to assess proposed program/project relevancy and priorities. During this meeting the Board approved formulation of expert subsystem teams, which would be constituted via invitation. The subsystem teams would provide input to GLOS staff for preparation of annual work plans.

An application for 501(c) 3 tax-exempt status through the Internal Revenue Service has not yet been submitted. This is expected to occur in early 2007. Purchase of Directors and Officers liability insurance is also pending.

- **Planning and Implementation**

A draft GLOS Business Plan was completed in November 2004 and submitted to Ocean.US and the NOAA Coastal Services Center. This plan included: goals and objectives of the organization; needs assessment; outline of subsystems and components; procedures for product development and periodic review; approaches for data management and communication, research and development, and education and outreach; preferred governance model for the organization; funding opportunities; and, marketing approaches. The draft GLOS Business Plan is available at: http://www.glos.us/draftplan/GLOS_BP_v2.4.pdf

The GLOS Business Plan will be rewritten in early 2007 to reflect the interests of the new GLOS Board particularly with respect to priorities for regional observing system improvements and value added products.

A major focus of the GLOS-RA during this reporting period was the development of the first GLOS Annual Work Plan. This plan identifies key activities, implementation responsibilities, timelines and budgets for the GLOS-RA for the period July 1, 2006, through June 30, 2007. This annual cycle corresponds with most state financial years within the region and generally corresponds with the NOAA grant cycle that funds the GLOS-RA. The 2006-07 GLOS Annual Work Plan was adopted by the GLOS-Board during its business meeting in June 2006, with the proviso that it be revisited by the Board on a quarterly basis. This work plan is available at: http://www.glos.us/annualworkplan/2006-2007.pdf.

Regional Observing Systems Coordination

A major focus of the GLOS-RA during this reporting period has been continuing discussions with regional entities, primarily states and provincial agencies and academic institutions, to refine subsystem design and implementation planning for the period of 2007-12. These coordination activities have engaged subject matter experts in developing an integrated and cohesive vision for each of the following GLOS subsystems:

- Open Water
- Scientific Ships
- Nearshore
- Interconnecting Waterways
- Remote Sensing
- Atmospheric Monitoring
- Process Modeling and Ecological Forecasting
- Information Integration
- Education and Outreach

Many of these subsystems have little new investment planned for the immediate future. Nevertheless, regional coordination of stakeholder activities is still critically warranted, which is a role that the evolving GLOS-RA is best suited to provide. As opportunities arise, the GLOS-RA has supported coordination efforts. For example, GLOS staff has provided assistance to the Great Lakes Association of Scientific Ships (GLASS) in planning and conducting its annual meeting in January of each year. There are more than 100 members of the maritime community that convene on an annual basis to coordinate field data collection operations, share information resources and identify community priorities. The Information Integration subsystem is being designed to provide data sharing capabilities between members of GLASS.

Regional coordination has continued with each of the eight Great Lakes states during this reporting period, particularly dealing with design, development and implementation of the GLOS Data Management and Communication (DMAC) subsystem. Each state maintains significant geospatial data resources which need to be accessible by the distributed web mapping portal being developed by the GLOS-RA. The needs of the Coastal Zone Management (CZM) programs conducted by each state are also critical inputs in the design of subsystem improvements.

Coordination of Federal Backbone Observations

Initial efforts have been focused on working closely with NOAA's Center for Oceanographic Products and Services (CO-OPS) to link delivery of their water level and meteorologic observations to the user community served by the Great Lakes Information Network (GLIN), see: www.great-lakes.net. Under the GLOS DMAC subsystem, GLC staff has designed interfaces to ingest NOAA/CO-OPS products into the GLOS web mapping application. GLC staff has begun to work with U.S. Geological Survey staff to import stream gauge observations into the web mapping application.

Near-term improvements to NOAA's Great Lakes CoastWatch products including generation of daily lakewide surface products for chlorophyll, organic solids and surface sediment loads have been explored. These new products could be produced from existing space-borne sensor arrays including MODIS, SeaWIFS and AVHRR and delivered to end users on a daily basis. Each of these three operational products are needed to monitor organic, contaminant and sediment loads to the Great Lakes, which in turn can be used to assess performances on meeting water quality management targets and to monitor harmful algal bloom development across the Great Lakes.

The CoastWatch Program currently generates surface temperature maps from daily satellite observations and buoys in the Great Lakes. The Great Lakes Sea Grant Network (GLSGN) has enhanced these efforts by repackaging these maps for use by the charter fishing community who rely upon this product extensively (estimated at 4,000 visits per week) to determine the location of temperature gradients where fish may congregate. The Remote Sensing subsystem is being designed to include existing CoastWatch products and identified new requirements.

In July 2005, the GLC sent letters to the Director of the NOAA, National Weather Service (NWS), National Data Buoy Center (NDBC) representing the GLOS-RA which outlined the region's needs for additional sensor enhancements to the existing buoy network and densification of observations across the system to support improved nearshore marine forecasts. The observation programs of the NOAA-NDBC are a critical backbone component of the GLOS Open Water subsystem. One of these letters specifically focused on maintaining existing meteorologic observations at the Lake St. Clair C-MAN site and upgrading this site to provide observations on current patterns and biological activity. The Lake St. Clair installation is a key observation node needed to model contaminant transport mechanisms within the lakes Huron to Erie Corridor (HEC). During this reporting period, GLOS staff has continued to coordinate NDBC activities across the region.

NOAA's National Weather Service Central Region has undertaken an initiative to increase the density of coastal meteorological observations across the Great Lakes. This effort is in response to user needs for improved nearshore marine weather information and forecasts, and is designed to provide support as a component of the GLOS Nearshore subsystem. It proposes to expand the number of NOAA coastal meteorological observations by 50 percent before 2012 with placement of critical observations determined through a priority gap analysis conducted collaboratively with NOAA-CO-OPS and NOAA-GLERL. To date, 10 new meteorological observation stations have been installed in the western Great Lakes with plans for installing additional platforms in 2007.

The GLOS-RA has been active in coordinating plans for the development and implementation of hydrodynamic modeling for the HEC, along with installation of dedicated Acoustic Doppler Current Profilers (ADCPs) in the St. Clair River, Lake St. Clair and the Detroit River. This activity is driven by the need to protect drinking water supplies for 4 million residents in southeast Michigan and southwest Ontario. These activities are components of the GLOS Interconnecting Waterway subsystem and engage elements in NOAA, the U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, the U.S. Geological Survey, Environment Canada, and state and provincial agencies.

Regional DMAC Initiation

During this reporting period, the GLOS regional DMAC effort has been focused on the system design requirements for incorporating the following information resources:

- a comprehensive binational (U.S. and Canada) monitoring inventory;
- NOAA's CoastWatch Great Lakes products;
- framework geospatial datasets and detailed geospatial mapping of coastal, open lake and riverine conditions collected under the International Joint Commission (IJC's) Lake Ontario – St. Lawrence River Study;
- water level and meteorological observations produced by the NOAA-CO-OPS program;
- air emissions datasets from the eight Great Lakes states and the province of Ontario; and,
- integration of the Great Lakes Information Network (GLIN) as a clearinghouse node in the National Spatial Data Infrastructure (NSDI).

Additional geospatial data resources are being factored into the design of the regional DMAC architecture, including open lake observations made from moorings and remotely sensed observations operated and maintained by universities across the region. The Service Oriented Architecture deployed by the GLOS-DMAC is being implemented piecemeal as datasets become readily available from collaborating organizations for serving to users.

GLOS technical supporters have attended relevant national DMAC meetings (OOS-Tech, DMAC Steering Committee, etc.) to insure that regional development is being conducted in concordance with rapidly evolving DMAC protocols and certification requirements.

A conceptual architecture for the regional DMAC node has identified the following critical factors:

- additional server capacity to support distributed geospatial data management;
- enhanced bandwidth to support data transfer between federal, state and academic data holdings;
- additional storage capacity to support regional data archiving and derived products;
- design concepts for ingesting data;
- general concepts for interdisciplinary product development; and,
- redesign of the Great Lakes Information Network (GLIN) to support product distribution.

Data ingestion will involve bringing in real-time in-situ observations, computer modeling output and raster datasets. In-situ observational data taken from sensor platforms (e.g., water level gauges, buoys) would be ingested in real-time using open source protocols (e.g., XML, Web Services, netCDF). Modeled outputs would be added including estimated, interpolated and forecasted values, such as weather and lake circulation predictions.

Web products being developed include dynamic maps of in-situ observations highlighting the spatial distribution of phenomena across the Great Lakes or within their interconnecting waterways. Future products will include graphs, statistics and animations depicting both real-time and historical phenomena to showcase significant trends, events, and other features.

Product distribution is based upon evolving Web Services (e.g., Web Feature Service (WFS), Sensor Web Enablement (SWE) and SensorML formats) to ensure maximum interoperability and access to data. By utilizing common and standardized formats for data and using Web Services as a distribution channel, the GLOS-DMAC is designed to support a diverse group of end users, enabling the development of additional websites, further analysis, data conversion and other value-added operations.

- **Stakeholder Engagement**

Workshops, Meetings and Conferences Attended

Four key events were conducted or attended during this reporting period that affected GLOS planning, systems integration and regional DMAC design and implementation.

- Great Lakes Observing System Annual Meeting - On June 19-20, 2006 the GLOS Board conducted its first Annual Meeting in Ann Arbor, MI. Approximately 60 attendees participated during the first day of the meeting, including members of the Steering Committee and Regional Interest Group. Presentations were made on the status of key facets of the initiative, including an overview of the governance model, subsystems design and legislative activities. The presentations are available at: http://www.glos.us/mtgs/2006/index.php. On the second day, the GLOS Board met and adopted its inaugural by-laws and addressed other administrative matters.

- NFRA Meeting / IOOS Regional Association Coordination Workshop - On November 6-9, 2006, several members of the GLOS Board and Secretariat participated in the NFRA Meeting and IOOS Regional Association Coordination Workshop conducted in Chicago, IL. Dr. Jeff Boehm, Vice President of the Shedd Aquarium and a GLOS Director, hosted the IOOS Workshop. The Shedd Aquarium was an excellent venue for information exchange between participants. The GLOS Board members learned a lot about how regional efforts related with national and international endeavors. They also made important contacts for future technology transfer opportunities. Another benefit derived from these meetings was learning about Ocean.US tool for determining priorities for observing system improvements.

- State of the Lakes Ecosystem Conference (SOLEC) - On November 1-3, 2006, several members of the GLOS Board and Secretariat attended SOLEC meetings in Milwaukee, WI. SOLEC is a biennial conference conducted around the Great Lakes region that brings approximately 400 researchers and environmentalists together to assess progress towards meeting the objectives of the Great Lakes Water Quality Agreement (GLWQA) between the U.S. and Canada. The current list of SOLEC indicators includes about 90 key metrics on key ecological conditions across the region. Many of these indicators have significant observational, data management and reporting requirements, which are frequently unmet. There is significant correspondence between the GLWQA objectives, SOLEC indicator development and implementation and IOOS societal goals. The status of GLOS activities were presented in several sessions including GLWQA review, Lake Michigan monitoring coordination, climate change assessments and land use mapping. Implementation of high value SOLEC indicators is a major area emphasis of the Great Lakes Regional Collaboration recommendations, which can be realized through the GLOS initiative.

- St. Lawrence Global Observatory (SLGO) Steering Committee Meeting – On November 16, 2006, GLOS staff met with the steering committee for the SLGO to initiate coordination between these two initiatives. The SLGO Steering Committee includes representatives from various federal, provincial, academic and non-governmental agencies within Quebec. The SLGO objectives are to promote information integration downstream of Cornwall, Ontario / Massena, NY and throughout the Gulf of St. Lawrence. The SLGO effectively links the Great Lakes with the Northeast Atlantic Regional Association, since they share common areas along the Atlantic seaboard. This meeting was very beneficial to GLOS planning efforts, particularly with respect to initial coordination on linking respective DMAC activities. SLGO is planning to support a Systems Oriented Architecture similar to that employed by GLOS and the GoMOOS system.

In addition to these meetings, the GLOS-SC and Secretariat staff participated in the following events with a focus on coordinating GLOS implementation and subsystem prioritization efforts:

- Canadian Ocean Tech Workshop (focused on Ontario's engagement in Canadian Ocean Action Plan) – July 25, 2006, in Markham, IL;

- Great Lakes Regional Research Information Network Workshop – September 5-6 in Chicago, IL;
- Shared Waters Conference - September 14, 2006 in Kalamazoo, MI;
- Ocean Research Priority Plan Briefing – September 15, 2006 in Chicago, IL;
- ORION/OOOI Cyber Infrastructure Workshop – October 3-4, 2006 in Washington D.C.;
- Great Lakes Commission Annual Meeting – October 3-5, 2006 in Duluth, MN;
- NFRA Remote Sensing Workshop – October 3-5, 2006 in Durham, NH;
- Macomb/St. Clair Inter-County Water Quality Advisory Board meeting – October 16, 2006 in Detroit, MI;
- Binational Executive Committee Meeting – October 25, 2006 in Toronto, ON;
- Great Lakes Coastal Zone Managers Workshop – October 25-26, 2006 in Traverse City, MI;
- NetCDF Software Programming Workshop – October 30 – November 2, 2006 in Boulder, CO;
- Huron to Erie Corridor (HEC) Modeling Workshop – November 20, 2006 in Ann Arbor, MI and
- Macomb/St. Clair Inter-County Water Quality Advisory Board meeting – November 21, 2006 in Detroit, MI.

New Partnerships

Special note is made about the following five areas of regional coordination that affect GLOS' role within the region:

- GLWQA/BEC – Dr. Gail Krantzberg, a GLOS Director, briefed the Binational Executive Committee (BEC) about GLOS implementation status at their meeting in Toronto, ON on October 25, 2006. The BEC membership includes all U.S. and Canadian federal agencies engaged in implementing the Great Lakes Water Quality Agreement (GLWQA), with particular engagement of the U.S. Environmental Protection Agency and Environment Canada. The BEC coordinates monitoring efforts to implement the agreement, including water quality, atmospheric deposition and fish sampling conducted across the region. The BEC agreed to convene a workshop in early 2007 to coordinate various monitoring program activities, including those conducted under the auspices of GLOS.

  The GLWQA signed between nations in 1972, is also undergoing periodic review to assess its current efficacy. The GLWQA has major sections dealing with monitoring protocols and research and surveillance approaches that are relevant to the mission of GLOS. The IJC, a binational treaty organization between countries, recently stated that the GLWQA should be replaced with a shorter and more action-oriented binational agreement. U.S. and Canadian federal agencies are still assessing alternate approaches The GLOS-RA will continue to be engaged in these important discussions.

- Ocean Research Priority Plan (ORPP) Comments – The GLOS Secretariat, in collaboration with the GLC and the IJC's Council of Great Lakes Research Managers provided comments on the final draft of the ORPP document entitled "*Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade.***"** The ORPP outlines U.S. national research priorities which would affect the Great Lakes – St. Lawrence River system over the next ten years. The comments that were provided were highly influenced by research priorities identified under the Great Lakes Regional Collaboration effort. The quality of future research across the region will rely upon improvements in observational capabilities.

- Great Lakes Regional Collaboration (GLRC) Implementation – In December 2005, the GLRC released its strategy report for restoring and protecting the ecological resources of the Great Lakes. Initiation of GLOS as the regional component of IOOS and GEOSS was prominent in the recommendations in this report. The report reflects the work of more than 1,500 Great Lakes stakeholders and 12 months of consensus building. The GLRC was convened by the Great Lakes Interagency Task Force to provide stakeholder input as required in the Presidential Executive Order creating the task force. NOAA plays a key role on the Task Force. The GLOS-RA has been promoting implementation of monitoring and research recommendations included in the report.

- Great Lakes Regional Research Information Network (GLRRIN) – In September 2006, the GLLRIN was formally constituted being led by key members of the Great Lakes Sea Grant Network. The GLRRIN project is funded by NOAA's Sea Grant program for the next four years. It will develop individual networks for each Great Lake to foster coordination of research activities and sharing of results across the region. The GLRRIN is patterned after the Lake Erie Millennium Network, an ad-hoc coordinating body facilitated by the Ohio Sea Grant Program and the University of Windsor. GLOS staffers are assisting the managers for GLRRIN for the development of communication and data management strategies.

- HEC/Lake St. Clair Management Plan Implementation – The GLOS Secretariat has been continually working with local counties in southeast Michigan, regional interests and Canadian federal and provincial representatives to promote observational improvement in the lakes Huron to Erie Corridor (HEC), which includes Lake St. Clair. Regional coordination during this reporting period includes defining opportunities to implement recommendations of the Lake St. Clair Management Plan, released by the U.S. Army Corps of Engineers in 2004. Several of these recommendations deal with monitoring water quality, coastal habitat and nearshore processes throughout the lake. Particular emphasis has been placed on developing a three-dimensional hydrodynamic flow modeling of the HEC which could be run continuously by NOAA to support several of the IOOS societal goals within the sub-region.

Web Page Development

During this reporting period, the GLOS RA further improved its web page for the enterprise, including prototype development of a regional web mapping engine to provide user friendly access to geospatial datasets. This GLOS web page provides comprehensive access to:

- background information on the GLOS initiative, including contact information for the Board of Directors, the Steering Committee and the GLOS Regional Interest Group, the draft Business Plan; the 2006-07 Annual Work Plan, the GLOS Bylaws; and, membership information;
- agenda and proceedings of all GLOS-RA meetings and conference calls:
- an events calendar;
- a user needs survey area;
- current lake conditions, including water levels, surface temperatures, meteorologic observations, weekly weather and water level forecasts, and links to an experimental buoy in Grand Traverse Bay;
- links to other collaborators including IOOS, other RAs, supporting agencies, Great Lakes regional partners and relevant publications;
- Great Lakes news stories including those on observations and monitoring programs across the region; and,
- past GLOS Update articles, including those written during this reporting period.

Education and Outreach

During this reporting period, the GLOS-RA concluded a memorandum of agreement with the GLSGN to implement an education and outreach campaign to promote the objectives of GLOS across the region. This broad public awareness campaign involves an oversight committee with representation from the seven programs in the GLSGN. Education efforts will build information-sharing relationships between data providers and educators and their students. Outreach efforts seek to engage and inform potential user groups and to seek their input in the design, implementation and product delivery of GLOS. The 2006-07 Annual Work Plan identifies strategic activities for education and outreach activities, including:

- further assessments of user needs, gaps and deficiencies in existing services;
- design and promotion of a GLOS awareness campaign;
- development of promotional materials (e.g., fact sheets, news releases, newsletters); and,
- convening of workshops to highlight modeling and remote sensing initiatives.

Education planning is being coordinated with the Great Lakes Center for Ocean Sciences Education Excellence (COSEE). The Great Lakes COSEE was funded by the National Science Foundation in November 2005 to create dynamic linkages between Great Lakes and ocean research and education with the goal of enhancing scientific literacy and environmental stewardship.

One of the Great Lakes COSEE program's key objectives is to improve communication between researchers and 4-10th grade teachers and students while enhancing teacher capabilities for delivering Great Lakes and ocean education. Over the next five years, more than 2,000 teachers throughout the region are expected to take part in COSEE Great Lakes activities along with more than 350 researchers. The Michigan Sea Grant program will lead the curriculum development, focused heavily on educational opportunities afforded by data integration efforts.

Other outreach activities include creation of periodic newsletters and implementation of a project Wiki. The GLOS Update e-newsletter is generated on a bimonthly basis, distributed to an increasingly wider user audience and posted on the web page. This communiqué was designed to provide GLOS and IOOS updates to a broad user community, including the Steering Committee and Regional Interest Group lists and other partners. GLOS staffers have also been providing updates for the Alliance for Coastal Technologies' Great Lakes Regional Chapter newsletter and for the Ocean.US newsletter.

The GLOS Wiki has been created to provide additional capacity for outside contributors to collaborate on the design and conduct of GLOS. The Wiki provides for a discussion forum between members of the GLOS Board, its committees, subsystem technical experts and others to exchange and archive information relevant to the endeavor.

Another key facet of outreach activities includes keeping congressional representatives apprised of ongoing developments across the region. GLOS staffers have provided input into the GLC's Annual Legislative Priorities on critical regional observing, monitoring and research needs that should be presented at Great Lakes Day in Washington D.C. in early April 2007.

3) Scope of Work

- **RA Establishment, Membership and Staffing**

The GLOS-RA has been established as a non-profit corporation in the State of Michigan, with adopted bylaws, a formal governance structure and a mechanism for engaging stakeholder input for defining resource allocation priorities. Recognition of tax-exempt status by the Internal Revenue Service is still pending. This is expected to be accomplished in early 2007.

A formal membership policy has not been adopted by the GLOS Board, although draft roles, responsibilities and due structures have been discussed. Development of a formal membership program will be a high priority in early 2007. Lack of a membership campaign has not hampered the development of the GLOS-RA, with the majority of emphasis being placed on utilizing existing regional collaboration processes to define short-term priorities.

Staffing for the GLOS-RA has been provided by the GLC, with 2.5 full-time equivalents being programmed for this grant year. The GLOS Board has approved a draft memorandum of agreement with the GLC formalizing this relationship. The GLC Board of Directors are expected to approve this MOA in early 2007.

- **Enhanced User Needs Assessment**

A cursory user needs assessment took place as part of developing the final draft of the GLOS Business Plan submitted to NOAA in 2004. Over this reporting period, the GLOS Secretariat has continued to assess user needs in the following specific categories:

- water supply protection in southeast Michigan along the St. Clair – Detroit rivers / Lake St. Clair waterway, lakes Huron and Erie Corridor (HEC);
- overlake remote sensing observations to support monitoring of nutrient and sediment loading; and,
- commercial navigation needs for improved channel conveyance forecasts for the St. Marys River, upper Great Lakes and the HEC.

Follow-on needs assessments are being included in the outreach efforts conducted by the GLSGN. Additional needs assessments for observations to support the Great Lakes recreational boating community has not yet been conducted, but will be pushed as part of the GLSGN outreach campaign. Of particular interest are defining prospective improvements to near-shore marine forecasts used by all mariners across the system.

In its strategy report released in December 2005, the GLRC recommended that specific activities be conducted by federal, state, county and municipal governments over the next five years to restore and protect Great Lakes ecological resources. These recommendations included a wide array of large-scale programs including restoration of coastal wetlands, protection of drinking water supplies, insuring safe public bathing beaches and reduction of toxics and non-point pollution loadings, all of which require an improved observing frame across the system. These drivers for improving the observing system functionalities are primarily focused on being able to adequately model and monitor spatial and temporal changes in loadings of contaminants, nutrients and sediments to the Great Lakes – St. Lawrence River system. The strategic goals expressed in the GLRC require greater spatial density of meteorologic, chemical, biologic and physical observations and integrated information resources including modeling and visualization.

One focal area of the GLRC Strategy Report was the Indicators and Information Strategy Team's appendix that outlined strategic improvements for observation and monitoring programs, implementation of indicator systems developed to measure progress, networking of information resources, research prioritization and improvements in communication systems. This annex outlines specific areas of focus for the GLOS-DMAC subsystem to address in years to come.

- **Subsystem Cost-Benefits Assessments**

Specific cost-benefit assessments for proposed GLOS regional observing subsystem components have not been conducted during this reporting period, being deferred until the needs assessments outlined above are fully completed. Methods will be developed in early 2007 to support long-term prioritization of resource allocations and funding for subsystem improvements that can be implemented with programmed funding resources.

Problems Encountered

The final draft of the GLOS Business Plan was forwarded to Ocean.US and the NOAA Coastal Services Center in November 2004. To date, the GLOS-RA has not received any comments requiring revision. This document will need to be revised to reflect a more current portrayal of the organization, its programmatic objectives as defined by the GLOS Board and all other requirements identified for RA certification by Ocean.US.

Participation from all U.S. federal agencies engaged in the Great Lakes region still has not been fully achieved. Engagement of representatives from NOAA, U.S. Fish and Wildlife Service, U.S. Geological Survey and the U.S. Coast Guard has been consistent from the beginning of the GLOS-RA. During this reporting period, greater involvement has occurred by the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers. Canadian participation in the design and implementation of GLOS has improved with the appointment of two key academic representatives from Ontario universities with substantial systemic knowledge on the inaugural GLOS Board. Formal relationships with Ontario governmental agencies still lag. Outreach to Quebec federal and state representatives have been noteworthy.

Soliciting buy-in from state organizations, academic institutions and non-governmental organizations has been a continuing challenge, particularly since new funding has not yet been realized. Work conducted by the GLC Secretariat staff in support of the GLRC, particularly dealing with the Indicators and Information Strategy Team, has been instrumental in advancing the potential role of GLOS across the region. Continued engagement of the GLOS Board and Secretariat in the GLWQA review process over the next six months will highlight the importance that GLOS can provide in coordinating monitoring and research across the region.

Development of formal memoranda of agreements between the GLOS Board and major federal agencies within the Great Lake – St. Lawrence River system could be daunting. NOAA has as many as 19 weather forecast offices under 2 regions. NOAA also has research facilities (e.g., GLERL) and other elements within the region. The USACE has three districts operating in the same domain. The USEPA has two regions covering the lakes, one national program office and one major research facility within the region. The USGS has one regional coordinator but eight district offices that could need to be signatories to any GLOS membership agreement. The NFRA and Ocean.US agencies need to provide more assistance in insuring that partnering occurs at the highest practical level.

Due to the binational nature of the Great Lakes – St. Lawrence River system, monitoring of the meteorology, hydrology, hydraulics, biology, chemistry and physical attributes of the system need Canadian involvement. At present, engagement with Canadian counterparts is extremely limited, since there does not appear to be a commensurate investment within Ontario to promote a truly integrated observing system. Horizontal connectivity downstream between GLOS and the SLGO system in Quebec is less problematic, since they have an organizational commitment towards data integration. Binational coordination between U.S. and Canada need to be promoted at a higher degree by Ocean.US and by participating U.S. federal agencies.

- **New Areas of Emphasis**

Due to the binational nature of the Great Lakes and the substantial influence of federal programs, the GLOS-RA will need to refine its priority setting procedures to better reflect emerging consensus about where observing improvements are needed. As such, the GLOS Secretariat will dedicate more staff resources over the next six months towards formalizing a priority setting protocol that is consistent with the systems engineering design strategy outlined by Ocean.US during the November 2006 workshop in Chicago, IL. This emphasis will engage many of the former GLOS Steering Committee members under the venue of "subsystem expert teams" who can identify technical, scientific and engineering solutions to clearly demonstrated problems within the Great Lakes – St. Lawrence River system.

4) Leadership Personnel

There have been no changes in principal GLC staff supporting this project during this reporting period. A total of 2.5 full-time equivalent staffing is expected to be delivered by the GLC to support the GLOS-RA development during this grant period.

5) Budget Analysis

Work through November 30, 2006, has required the expenditure of approximately 51 percent of the total funds provided under the second year of this multi-year grant ($165,882.53 of $325,000.00).

No changes in object class categories have been requested during this reporting period. It is anticipated that travel and contract expenses will need to be increased during this grant period, however, with corresponding decreases occurring in the personnel, fringe benefits, equipment and miscellaneous categories. As such, a revised budget will be submitted on the SF424-A in January 2007 to seek prior approval of the Federal Program Officer and Grants Officer for transfer of funds among line item cost categories.