

**Task Agreement P13AC00875
Against
Cooperative Agreement
P09AC00212 (formerly H4503090700)
between
The United States Department of the Interior
National Park Service
and
University of Rhode Island**

Project Title: Acquisition Coordination, Compilation, Data Management and Change Analysis of LiDAR and Other Geospatial Data Collected Pre- and Post-Hurricane Sandy

CFDA: 15.945, Cooperative Research and Training Programs – Resources of the National Park System (CESU)

This Task Agreement is entered into by and between the University of Rhode Island and the United States Department of the Interior, National Park Service, hereinafter called “NPS.”

ARTICLE I – BACKGROUND AND OBJECTIVES

Cooperative Agreement Number P09AC00212 (formerly H4503090700) dated June 19, 2009, was entered into by and between the Department of the Interior, National Park Service (NPS), Northeast Region and the University of Rhode Island. The purpose of this cooperative agreement is to support coastal national parks in the Northeast Region of the National Park Service, and Servicewide, by providing research, technical assistance, and education through the cooperative relationship with partners of the North Atlantic Coast Cooperative Ecosystem Studies Unit (CESU), including the University of Rhode Island. Unless otherwise specified herein, the terms and conditions as stated in the Cooperative Agreement will apply to this Task Agreement.

Following Hurricane Sandy, numerous Federal Agencies (USGS, NOAA, FEMA, USACE, USDA) mobilized efforts and resources to collect and consolidate large volumes of post-storm geospatial data. The collection includes high resolution LiDAR data, hydrographic survey data, and aerial imagery from multiple collection dates, as well as high-resolution GPS surveys in key park areas. The existing systems architectures at parks is not adequate to support the storage and processing of the large volumes of data and information that parks impacted by Hurricane Sandy have and will be receiving over the next few years. In addition, these important datasets will need to be further processed to provide useful foundation and operational information for planning and storm recovery initiatives for these parks.

The goal of this research is to create an emergency data preparedness and response system for coastal National Parks that will guide geospatial data acquisition, analysis, data management and archiving before, during, and after extreme storm events. The system will be based on lessons learned from

Hurricane Sandy's impact on three National Parks in October 2012 – Gateway National Recreational Area (GATE), Assateague National Seashore (ASIS), and Fire Island National Seashore (FIIS). Geospatial products developed and acquired from other agencies and institutions will be used to quantify damage and guide recovery from storm damage and maximize the benefits of mitigation efforts in the future for these parks. The cooperators will also identify data or information gaps that hindered the response to Hurricane Sandy and data/information resources that were especially important in responding to the storm. In addition, a system will be developed for geospatial data and information acquisition, data processing, data communication, data management, and map production that will be essential to these parks in future storm events.

ARTICLE II – AUTHORITIES

Authorities for this task agreement under Cooperative Agreement **are**:

- Pursuant to 16 U.S.C. Section 1g, the National Park Service may in fiscal year 1997 and thereafter enter into cooperative agreement that involve the transfer of National Park Service appropriated funds to State, local and tribal governments, other public entities, educational institutions, and private nonprofit organizations for the public purpose of carrying out National Park Service programs pursuant to 31 U.S.C. 6305 to carry out public purposes of National Park Service programs.
- Pursuant to 16 U.S.C. Section 1a-2(j), also known as " The Omnibus Parks and Public Lands Management Act of 1996" the National Park Service may "enter into cooperative agreements with public or private educational institutions, States, and their political subdivisions, for the purpose of developing adequate, coordinated, cooperative research and training programs concerning the resources of the National Park System, and, pursuant to any such agreements, to accept from and make available to the cooperator such technical and support staff, financial assistance for mutually agreed upon research projects, supplies and equipment, facilities, and administrative services relating to cooperative research units as the Secretary deems appropriate; except that this paragraph shall not waive any requirements for research projects that are subject to the Federal procurement regulations."
- 16 U.S.C. Section 5933, Cooperative Study Units, authorizes and directs the Secretary to enter into cooperative agreements with colleges and universities, including but not limited to land grants schools, in partnership with other federal and state agencies, to establish cooperative study units to conduct multi-disciplinary research and develop integrated information products on the resources of the national park system, or the large region of which parks are a part.

ARTICLE III – STATEMENT OF WORK

- A. The University of Rhode Island agrees to implement the attached study proposal/work plan (ATTACHMENT A).
- B. The NPS agrees to the tasks presented in ATTACHMENT B.

ARTICLE IV – TERM OF AGREEMENT

This Agreement will become effective upon signature by the NPS Agreements Officer and extend through December 30, 2016.

ARTICLE V – KEY OFFICIALS

The personnel specified below are considered to be essential to ensure maximum coordination and communication between the parties and the work being performed hereunder. Either party, on notice to the other party, may designate another person or persons to act in his/her place for point of contact positions that do not require specific designation.

The NPS Agreements Technical Representative (ATR) will be designated in writing by the Agreements Officer. Authorities and limitations of authority will be explained in the designation letter.

The Cooperator/Recipient may change its Key Officials by notifying the NPS Agreements Officer in writing. The Cooperator/Recipient will address any communication regarding this Agreement to the NPS ATR.

1. For the National Park Service:

Signatory Agreements Officer

NER Agreements Officer
National Park Service
US Custom House
200 Chestnut Street-3rd Floor
Philadelphia, PA 19106
Telephone: 215-597-6476

Agreements Technical Representative

Mary K. Foley-Agreements Technical Representative (ATR)
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2. For the University of Rhode Island:

Signatory

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University of Rhode Island
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Peter V. August, Ph.D.
Department of Natural Resources Science
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Kingston, RI 02881
401-874-4794
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ARTICLE VI – AWARD AND PAYMENT

- A. The NPS has approved this project and the following documents have been submitted by the University of Rhode Island prior to award:
1. SF-424, Request for Federal Financial Assistance
 2. SF-424A, Budget Information, Non-construction Programs
 3. SF-424B, Assurances, Non-construction Programs
- Budget Information from the SF-424A is summarized later in this Article.
- B. Financial Assistance: NPS will provide funding to the University of Rhode Island in an amount not to exceed \$775,500 in fiscal year 2013 for the work described in Article III and in accordance with the approved budget. Any award beyond the current fiscal year is subject to availability of funds.

Appropriation Data: The chargeable appropriation for this Task Agreement is
\$775,500 ----FC: PPNENERO00 FA: PLCLISD5S.CN0000 WBS: PX.P0199992A.00.4

- C. The University of Rhode Island shall request payment in accordance with the following:

1. **Method of Payment.** Payment will be made by advance and/or reimbursement through the Department of Treasury's ASAP system.
2. **Requesting Advances.** Requests for advances must be made submitted via the ASAP system. Requests may be submitted as frequently as required to meet the needs of the Cooperator/Recipient to disburse funds for the Federal share of project costs. If feasible, each request should be timed so that payment is received on the same day that the funds are dispersed for direct project costs and/or the proportionate share of any allowable indirect costs. If same-day transfers are not feasible, advance payments must be as close to actual disbursements as administratively feasible.
3. **Requesting Reimbursement.** Requests for reimbursements must be submitted via the ASAP system. Requests for reimbursement should coincide with normal billing patterns. Each request must be limited to the amount of disbursements made for the Federal share of direct project costs and the proportionate share of allowable indirect costs incurred during that billing period.
4. **Adjusting payment requests for available cash.** Funds that are available from repayments to, and interest earned on, a revolving fund, program income, rebates, refunds, contract settlements, audit recoveries, credits, discounts, and interest earned on any of those funds must be disbursed before requesting additional cash payments.
5. **Bank Accounts.** All payments are made through electronic funds transfer to the bank account identified in the U.S Treasury ASAP system by the Cooperator/Recipient.
6. **Supporting Documents and Agency Approval of Payments.** Additional supporting documentation and prior Agency (NPS) approval of payments may be required when/if a Cooperator/Recipient is determined to be "high risk" or has performance issues. If prior Agency payment approval is in effect for an award, the ASAP system will notify the Cooperator/Recipient when they submit a request for payment. The Recipient must then notify the NPS Awarding Officer identified on the Assistance Agreement that a payment request has been submitted. The NPS Awarding Officer may request additional information from the recipient to support the payment request prior to approving the release of funds, as deemed necessary. The Cooperator/Recipient is required to comply with these requests. Supporting documents may include invoices, copies of contracts, vendor quotes, and other expenditure explanations that justify the reimbursement requests.

D. Nothing contained in this Agreement will be construed as binding the NPS to expend in any one fiscal year any sum in excess of the appropriation made by Congress or administratively allocated for purposes of this Agreement in that fiscal year.

ARTICLE VII – PRIOR APPROVAL

Provisions as set forth in the Cooperative Agreement shall apply to this Task Agreement.

ARTICLE VIII – LIABILITY

Provisions as set forth in the Cooperative Agreement shall apply to this Task Agreement.

ARTICLE IX – REPORTS AND/OR DELIVERABLES:

- A. **Where to Submit** – In accordance with 43 CFR Part 12, the Cooperator/Recipient will submit reports to the NPS Agreements Officer at the address specified in Article V. The Cooperator/Recipient will also submit a copy of each report to the ATR at the address specified in Article V.
- B. **What and When to Submit** – The Cooperator/Recipient will submit to the NPS the following reports at the specified times:
1. Federal Financial Report (FFR), SF425, submitted quarterly, no more than 30 days after the end of the reporting period. The following reporting period end dates will be used for quarterly reports: 3/31, 6/30, 9/30 or 12/31. Upon completion of the project a final FFR will be submitted no more than 90 days after the final project end date.
 2. FFR reports will be submitted for this agreement for any period of time within the quarterly report period.
 3. Performance Reports - In accordance with 2 CFR 215.51 or OMB Circular A-102, **Cooperator/Recipient** will provide quarterly performance reports describing the accomplishments of the Cooperator/Recipient, the expenses and income of the Cooperator/Recipient, and each entity to which the Cooperator/Recipient made any grant during the fiscal year. Quarterly reports shall be due 30 days after the end of the reporting period. Annual reports shall be due 90 days after the grant year. The final performance report is due 90 days after the end of the award.
- C. **Recordkeeping** – The Cooperator/Recipient will keep records concerning this Agreement in accordance with the requirements of the General Provisions, CFR and applicable Office of Management and Budget Circulars.
- D. The Secretary of the Interior and the Comptroller General of the United States, or their duly authorized representatives, will have access, for the purpose of financial or programmatic review and examination, to any books, documents, papers, and records that are pertinent to the Agreement at all reasonable times during the period of retention in accordance with 2 CFR 215.53 or OMB Circular A102.
- E. **Specific Deliverables**
A list of project deliverables and due dates for this Agreement include:

Objective 1 Deliverables - Geospatial Data and Analysis Needs Before, During, and After Storm Events

1. Synthesis report - December 2013
2. Finalization of work plan-December 2013

Objective 2 Deliverables - A System for Improving Park Preparedness

Task A - Geospatial Data Infrastructure

1. Draft schemas for a series of standalone geospatial databases and data repositories as they pertain to the support of emergency response and hazard mitigation efforts. (March 2014)
2. Draft standalone geospatial databases and data repositories (May 2014)
3. Final schemas (September 2014)
4. Standalone geospatial databases and data repositories for parks (January 2015)
5. Report on physical system architecture recommendations for individual parks and/or a regional basis. (November 2014)

Task B - Geospatial Data Workflows in Support of Emergency Response

1. Workflows to be submitted to the NPS on a rolling basis throughout the duration of this project, with the overall work plan finalized in December 2013.
2. First workflow delivery will coincide with the delivery of the initial draft standalone geospatial databases and data repositories. (May 2014)

Task C - Critical Data Acquisition, Processing, and Management

1. Inventory existing datasets that directly support future emergency response efforts. Developed simultaneously with the draft standalone geospatial databases and data repositories. (February-April 2014)
2. Acquire, process, and document existing datasets to create the draft geospatial databases and data repositories as identified in Objective 2, Task A. (April-May 2014)
3. Acquire, process, and document existing datasets to create the draft geospatial databases and data repositories as identified in Objective 2, Task A. (September-December 2014)
4. Maintain the geospatial databases and data repositories as identified in Objective 2, Task A. (February-September 2015)
5. Comprehensively review of existing LiDAR data resources (June-August 2014) and provide summary report to NPS (October 2014).
6. Inventory and compile information regarding current and projected LiDAR data acquisition projects (July 2014) and maintain this inventory. (August 2014 - September 2015)
7. Identify, acquire, process, and archive datasets that document the impacts of Hurricane Sandy. (November 2014 – April 2015)
8. Assist with the development of new datasets that help document high-priority park conditions. (May-September 2015)

Task D - Online Data, Map, and Information Distribution

1. Prototype web page, or series of web pages, featuring basic descriptions, maps, and datasets. (July 2014)
2. Final web-based portal for geospatial data. (July 2015)

Task E - Change Detection and Impact Assessment

1. Final Hurricane Sandy change assessments identified in deliverable 1 (scenario "C" above). (August-September 2015)

Task F - Communication Strategy

1. Draft communication plan for emergency events. (June 2014)
2. Final communication plan. (July 2015)

Objective 3 Deliverables - Prototype Mobile GIS Center for Emergency Response Support

Task A - Design, Test, and Evaluate Prototype Mobile GIS Center

1. Draft Prototype design. (November 2014)
2. Report on testing results and system specifications for prototype mobile GIS Center. (April 2015)

Task B - Inundation Model Prototyping at Site and Landscape Scales

1. Final report presenting prototype inundation maps and models-August 2015

Task C - Creating an Online Interactive Web Viewer for FIIS, ASIS, and GATE that is Accessible Publically, Showing Critical Park Areas and Associated Available Data

1. Online interactive web-map viewer for each park-February 2015
2. Training manuals for each park-August 2015

ARTICLE X – PROPERTY UTILIZATION

Provisions as set forth in the Cooperative Agreement shall apply to this Task Agreement.

ARTICLE XI – MODIFICATION AND TERMINATION

Provisions as set forth in the Cooperative Agreement shall apply to this Task Agreement.

ARTICLE XII – GENERAL AND SPECIAL PROVISIONS

1. Provisions as set forth in the Cooperative Agreement shall apply to this Task Agreement.
2. **Certifications** – The following certification is required in accordance with the provisions of this Agreement: Certification in Regards to Lobbying, on individual awards made under this Agreement that are \$100,000 or over.

ARTICLE XIII – ATTACHMENTS

The following documents are attached and made part of this Task Agreement:

A. The University of Rhode Island study proposal and budget, titled “Acquisition Coordination, Compilation, Data Management and Change Analysis of LiDAR and Other Geospatial Data Collected Pre- and Post-Hurricane Sandy”

B. Statement of work for which the National Park Service agrees to perform.

ARTICLE XIV – SIGNATURES

IN WITNESS WHEREOF, the parties hereto have executed this Cooperative Agreement on the date(s) set forth below:

FOR THE UNIVERSITY OF RHODE ISLAND:

Date

FOR THE NATIONAL PARK SERVICE

Agreements Officer
Northeast Region
Date

ATTACHMENT A: University of Rhode Island Study Proposal

PROPOSAL TITLE: Acquisition Coordination, Compilation, Data Management and Change Analysis of LiDAR and Other Geospatial Data Collected Pre- and Post-Hurricane Sandy

PRINCIPAL INVESTIGATORS: Peter August, Charles LaBash, Greg Bonyng, Roland Duhaime, Aimee Mandeville, and Sunshine Menezes

PROJECT GOAL, MEASURABLE OBJECTIVES, AND GUIDING PRINCIPLES: The goal of this project is to create an emergency preparedness and response system for coastal National Parks that will guide geospatial data acquisition, analysis, and archiving before, during, and after extreme storm events. The system will be based on lessons learned from Hurricane Sandy's impact on three National Parks in October 2012 – Gateway National Recreational Areas (GATE), Assateague National Seashore (ASIS), and Fire Island National Seashore (FIIS).

To meet this goal, we will accomplish the following objectives:

1. Assessment of Geospatial Data Needs by ASIS, FIIS, and GATE Before, During and After Hurricane Sandy. We will evaluate the availability and resolution of geospatial data and information assets for each of the three Parks prior to Hurricane Sandy (October 2012). Working with Park personnel we will identify what geospatial data processing tasks were done in preparation for and response to Hurricane Sandy. We will identify data or information gaps that hindered the response to Hurricane Sandy and data/information resources that were especially important in responding to the storm. Our focus will be on geospatial data, processing tasks, and derivative data products *writ large* and not focus on any single theme or data layer type.
2. An Information System To Improve Park Preparedness for Future Storms. We will develop a system for geospatial data and information acquisition, data processing, data communication, data management, and map production that would be essential in future storm events. Our system will include the following elements: (a) identification of the geospatial data infrastructure (personnel, equipment, data, supplies, connectivity) inside and outside Parks that can function under limited or no public utilities and Internet connectivity to the Park; (b) identification of geospatial data workflows and processing tasks that are high priority before, during, and immediately after a storm event; (c) identification of critical data acquisition activities, including LiDAR data and submerged resource data, that must occur before, during and following a storm to support recovery and damage assessment activities; (d) development (or adoption) of a system of post-storm geospatial data consolidation,

distribution, and archiving that maximizes web-based accessibility to Park personnel and the scientific community; (e) development of protocols for post-storm change detection for natural and anthropogenic components of Park landscapes impacted by storms; and (f) development of a communication strategy that will inform Park personnel, scientists, resource managers, superintendents, and the public about the impact of storms on Park resources and assets.

3. Creating an Expanded Level of Storm Preparedness for ASIS, FIIS, and GATE. Based on objectives 1 and 2 above, we will develop a prototype of the data and information infrastructure required of each of the three Parks for planning and responding to significant coastal storms. The prototype system will include the core elements (a-f) described in Objective 2.

The University of Rhode Island Coastal Institute (CI) and the Department of Natural Resources Science Environmental Data Center (EDC) are experienced partners working together on geospatial data and emergency response planning. The EDC has been actively involved in GIS processing in multiple oil spill events since 1985, as well as supporting the scientific response to natural disasters such as floods, hurricanes and Nor'easters. For over a decade, the Coastal Institute has been involved in emergency response planning activities with the RI Emergency Management Agency, the Emergency Response Division within the RI Department of Environmental Management, FEMA, and the NOAA Office of Response and Restoration. The CI and EDC embrace the following principles in emergency response planning:

Simple: Confusion and complexity abound during emergency. As much as possible, the response plan should be as simple as possible.

Nimble and Flexible: It is impossible to plan for every contingency during an emergency event, but it is possible to engineer flexibility to the plan. We embrace adaptive management, which provides a conceptual basis to adjust response activities real-time as needed.

Science-based: Our focus on emergency planning encompasses the science dimensions of the response system. Other programs manage other aspects of the emergency response portfolio, such as humanitarian aid and public safety. However, our geospatial science can inform and be informed from these activities.

Practical: We strive to develop plans and establish infrastructure that provide service between emergency events. Emergency response assets (personnel, data, infrastructure, processes) should provide continuous value to programs in-between emergency events; but they should

also be ready and available to mobilize when needed during emergencies.

PROJECT ACTIVITIES:

Objective 1 – Geospatial Data and Analysis Needs Before, During, and After Storm Events

Task A - Needs Assessment

In August 2013, we will work with each of the three Parks in this study (FIIS, GATE, ASIS) to determine data and information that served the Park well in Hurricane Sandy and data and information that were not available but would have been useful in preparing for and responding to the storm. We will accomplish this by having critical park personnel (GIS analysts, resource managers) complete a very short web-survey followed by a visit by URI personnel to the Park to discuss data needs. A synthesis of data and information requirements will be developed and sent to the Parks for review and evaluation. This analysis of needs and data gaps will lay the foundation for the specific elevation data collection, modeling, information system design, and communication planning that will be done for the project.

We will be most interested in learning the following from each of the Parks. Our interests are wide ranging and include data and information on natural resources, cultural resources, and Park infrastructure.

1. Pre-storm Preparedness

- a. What geospatial data processing and mapping activities were prominent in the pre-storm period?
- b. What data, information products, and maps were most valuable?
- c. What data, information products, and maps were unavailable but would have been useful?
- d. What were the limitations in pre-storm planning with respect to geospatial data, information, and Maps (personnel, time, specific data, etc.)?
- e. What geospatial resources do Park personnel require to be more effective in planning and preparing for future storms?

2. During the Storm

- a. What activities and tasks dominated park personnel during the storm?
- b. What data, information, and maps were used during the storm?

- c. What data, information, and maps were unavailable but would have been useful?
- d. What geospatial resources do Park personnel require to be more effective during storm events?

3. Post-Storm Recovery and Damage Assessment

- a. What activities and tasks dominated park personnel following the storm?
- b. What data, information, and maps were critical following the storm?
- c. What data, information, and maps were unavailable but would have been useful following the storm?
- d. What geospatial resources do Park personnel require to be more effective in recovering from large storm events?

Deliverables & Timeline

- 1. Synthesis report provided to the NPS. (December 2013)
- 2. Finalization of work plan. (December 2013)

Responsible Personnel

Peter August
Greg Bonyng
Charles LaBash
Roland Duhaime
Sunshine Menezes

Objective 2 – A System for Improving Park Preparedness

Task A – Geospatial Data Infrastructure

Two fundamental geospatial data infrastructure needs have been identified by the NPS for the three Parks in this study. The first is a need for a system of standalone geospatial databases and data repositories that are not dependent on Internet access. The second is a need for physical system architecture recommendations that will help empower the Parks to more easily manage large influxes of disparate digital data, particularly after storm events.

The eventual approach to this task will be mutually determined with NPS emergency response team specialists as part of the initial needs assessment phase of this project.

At this time, we anticipate prioritizing the development of standalone geospatial databases and data repositories that are able to function without Internet access. Our goal is to have initial versions in place at each Park prior to the start of the next Atlantic hurricane season on June 1, 2014. We envision these resources as built around software and technologies easily accessible and by the individual Parks, with an emphasis on Esri ArcGIS Desktop. Database and data repository schemas will be designed in partnership with NPS emergency response team specialists. While we intend for them to share common elements (e.g., nomenclature and data themes), we also expect that these will be customized to a modest extent to meet unique needs of each Park. The actual implementation of the database and data repository designs produced during this phase, as well as workflows that leverage these new resources, will take place as part of *Objective 2 Tasks B and C* of this study.

Beyond the initial project needs assessment, an online survey, or telephone interview will likely be conducted for gathering more information pertaining to the various aspects of the geospatial databases and data repositories. These aspects will include geographic extents, available data layers, ease of use, data gaps, and naming convention. Results of the database schema review will be used to steer improvements for the entire geospatial data infrastructure.

Physical systems architecture recommendations (e.g., workstations, laptops, mass storage devices) will also be made to each individual park after learning what resources are currently available to each. The goal for these recommendations is twofold: 1) have sufficient hardware to meet the needs of a mobile, on-demand GIS center for each Park that may be quickly moved between locations and function without Internet access, and 2) a more robust infrastructure that

may readily accommodate erratic influxes of large, disparate datasets. The specifics of this infrastructure will be developed mutually with NPS emergency response team specialists. For example, it is unknown at this time if it would be more practical to recommend a more robust geospatial infrastructure at individual Parks, or promote a system that functions on a regional scale and housed by a specific Park or partner institution (and is therefore is reliant on a functioning Internet connection).

We will prototype and demonstrate the mobile, on-demand GIS center using primarily existing resources available to us at URI (see *Objective 3, Task A*). The expense of implementing the physical systems architecture recommendations developed by this study will be borne directly by the NPS at its discretion.

Simplicity in both the design of the systems themselves, and the hardware resources that make these systems possible, will be emphasized throughout this task.

Deliverables & Timeline

1. Share draft schemas for a series of standalone geospatial databases and data repositories for each of the three Parks in this study, as they pertain to the support of emergency response and hazard mitigation efforts. (March 2014)
2. Draft schemas reviewed by three or more potential users. (April 2014)
3. Provide initial draft standalone geospatial databases and data repositories to Parks. (May 2014)
4. Schemas finalized and applied to standalone geospatial databases and data repositories. (September 2014)
5. Deliver standalone geospatial databases and data repositories to Parks. (January 2015)
6. Update standalone geospatial database and data repository schemas as the needs of the Parks change over the course of this project. (January-September 2015)
7. Provide pertinent physical system architecture recommendations for individual parks and/or a regional basis. (November 2014)

Responsible Personnel

Greg Bonyng
Roland Duhaime

Task B – Geospatial Data Workflows in Support of Emergency Response

The speed and efficiency for how geospatial technologies may be used to effectively support emergency response is largely determined by the use of pre-positioned, accessible data (see *Objective 2, Task A*), and pre-determined and tested workflows and analyses. Workflows to support emergency response are addressed by this Task, and analyses are addressed by *Objective 2, Task E*.

Workflows will be developed that address both data management and processing, as well as map production. Previous work by the NPS Northeast Region's Field Technical Support Center (FTSC) and the Northeast Coast and Barrier Inventory and Monitoring Network (NPS I&M), both located at URI, will be leveraged as appropriate. The identification of specific workflows, and the development priority of these workflows, will be mutually determined with NPS emergency response team specialists. Deliverables will consist of workflows documented using Microsoft Office (using Word and/or PowerPoint files), and accompanied by sample data and Python or ModelBuilder scripts when appropriate.

We envision the development of data management and processing workflows that address the following topics:

1. Data acquisition utilizing the NPS and federal government framework, with an emphasis on LiDAR data collected after storm events.
2. Approaches to quality control and quality assurance techniques for quickly assessing recent acquisitions.
3. Cataloging and publicizing the existence of currently available datasets.
4. Streamlining the processing of particular data types and formats (e.g. efficiently importing and utilizing data collected by specific handheld GPS models).
5. Using online resources to search for external sources of data (e.g., Data.gov, USGS EarthExplorer).
6. Methods for documenting datasets as the situation warrants, ranging from simple descriptions, to Esri ArcGIS metadata tools, to full FGDC CSDGM compliant metadata.
7. Preparation of data for distribution.
8. Archiving of digital data using recommendations developed by the GeoMapp project (<http://www.geomapp.net>).

We expect to emphasize the creation of workflows for the processing of larger, more complex datasets (e.g., LiDAR and LiDAR-derived products) rather than basic geospatial data delivered in more common formats. Needless to say that workflows that entail using specific NPS or federal

government guidelines and protocols (such as LiDAR data acquisition) will require NPS specialists to actively participate in the development of these workflows.

With respect to map production, we envision the development of workflows that address the following topics:

1. Semi-automated map production using Esri ArcGIS map templates and map books.
2. Production of georeferenced PDF-based maps for use on mobile devices.
3. Cataloging and publicizing the existence of currently available maps.
4. Archiving digital copies of maps.

Like the development of a geospatial data infrastructure described in *Objective 1, Task A*, workflows will emphasize simplicity to the extent that the supporting technology and data reasonably permit, without sacrificing the quality of the end products.

Deliverables and Timeline

1. Workflows to be submitted to the NPS on a rolling basis throughout the duration of this project, with the overall work plan finalized in December 2013.
2. First workflow delivery will coincide with the delivery of the initial draft standalone geospatial databases and data repositories. (May 2014)

Responsible Personnel

Greg Bonyng
Roland Duhaime
Graduate Student Assistant

Task C – Critical Data Acquisition, Processing, and Management

Once an initial vision of the standalone geospatial databases and data repositories has been completed, we will assist the three Parks in this study with identifying, acquiring, processing, and archiving appropriate data that will meet identified data needs. We expect that these data needs will range from small to large scales, and will work with NPS emergency response team specialists to prioritize data needs and budget staff time for this task accordingly. We propose the priorities of this task to be the following, listed in order of priority:

1. Identify, acquire, and process datasets that fill out the standalone geospatial databases and data repositories intended to support future emergency response efforts.
2. Conduct a comprehensive review of existing, pertinent LiDAR data, and LiDAR-derived datasets, available to the three Parks in this study. The review will include documenting the areal extent, technical specifications, and quality control information available for each dataset. We will ensure that these data are accessible to the NPS, and wherever possible and within the reasonable constraints of this project's budget, ensure that the delivered product match what the NPS contracted for. Should existing geospatial infrastructure at the three Parks not be able to accommodate these existing LiDAR data and LiDAR-derived products, we will make reasonable accommodations to distribute these data using existing URI EDC resources, assuming these data are not already readily available elsewhere (e.g. NOAA Digital Coast).
3. Using information learned during the review of existing LiDAR datasets, we will collect and compile information regarding current and potential future LiDAR acquisition projects for the three Parks. We will assess that the areas of critical concern identified by NPS emergency response team specialists are addressed by these projects, and when appropriate, make recommendations for LiDAR data collection specifications.
4. Time and budget permitting, we will produce high-priority LiDAR-derived products that may not be already in development by another NPS partner or project.
5. Identify, acquire, and process datasets that document the impacts of Hurricane Sandy. New datasets will be created, when practical and within the limits of this project's resources, for high-priority concerns identified by NPS emergency response teams. For example, West Pond and East Pond are freshwater ponds at GATE. These important flyway stopover areas breached as a result of Hurricane Sandy. While the breach areas are relatively small, the impacts are much larger because these ponds have been opened to

salt water flow¹. When applicable, we will seek to acquire and document data products from pertinent research that measure the impacts of Hurricane Sandy, as these may influence future decisions related to natural resource management and hazard mitigation.

6. Time and budget permitting, assist with the development new datasets that help document current high-priority park conditions that may be used as a baseline to measure future storm impacts. This may include acquiring pertinent data that support the hazard mitigation efforts of natural resources management, park facilities, and cultural resources protection staff.

We expect this list of priorities to change as more applicable data becomes available and we learn more about specific needs of the NPS staff. In addition, because each National Park is unique, we expect data to vary slightly between each of the Parks and their respective state organizational units.

In conjunction with the ongoing work of the NPS Northeast Region's FTSC, we will work to stay informed via regional meetings, conference calls, and discussions pertaining to the data needed for Sandy response and future response efforts. In addition to learning information that will guide the work of this project, our participation will be also to help champion the inclusion of important NPS area into any proposed data collection footprint.

Deliverables and Timeline

1. Inventory existing datasets that directly support future emergency response efforts. Developed simultaneously with the draft standalone geospatial databases and data repositories. (February-April 2014)
2. Acquire, process, and document existing datasets to create the draft geospatial databases and data repositories as identified in *Objective 2, Task A*. (April-May 2014)
3. Acquire, process, and document existing datasets to create the draft geospatial databases and data repositories as identified in *Objective 2, Task A*. (September-December 2014)
4. Maintain the geospatial databases and data repositories as identified in *Objective 2, Task A*. (February-September 2015)
5. Comprehensively review of existing LiDAR data resources (June-August 2014) and provide summary report to NPS (October 2014).
6. Inventory and compile information regarding current and projected LiDAR data acquisition projects (July 2014) and maintain this inventory. (August 2014 - September 2015)
7. Identify, acquire, process, and archive datasets that document the impacts of Hurricane Sandy. (November 2014 – April 2015)
8. Assist with the development of new datasets that help document high-priority park conditions. (May-September 2015)

¹ <http://news.nationalgeographic.com/news/2013/13/130426-gateway-national-parks-new-york-city-hurricane-sandy>

Responsible Personnel

Roland Duhaime
Greg Bonyng
Charles LaBash
Graduate Student Assistant

Task D – Online Data, Map, and Information Distribution

We will develop basic descriptions, maps, and document the geographic extent and availability of datasets collected after, and in response to the effects of, Hurricane Sandy for each of the three Parks in this study. Information about these datasets will be requested during the needs assessment phase of this study, and follow-up conversations will be conducted as necessary. The development of these materials will be documented as a workflow (or a series of workflows) that may be re-used for future storm events.

A simple online portal webpage will be developed for sharing these materials. It will either be hosted in the context of the URI Environmental Data Center website, a NPS website that URI EDC staff are invited to contribute to, or another mutually determined location. Maps illustrating the extent and areal coverage of these data will be produced and shared in the form of a dynamic web mapping application, as well as a series of standalone georeferenced PDF files exported from Esri ArcGIS Desktop.

The method for how the online web mapping application is developed is to-be-determined. It largely depends on the resources available to NPS emergency response team specialists. For example, while the URI EDC has a robust Esri ArcGIS Server system, such a solution may not be suitable in the long term for the three Parks in this study if ArcGIS Server is not available to them. The NPS may prefer that the online web mapping application be developed within the context of Esri ArcGIS Online (<http://www.arcgis.com>).

The URI EDC also has the capability to develop and host websites, however it is unknown if the NPS would like the data, maps, and communication materials hosted on a NPS system or elsewhere. At this time, the URI EDC assumes it will host the new portal webpage and any related online web mapping applications on its own web server until the NPS is ready to incorporate the content onto a website and server of its own.

Deliverables and Timeline

1. Delivery of a prototype web page, or small series of web pages, featuring basic descriptions, maps, and datasets depicting the extent of datasets collected in response to the impacts of Hurricane Sandy. The portal will initially focus on available LiDAR data resources, and then grow to accommodate other types of data. (July 2014)
2. Review of prototype web portal by park personnel. (August-September 2014)
3. Continued refinements and maintenance of web-based portal as mutually determined URI EDC and NPS. (October 2014-June 2015)
4. Final delivery of web-based portal for geospatial data, if it is to be hosted on a NPS server. (July 2015)
5. If necessary, support the implementation of the web-based portal by NPS server administrators. (August-September 2015)

Responsible Personnel

Aimee Mandeville
Greg Bonyng
Sunshine Menezes

Task E – Change Detection and Impact Assessment

Major coastal storms such as Hurricane Sandy cause significant change in Park landscapes. Coastlines, dune systems, salt marshes, terrestrial and submerged habitats, and infrastructure shift, become inundated, or are destroyed. Developing an effective recovery plan requires timely and careful assessment of site and landscape-scale changes. For the change analysis to be effective and relevant, pre-storm data on the feature in question needs to be in place and available for change analysis. For example, accurate measurement of the impact of Hurricane Sandy to barrier beach dune systems requires accurate data on coastal topography prior to the storm. Recovery of ecosystems from storm damage can occur rapidly so the time window of collecting post-storm data can be short.

Working with Park personnel and NPS partner institutions (e.g., Rutgers University), we will identify critical change analyses that should be done following a storm event, then identify the baseline geospatial data collected prior to the storm event that will allow these analyses to be conducted. Furthermore, we will identify workflows and protocols to use in these change assessments. As much as possible, protocols will be consistent with NPS I&M monitoring methods.

In the scoping component of the project (*Objective 1*) we will determine which change analyses are most important, and what pre- and post-storm data (e.g., LiDAR elevations, digital imagery) are required to perform the change analysis that are both available and compatible. We anticipate discovering change analyses that are: (A) essential and have been completed, (B)

essential and are underway by the NPS or partners, (C) essential but not being done, and (D) non-essential but would be nice to have. The results of our change analysis assessment will be incorporated into our overall response plan. Depending on budget and data availability, we will begin to conduct those change analyses identified in scenario “C” above.

Deliverables and Timeline

2. Inventory landscape and habitat change assessments that NPS personnel feel are essential. (December 2013)
3. Development and compilation of pre- and post-storm change analysis data and workflow requirements. (January-July 2014)
4. Completion of Hurricane Sandy change assessments identified in deliverable 1 (scenario “C” above). (August-September 2015)

Responsible Personnel

Peter August
Roland Duhaime
Greg Bonyng
Charles LaBash

Task F - Communication Strategy

Part of our focus of the initial Needs Assessment (Objective 1) for this study will be consideration of efficiency and effectiveness of communication channels before, during, and after Hurricane Sandy. Our communication network includes park personnel, non-NPS partners, state and federal agencies, emergency response personnel, and the public. Communication formats include analog (hardcopy) products, web services, social media, and multimedia. Storm response messaging is complex. Not only are there many different topics that have to be clearly conveyed (e.g., public safety, data availability, results of scientific analysis), basic telecommunication infrastructure will likely be impaired during and immediately significant storms, as we saw with Hurricane Sandy.

Based on the input we receive from Objective 1, we will compile a list of communication requirements and develop a communications plan to meet those needs. This project aspect will be led by staff from the University of Rhode Island's (URI) Metcalf Institute for Marine & Environmental Reporting at the URI Graduate School of Oceanography and with additional input from faculty at the URI Harrington School for Communication and Media. The Metcalf Institute is a powerful partner in this project. The Institute strives to improve news coverage of science and environmental issues through science immersion programs for journalists and science communication programs for scientists, and regularly integrates topics relevant to this project within its workshops, seminars, and resources for professional journalists.

Note – we are not going to dwell on telecommunication issues (e.g., two-way radio frequencies, cell systems, satellite communications, Incident Command protocols, etc.) that emergency responders manage. Our focus is communication of scientific information, geospatial data and analytical results, and resource management issues that occur during heavy weather events.

Deliverables and Timeline

1. Synthesis of emergency event communication needs expressed by FIIS, GATE, and ASIS. (December 2013)
2. Draft communication plan for emergency events for Park review. (June 2014)
3. Finalization of communication plan, preliminary implementation (as budget permits) and development of communication templates. (July 2015)

Responsible Personnel

Sunshine Menezes
Graduate Student Assistant

Objective 3 – Prototype Mobile GIS Center for Emergency Response Support

Task A – Design, Test, and Evaluate Prototype Mobile GIS Center

The URI EDC will design, prototype, and test a simple mobile GIS center that may be used by individual parks for emergency response support. The intent is to have a system that may be

quickly stowed, transported, and setup again with little advance notice. It will be deliberately designed to be able to function without Internet access, and will feature the standalone geospatial databases and data repositories for a single Park. The system will likely consist of a mobile workstation (e.g., a robust laptop), a secondary display, printer, scanner, and accessories. While the prototype will use existing off-the-shelf URI hardware resources, recommendations will be made in the final report for a similar system should a Park wish to setup a similar system.

In addition to prototyping the utility of a mobile GIS center, this Task will provide an ideal opportunity to synthesize the compiled data sources, workflows, and analyses compiled to date during this project. After the completed build of the prototype, it will be maintained for the duration of this project to give the team opportunity to further test and verify the workflows that support the use of geospatial technology to support emergency response in the three Parks featured in this study.

The draft timeline described below is intended to give Parks an opportunity to implement a mobile GIS center of their own prior to the start of the 2015 hurricane season. The final timeline will be determined as part of the final work plan to be submitted in December 2013.

Deliverables and Timeline

1. Prototype design completed and shared with NPS for review. (November 2014)
2. Prototype assembled. (January 2014)
3. Prototype tested and refined. (February-March 2015)
4. Report with testing results and system specifications submitted. (April 2015)
5. Prototype hardware and data maintenance, and further workflow refinement as necessary. (April-September 2015)

Responsible Personnel

Greg Bonyng
Roland Duhaime
Aimee Mandeville
Peter August
Charles LaBash
Graduate Student Assistant

DELIVERABLE AND TIMELINE COMPOSITE

Objective 1 – Geospatial Data and Analysis Needs Before, During, and After Storm Events

Task A – Needs Assessment

1. Synthesis report provided to the NPS. (December 2013)
2. Finalization of work plan. (December 2013)

Objective 2 – A System for Improving Park Preparedness

Task A – Geospatial Data Infrastructure

1. Share draft schemas for a series of standalone geospatial databases and data repositories for each of the three Parks in this study, as they pertain to the support of emergency response and hazard mitigation efforts. (March 2014)
2. Draft schemas reviewed by three or more potential users. (April 2014)
3. Provide initial draft standalone geospatial databases and data repositories to Parks. (May 2014)
4. Schemas finalized and applied to standalone geospatial databases and data repositories. (September 2014)
5. Deliver standalone geospatial databases and data repositories to Parks. (January 2015)
6. Update standalone geospatial database and data repository schemas as the needs of the Parks change over the course of this project. (January-September 2015)
7. Provide pertinent physical system architecture recommendations for individual parks and/or a regional basis. (November 2014)

Task B – Geospatial Data Workflows in Support of Emergency Response

1. Workflows to be submitted to the NPS on a rolling basis throughout the duration of this project, with the overall work plan finalized in December 2013.
2. First workflow delivery will coincide with the delivery of the initial draft standalone geospatial databases and data repositories. (May 2014)

Task C – Critical Data Acquisition, Processing, and Management

1. Inventory existing datasets that directly support future emergency response efforts. Developed simultaneously with the draft standalone geospatial databases and data repositories. (February-April 2014)
2. Acquire, process, and document existing datasets to create the draft geospatial databases and data repositories as identified in *Objective 2, Task A*. (April-May 2014)
3. Acquire, process, and document existing datasets to create the draft geospatial databases and data repositories as identified in *Objective 2, Task A*. (September-December 2014)
4. Maintain the geospatial databases and data repositories as identified in *Objective 2, Task A*. (February-September 2015)
5. Comprehensively review of existing LiDAR data resources (June-August 2014) and provide summary report to NPS (October 2014).
6. Inventory and compile information regarding current and projected LiDAR data acquisition projects (July 2014) and maintain this inventory. (August 2014 - September 2015)
7. Identify, acquire, process, and archive datasets that document the impacts of Hurricane Sandy. (November 2014 – April 2015)
8. Assist with the development of new datasets that help document high-priority park conditions. (May-September 2015)

Task D – Online Data, Map, and Information Distribution

1. Delivery of a prototype web page, or small series of web pages, featuring basic descriptions, maps, and datasets depicting the extent of datasets collected in response to the impacts of Hurricane Sandy. The portal will initially focus on available LiDAR data resources, and then grow to accommodate other types of data. (July 2014)
2. Review of prototype web portal by park personnel. (August-September 2014)
3. Continued refinements and maintenance of web-based portal as mutually determined URI EDC and NPS. (October 2014-June 2015)
4. Final delivery of web-based portal for geospatial data, if it is to be hosted on a NPS server. (July 2015)
5. If necessary, support the implementation of the web-based portal by NPS server administrators. (August-September 2015)

Task E – Change Detection and Impact Assessment

1. Inventory landscape and habitat change assessments that NPS personnel feel are essential. (December 2013)
2. Development and compilation of pre- and post-storm change analysis data and workflow requirements. (January-July 2014)
3. Completion of Hurricane Sandy change assessments identified in deliverable 1. (August-September 2015)

Task F - Communication Strategy

1. Synthesis of emergency event communication needs expressed by FIIS, GATE, and ASIS. (December 2013)
2. Draft communication plan for emergency events for Park review. (June 2014)
3. Finalization of communication plan, preliminary implementation (as budget permits) and development of communication templates. (July 2015)

Objective 3 – Prototype Mobile GIS Center for Emergency Response Support

Task A – Design, Test, and Evaluate Prototype Mobile GIS Center

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2. Prototype assembled. (January 2014)
3. Prototype tested and refined. (February-March 2015)
4. Report with testing results and system specifications submitted. (April 2015)
5. Prototype hardware and data maintenance, and further workflow refinement as necessary. (April-September 2015)

BUDGET AND BUDGET EXPLANATION

Start Date: 8/1/13	Man Months	Total Request
A. Personnel		
Gregory Bonyng, Research Associate Lvl IV	18.0	95,778
Roland Duhaime, Research Associate Lvl IV	9.6	61,390
Aimee Mandeville, Research Associate Lvl III	12.5	42,001
Charles LaBash, Research Associate Lvl IV	2.6	18,293
Peter August, Professor	3.0	30,000
GIS Specialist, Research Associate Lvl III	16.7	76,336
Hourly Payroll for GIS Technical Support	9.5	37,440
Grad Students MESM, Academic Yr.	3.2	20,459
Grad Student, Scientific Comm., Academic Yr.	3.4	22,000
TOTAL PERSONNEL COSTS		403,696
B. Fringe		
Fringe for Bonyng Res Assoc IV@ 48%		45,973
Fringe for Duhaime Res Assoc III@ 48%		29,467
Fringe for Mandeville Res Assoc IV@ 35%		14,700
Fringe for LaBash Res Assoc IV@ 48%		8,781
Fringe for GIS Specialist Res Assoc III@ 48%		36,641
Fringe for Hourly Payroll GIS Technical Support		2,864
TOTAL FRINGE BENEFITS		138,427
C. Travel		
Vehicle mileage RI-GATE/FIIS/ASIS (4 trips/park)		3,324
Travel per diem for Park visits (4 trips, 2 people, 2 days/trip)		14504
Administrative travel NPS Offices in Boston, Philadelphia (2 trips, 2 people, 2 days)		1,560
GIS Conference (NEARC New England, esri UC California, NOAA Coastal GeoTools, national/regional LiDAR/geospatial data, coastal hazards/emergency planning/response workshops)		5,033
TOTAL TRAVEL		24,421
D. SUPPLIES		
Mobile GPS/GIS prototype equipment to support Objective 2, Task B		400
Geospatial/organizational/communications software to support Objective 2, Task B		1,550
Computer hardware to support Objective 2, Tasks C,D, E; Objective 3, Task A		5,300
Software to support Objective 2, Tasks C,D, E; Objective 3, Task A		2,500

Data storage to support Objective 2 Tasks C,D,E; Objective 3, Task A		8,250
TOTAL SUPPLIES		18,000
E. OTHER COSTS		
EDC Computing Costs Costs (includes GIS software, computing workstations, data backup services, security infrastructure, GPS equipment)		75,456
TOTAL OTHER COSTS		75,456
TOTAL DIRECT COSTS		660,000
TOTAL MODIFIED DIRECT COSTS		660,000
FACILITIES AND ADMINISTRATIVE COSTS 0% MTDC		115,500
TOTAL REQUESTED FROM AGENCY		<u>\$ 775,500</u>

Budget Notes

Personnel consist of salaries and benefits for Gregory Bonyng, Roland Duhaime, Aimee Mandeville, Charles LaBash, Peter August, and graduate student assistants. We will use M.S.-level students (academic year) from the GIS and remote sensing track from the CELS MESM program to assist in this project. We have also allocated partial funding for a new Research Associate Lvl III staff position to assist in part with this project.

Travel consists of URI travel to the three parks and includes mileage, per diem, and hotel costs. We anticipate four trips to each park over the course of the project with each trip spanning 2 days. Travel to NPS Administrative Offices in Philadelphia and Boston at two trips for 2 people at 2-days per trip. Per diem rates from federal guidelines and auto mileage computed at \$0.55/mile. Also included is travel to the ArcGIS users conferences for the northeast US (NEARC), national (NOAA Coastal GeoTools, South Carolina), and national/international (esri, San Diego, CA) communities to present the results of our work and to gain advanced training in elevation mapping and modeling. Travel to relevant meetings and conferences involving LiDAR/geospatial data coordination/application workshops. Travel to relevant regional/national emergency planning and response conferences.

Supplies support additional GPS/mobile GIS devices to prototype the development of field data workflows in Objective 2, Task B. Additional geospatial/organizational/communication software for general geospatial workflow development in Objective 2, Task B. Additional computing hardware/storage/software to support critical data acquisition, processing and management in Objective 2, Task C; online data, map, and information distribution in

Objective 2, Task D; and essential change analyses in Objective 2, Task E.
EDC computing costs are based on 2 FTE seats. EDC costs include GIS software, access to desktop computers, disk storage space, data backups, network security, and use of EDC printers and plotters.
Indirect Costs are computed at the CESU rate of 17.5%.

ATTACHMENT B

The National Park Service agrees to:

- Assign the Northeast Coastal and Barrier Network (NCBN) Program Manager as the Science Technical Advisor on this project. The Project Manager and the NCBN Data Manager will actively collaborate with the University of Rhode Island investigator, research associates, graduate students and under graduate interns on the project priorities, design, data management, data interpretation, and production of final deliverables including data formats.
- Provide the cooperator will all relevant GIS and LiDAR data sets that may be important to the study.
- Work closely with the URI EDC team to identify what geospatial data processing tasks were done in preparation for and response to Hurricane Sandy.
- Work closely with the URI EDC team to develop a strategy for each park to better understand their emergency data needs, such as during and post Hurricane Sandy.
- Work with URI to identify specific workflows and the development priority of these workflows.
- Provide guidance and expertise on NPS data management procedures and protocols, and work closely with the URI EDC lab to meet NPS data and web standards.
- NCBN staff will meet regularly with the URI staff to provide assistance and expertise with all components of this project.
- Review and provide feedback on documents, material and reports prior to URI's final submission.