NPMap Builder

2015 URISA ESIG Award Submission

NPMap

www.nps.gov/npmap
US National Park Service
Lakewood, Colorado
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A. System

1. Name of system and ESIG™ category for which you are applying (Enterprise System or Single Process System).

NPMap Builder: [http://github.com/nationalparkservice/npmap-builder](http://github.com/nationalparkservice/npmap-builder)

(Enterprise System)

2. A letter from the executive administrator authorizing submission of the system application.

United States Department of the Interior

NATIONAL PARK SERVICE
1849 C Street, N.W.
Washington, DC 20340

A7237(2550)

APR 29 2015

Urban and Regional Information Systems Association (URISA)
701 Lee Street, Suite 680
Des Plaines, IL 60016

Attention: Exemplary Systems in Government Awards Coordinator (ESIG)

On behalf of the National Park Service (NPS), I am pleased to authorize the submission of NPMap Builder: a platform for creating and showing beautiful web maps for URISA’s ESIG Award in the Enterprise System Category.

The NPS helps care for some of America’s most cherished cultural and natural resources across the United States and its territories. NPMap Builder is helping NPS employees discover how valuable web maps are in their efforts to protect and conserve these resources for future generation. Web maps are quickly becoming an important way we can communicate the stories to be told about Park Service sites. In the coming years, new technologies such as NPMap Builder are an essential part of the Park Service efforts to enhance visitor experiences by allowing the public to explore the richness of our parks physical and cultural environments in new ways.

NPMap Builder is helping the Park Service build new foundations upon which NPS staff can leverage the power geospatially enabled data and applications brings to their work and how future generations will be able to enjoy our parks.

Sincerely,

Shane Compton
Associate Director, Information Resources

EGIS Award Submission: NPMap Builder
3. What does the system accomplishes and why it is exemplary?

The National Park Service cares for some of the most stunning landscapes and historically significant places in the United States. With 400+ park units and over 300 million visitors a year, digital products created by the National Park Service serve a wide audience and tell a variety of stories.

Using emerging open source technologies, the NPMap team is creating a flexible set of mapping tools that can be used by all Park Service employees to share information with the public via web and mobile applications. Our toolset is made up of a set of core components that can be used either individually, or together, in an easy-to-use graphical mapping interface, NPMap Builder (here on out referred to as Builder).

Builder seamlessly integrates our web mapping library, NPMap.js, our front-end development framework, NPS Bootstrap, our crowd-sourced data collection system, Places, and Park Tiles and NPMaki - which aim to bring the rich cartographic traditions of the NPS to the web.

Builder is exemplary for several reasons:

- guides people step-by-step through the map building process, eliminating technical hurdles
- has our accessibility, usability, and graphic identity best practices built in
- ensures a consistent visitor experience across all maps
- supports advanced use cases by exporting a config file that can be used in conjunction with NPMap.js to add custom functionality
- takes the guess work out of building a web map (cartography, accessibility/usability, graphic identity, interactivity, using multiple technologies, etc.)
- simplifies the process of deploying and embedding web maps into NPS.gov and standalone web pages
4. Three “user testimonials”.

Please see Section G for user testimonials from:

**Thomas Colson**  
GIS Program Manager  
Great Smoky Mountains National Park

**Jeff Trudrung**  
Communications Supervisor  
Blue Ridge Parkway

**Melanie Peters**  
Natural Resource Specialist  
NPS Air Resources Division
B. Jurisdiction

1. Name of jurisdiction

US National Park Service

2. Population served by the organization/agency

The National Park Service serves over 300 million visitors a year.

3. Annual total budget for jurisdiction

The National Park Service has an annual budget of approximately $2.6 billion.

4. Name, title, and address of chief elected and/or appointed official

**Seshagirirao Vaddey**
Chief, Resource Information Services Division
National Information Services Center
W. Jefferson Ave,
Lakewood, CO 80228

5. Name, title, address, telephone, FAX, and email for contact person for system

**Nate Irwin**
Web Mapping Coordinator
12795 W Alameda Pkwy
Lakewood, CO 80228
Phone: 303-969-2870 - Email: npmap@nps.gov - Fax: 303-969-2926
C. System Design

1. What motivated the system development?

The NPMap team has been building custom web maps for the National Park Service and its partners since 2010. After the first few years of building these maps, we began defining a set of standards and best practices that needed to be built into every map that was deployed on NPS.gov.

As we were pushing forward our client-based projects, we were simultaneously building the lessons we learned into a toolset we used internally in all of our projects. With best practices, graphic traditions, and standards built in, Builder enables every NPS employee, not just us, to create beautiful web maps for NPS.gov.

2. What specific service or services was the system intended to improve?

The system is intended to improve both our internal workflows and workflows for Park Service employees who are using our tools. We want to take the guess work out of building a web map and make it easy for any employee to build their own map(s) without having to work their way through complex coding and design decisions.

Our goal is simple: empower National Park Service employees to tell stories through digital media that can be shared with park visitors – and make it easy.

3. What, if any, unexpected benefits did you achieve?

First of all, we have employees building and deploying their own web maps!

We have also been pleasantly surprised with the number of National Park Service employees who have contributed something back to our toolset. In some cases, they may just open an issue to let us know about a bug, but in
others cases they have contributed code, documentation, or ideas for enhancements back. Given the limited number of technical individuals in the Park Service, this was not something we expected when we first started working on Builder.

One last unexpected benefit we have seen is a renewed interest in data quality in the National Park Service. Builder enables non-technical employees to build maps with data, and when people can see data and identify problems and gaps, fixing data quality issues becomes a priority for whoever the data steward is.

4. **What system design problems were encountered?**

The Park Service does not, at this time, have an enterprise geospatial system. Therefore, there is not one way of collecting, organizing, and storing data. Because of this, we needed to create a flexible system that could read a variety of different data formats, such as data coming from ArcGIS Server, CartoDB, Mapbox, etc.

Further challenges with our system included integrating multiple technologies that the park service uses (ArcGIS, etc.), converting cartographic traditions to the web, and creating a friendly user interface and experience for non-technical and non-GIS users.

5. **What differentiates this system from other similar systems?**

Everything. This system allows users to edit/update and create beautiful maps with NPS design elements incorporated. If an employee uses Builder, they can be assured that their map meets our web accessibility/usability, graphic identity, and responsiveness standards.

In addition, this system is flexible, open source, and not tied to any one technology or platform. These characteristics differentiate Builder and our other tools from other systems we are aware of.
D. Implementation

1. What phases did you go through in developing the system?

When we first started building web maps, we found ourselves building a lot of “one-offs” with duplicate code. We quickly identified this as a problem and started developing modular tools that could be shared across all of our projects.

These individual tools - like NPMap.js, Park Tiles, and Places - evolved and grew organically as we worked our way through targeted projects for National Park Service parks, regions, and programs. While working on these projects, we identified requirements and then extended our larger toolset so they addressed these requirements. After the requirements were met, any bug fixes or new features (e.g. point clustering) could be seamlessly rolled out to other projects.

Eventually our toolset matured, but we then realized that most National Park Service employees didn’t have the skill set to use our standalone tools to build their own web maps. Builder was born to bridge this gap in knowledge and skill.

2. Were there any modifications to the original system design?

Yes. Each of our tools, including Builder, are dynamic and in a constant state of evolution as we adapt new technologies and phase old technologies out.

One of the main drivers of change for our toolset is evolving user requirements. We focus our efforts on fixing bugs and adding enhancements identified as high priority by our user community. In this way, we hope to build a passionate community around our toolset.
E. Organizational Impact

1. What user community does the system serve and how?

Builder is a tool National Park Service employees can use to share information and stories with both internal Park Service users and the general public.

The National Park Service has a dedicated workforce of over 22,000 employees spanning a wide variety of professions. Of these employees, only a handful have the technical skills necessary to build a web map. In addition to technical know-how there are additional barriers associated with building and deploying web based products for an organization like the National Park Service.

Builder enables any NPS employee to create maps that follow accessibility/usability guidelines, fit into the look-and-feel of the NPS graphic identity, can be viewed across multiple devices and browsers, and can be maintained for the long-haul with the Park Service’s limited resources.

Because Builder allows NPS employees to easily create and share maps with the public, the variety of stories that the park service has to tell are now being shared with a wider audience.

2. What are the ultimate decisions/operations/services being affected?

In and of itself, Builder doesn’t address any one specific use case. It, rather, gives National Park Service employees who have little-to-no technical knowledge the ability to build and publish their own high-quality web maps. The type of maps these individuals choose to build is up to them.

Some of the more interesting examples that have been built up to this point include:
• A map of the current wildlife closures in Denali National Park
• A map that highlighted tree locations and other points of interest for the National Mall’s Cherry Blossom Festival
• A map that highlights locations where soundscape data was collected in and around Grand Teton and Yellowstone National Parks, with the ability to listen to audio clips and view summary information for the types of sounds collected
• A map created by Rocky Mountain National Park to highlight trail damage that occurred during the 2014 flooding event in the park
• A map that shows motor and carriage road vistas in Acadia National Park
• A heat map that shows the extent of the territory of three bears and where they spent most of their time over a three year period in Denali National Park

This list is an incomplete sampling. At the time of writing, more than 350 maps have been built and deployed with Builder.

3. What were the quantitative and qualitative impacts of the system?

Qualitative:

• Employees do not need specialized training in cartography, development, or IT.
• Employees do not need to install any software on their machines to use Builder. Many employees do not have admin rights on their computers, so this is important to them.
• Simple maps take less than five minutes to build and deploy. This means that Park employees can use Builder to communicate real-time information to their visitors.
• The rich graphic and cartographic traditions of our agency are now being applied to our web products.
• Maps made with Builder can be used by everyone because we adhere to strict usability/accessibility guidelines, including Section 508 and WCAG 2.
Quantitative:

- Updating visitor facing maps with the most up-to-date information used to take months. Taking advantage of cutting-edge technologies, the maps and data available in Builder always reflect the best information available.
- Time saving. NPS employees do not have to jump over technical hurdles to create web maps. This allows them to focus on content and the story they want to tell.

4. What effect has the system had on productivity?

Our tools change the way people can contribute and add data to maps. They allow users to create maps that provide important information for public consumption. While some parks have the manpower and ability to update their own data, others don’t. Our tools lower the barrier for building and deploying a good-looking, informative map.

As Melanie Peters puts it in one of the attached user testimonials: “I shudder to think back to the time when accessing dynamic map data required special training and expensive software and was still, usually, ugly.”

5. What, if any, other impacts has the system had?

The maps that have been created with Builder have forced the National Park Service to rethink how it collects, maintains, and shares data. In some parks, basic geospatial datasets like roads, trails, and points of interest are nonexistent or have not been updated for years. Our maps have brought these problems to the forefront, and have, in turn, initiated new conversations about data quality.

6. How did the system change the way business is conducted with and/or service delivered to clients?

The user testimonials attest to the way that Builder has changed “legacy” or existing workflows. Builder has dramatically decreased the number of steps
required to get information out to the public, such as showing the public which roads are closed, which geysers are about to erupt, which Parks have air quality issues, and which areas in a park are the quietest.

**Yellowstone Live**

Before Yellowstone National Park started using NPMap’s Places system to collect and maintain road status information, they had to walk through a number of disconnected steps to report an incident that occurred on a park road to the public. This process involved multiple people, and it was so convoluted that status updates sometimes never made it out to the park’s website.

Now that the park is using Places to collect this information, they are able to use a simple online editor to create or update an incident, and this change is automatically pushed out to the park website (via a map created with Builder) and heads-up/kiosk displays visitor centers. This ensures that the public always has access to the most up-to-date status information.

**New River Gorge Rapids**

An employee at the New River Gorge National River used Builder to map out the main rapids on the New River. She collected videos of a park ranger kayaking through each of the rapids and linked those videos to markers on the map. Building a map like this would have previously required involvement from someone with specific technical knowledge, but she was able to build and deploy the map on her own.

**Grand Teton and Yellowstone Soundscapes**

A scientist who works at Grand Teton and Yellowstone National Parks used Builder to plot out the location of acoustic soundscape monitoring locations in the parks. The map became a container in which he could organize his ideas and data. He used popups to display photos, spectrograms, audio, and descriptive text that detailed the soundscape at each location.
F. System Resources

1. What are the system’s primary hardware components? Give a brief list or description of the hardware configuration supporting the system.

   - CartoDB
   - GitHub Pages
   - Mapbox

2. What are the system’s primary software components? Describe the primary software and, if a commercial package, any customizations required for the system.

Builder wraps a graphical user interface around a set of standalone tools our team builds and maintains. Below is a brief description of each tool.

- **NPMap.js**: [http://github.com/nationalparkservice/npmap.js](http://github.com/nationalparkservice/npmap.js)
  A customized JavaScript library for web maps - built as a Leaflet plugin. NPMap.js is customized to meet the graphic identity and accessibility/usability standards of the NPS.

- **NPS Bootstrap**: [http://www.nps.gov/npmap/tools/bootstrap](http://www.nps.gov/npmap/tools/bootstrap)
  A frontend development framework for building mobile-first websites. NPS Bootstrap is a customized version of Twitter Bootstrap that is designed to meet the National Park Service’s user interface needs.

- **Places**: [http://github.com/nationalparkservice/places-editor](http://github.com/nationalparkservice/places-editor)
  An internal data collection system used to power our maps and digital products. Places is built on top of OpenStreetMap tools and infrastructure.

  A web-friendly version of the National Park Service’s iconic symbol set.

- **Park Tiles**: [http://www.nps.gov/npmap/tools/park-tiles](http://www.nps.gov/npmap/tools/park-tiles)
A suite of custom basemaps built for use on the web by the National Park Service. This suite of maps transfer the cartographic traditions of NPS print maps to the web.

The NPMap toolset uses a number of open source projects internally, including, but not limited to:

- Leaflet, including a number of community-contributed plugins
- Maki
- OpenStreetMap, including a number of supporting projects
- PostgreSQL/PostGIS
- Twitter Bootstrap
- Ubuntu

3. **What data does the system work with? List and briefly describe the database(s).**

Builder allows users to add data coming from ArcGIS Server services, Mapbox, CartoDB, SPOT, and a number of “static” data formats (CSV, GeoJSON, KML, etc.) to their web maps. This flexibility means that employees with a wide variety of technical skills can use Builder.

4. **What staff resources were required to implement the system? (i.e., report approximate staff and consultant time as FTE’s)**

A web developer, a cartographer and a data engineer. (So ~3 FTEs over the course of ~2 years.)

5. **Comment on anything unusual about the resources used to develop your system, such as data, software, personnel and financing.**

One thing that is fairly unusual, at least in the federal government, about the way we build all of our tools is that we default to open source. This means that almost all of our tools are available under an open source license and available for others, even those outside of the National Park Service, to use.
We also do most of our development on these tools out in the open on GitHub, so anyone who wants to contribute can, and those who want to follow along can see what we are working on and impact our priorities.
G. User Testimonials

Thomas Colson, GIS Program Manager
Great Smoky Mountains National Park

TO: ESG Award Coordinator

SUBJECT: User Testimonial (Great Smoky Mountains National Park Testimonial in Support of National Park Service Places and Park Tiles)

DATE: April 23rd, 2015

Great Smoky Mountains National Park (GRSM) is one of the nations, if not the worlds, most visited park with over ten million annual visitors. With such a high-volume of visitors accessing a very remote area, the ability to provide those visitors with accurate map content and navigation options is not only beneficial to the visitor experience but critical to ensuring visitor safety and resource protection. The park conducts over 150 Search and Rescue (SAR) operations yearly with many of those attributed to lost and injured hikers, a situation resulting from reliance on low-quality paper maps or inaccurate digital maps provided by commercial location based service providers whom have shown no interest in improving the quality and accuracy of digital map products within National Park Service (NPS) Boundaries.

The NPMap team has created several agency-wide enterprise products that meet park visitor cartographic needs. Sourced from open source databases such as OpenStreetMap the NPMap Team publishes a tile cache of base maps called Park Tiles which is used by GRSM is a variety of base mapping products such as the park web page, visitor center kiosk displays, and mobile devices operated by park interpretive rangers. These base map products allow the park to develop interpretive content for digital applications and include a navigation component without having to worry about the back-end infrastructure necessary to deliver dynamic map and location services to application interfaces. The Park Tiles “Base Map” is simply “just there” and the NPMap Team has simplified its deployment through the NPMap Builder Application in a manner that allows any park staff to create a highly-customized digital map with a few mouse clicks and no GIS experience.

In addition to the Park Tiles product, the NPMap Team also maintains an open source database application, “Places” that allows the park to house the GIS data that is used for base cartographic products. This allows the park to focus on data development such as GPS survey of trails and campgrounds and not incur the workload and expense of maintaining the data. Multiplied by 400-plus National Park units this efficiency of content management results in a substantial improvement in spatial data operations for the NPS as well as branding a GIS identity for the agency. Data edits made by a park unit to this database are instantly applied to the Park Tiles application as well as made available for raw data access to the public, enabling all application developer access to authoritative and accurate GIS data.

Great Smoky Mountains National Park utilizes NPMap Team data and products daily in both visitor and internal operations. By integrating the centrally-managed GIS products in park data management products such as web-based mapping and project management, park staff are able to focus on GIS data that is pertinent to their operations and no longer struggle with maintaining base map data for their mapping needs. Park law enforcement operations rely on the 24-7 uptime provided by the Park Tiles application for instantaneous location of E911 call coordinates and plotting locations of enforcement rangers.

Thomas Colson, GIS Program Manager
(865)436-1702, thomas_colson@nps.gov
TO: ESIG Award Coordinator

FROM: Jeff Trudrung, Blue Ridge Parkway Communications Supervisor (jeff_trudrung@nps.gov)

SUBJECT: User Testimonial

DATE: April 28th, 2015

The staff at the Blue Ridge Parkway would like to nominate NPMap for the URISA ESIG award for their work in developing the Blue Ridge Parkway Real Time Road Conditions map as an enterprise system, as it has served as a model for park units throughout the National Park System.

This project has provided an invaluable communication tool to Parkway Staff and the public, providing visitors a more positive visitor experience. We recognize that not only is the Parkway a national treasure that attracts visitors from around the world, but also part of local and regional transportation systems that contributes to the economic vitality of all 29 adjacent counties.

The Parkway strives to provide a high level of service and visitor experience for all visitors - those who live nearby and those who travel from far away. The Blue Ridge Parkway Real Time Road Conditions map allows us to provide accurate, visual information that we have never been able to provide. In the past we have had to rely on recorded phone messages that may or may not be accurate, causing frustration and confusion. We see this interactive, live map as an exciting way to help improve safety, visitor experience, and park operations.

The Blue Ridge Parkway Roadmap (developed by NPMap) serves as a system of the National Park Service (NPS), the Blue Ridge Parkway (Parkway). The Parkway is a designed landscape which travels 469 miles through 29 counties in two states, Virginia and North Carolina. All of those adjacent communities rely on the Parkway not only for recreational visits but as part of their regional transportation system – for that reason, the community of users is not only Parkway visitors (all 13+ million from around the world) but those local residents as well.

The Parkway is one of the most visited units of the NPS, and the critical feature that draws visitors is the motor road itself. The 469 road connects Great Smoky Mountains National Park and Shenandoah National Parks, has 8 campgrounds, 13 picnic areas, 18 book/craft shops, and 14 visitor centers. Obviously the road itself is a critical component of the visitor experience and the connection between all of these sites and resources. We are currently working with NPMap on an updated version to include additional road and visitor information.

Until the development of this system, the Parkway relied upon a static phone line that was manually updated daily or as needed and may not always reflect current conditions. With the development of the Blue Ridge Parkway Real Time Road Conditions map, the Parkway now allows visitors to plan their visits and expectations more precisely, and provides real time data to an extended audience.
Park operations have been improved through the provision of accurate, timely information to staff and visitors; this in turn creates a high quality visitor experience -- part of the NPS mission -- as people know what to expect before they reach the park and are able to minimize frustration.

Communicating road closures -- an almost daily occurrence given weather, construction, traffic, accidents, etc -- is a monumental task and this Real Time Road Conditions map allows us to improve visitor and staff satisfaction, safety, and experience.

This system has streamlined communications in a number of ways. NPS staff can in a matter of seconds update the live map system and closure information can be instantly communicated. This has had a huge impact on a much greater number of visitors, and the quality and volume of information they receive is light years ahead of where we were. Under the old system we had approximately 14,000 calls per year about road conditions, in the first year of the Real Time Road Conditions map we had over 250,000 and that number has been steadily increasing. With the additional functionality being added, we envision reaching a wider audience who are in search of Blue Ridge Parkway visitor information. Visitors can now pull up the map on mobile devices as they travel, they can see where the road/feature is closed rather than having to listen to an automated list of mileposts describing the closures and then take out a map and try to map those manually. Access to timely information describing road conditions makes visitors much happier.

In addition, the Parkway works with travel and tourism groups, and partner groups in the region - we have received very positive feedback from those groups describing improved planning, improved visitor satisfaction, and excitement that real time road condition information is available easily and can easily be shared and communicated.

The Real Time Road Conditions map has served as a model for several other units of the National Park System who need to communicate resources to visitors and other users, so it has had an impact across the country. It has become a standard for National Parks to use in managing visitor expectations, experiences, and information.

The Real Time Road Conditions map system has drastically and dramatically changed the way we provide information to visitors planning a trip to the Parkway, as well as those in the midst of their trip. NPS staff can in a matter of seconds update the live map system and closure information can be instantly communicated. In the past, the road closure static phone number was updated about once a day, and was often inaccurate and hard to follow as there was no visual component. Visitors can now pull up the map on mobile devices as they travel, on computers from home, or wherever they are and they can actually see and visualize road conditions.

Sincerely,

Jeff Trudrung

Blue Ridge Parkway 199 Hemphil Knob Road. Asheville, NC 28803-8586
TO: ESIG Award Coordinator

FROM: Melanie V. Peters, Natural Resource Specialist, Air Resources Division

SUBJECT: User Testimonial

DATE: April 23rd, 2015

As part of the NPS Air Resources Division (ARD) I have collaborated with the NPMap team to develop several web-map products. These intuitive tools present complex national level data sets through web maps and are a key component of ARD’s information outreach strategy. Natural resources, including air, are inherently spatial. Accessible, visually appealing web maps open up new ways of presenting, exploring, and understanding air quality data.

NPMap products on the ARD public webpage communicate air quality conditions, illustrate concerns, and provide data to park staff, researchers, permit applicants, and the public. Where stacks of static maps and long tables of data were once difficult to understand and maintain, NPMap products are easy to explore and update.

The NPMap team consistently raises the bar for improving the visual appeal and ease of use for spatial data on the web. I use these products daily and have received positive user feedback both in person and through our website. I shudder to think back to the time when accessing dynamic map data required special training and expensive software and was still, usually, ugly. Today, the NPMap team is bringing modern web mapping to the National Park Service while following the proud cartographic tradition that has supported our agency for decades and I am proud of what they have achieved. NPMap is making it easier than ever to harness the power of spatial data and share it in meaningful ways. Thank you NPMap for making the NPS look good and for helping us share air quality information in new and exciting ways!

Sincerely,

Melanie Peters