

David Myers is senior project specialist at the Getty Conservation Institute. He is part of the Arches project team, and has worked on its implementation for Los Angeles. He previously worked on GCI projects to establish a citywide historic resource survey of Los Angeles, the implementation of MEGA–Jordan, and on GCI field projects in Egypt, Southern Africa, and Iraq.

Alison Dalgity is senior project manager at GCI, where she is manager of the GCI's Web Application Development Initiatives. She has managed development of Arches and its customization for Los Angeles. She previously managed development of MEGA–Jordan.

Yiannis Avramides is program manager at World Monuments Fund. He is a member of the project team behind the development of Arches, has been a member of the team managing the World Monuments Watch, and has participated in conservation field projects and edited research publications for WMF.

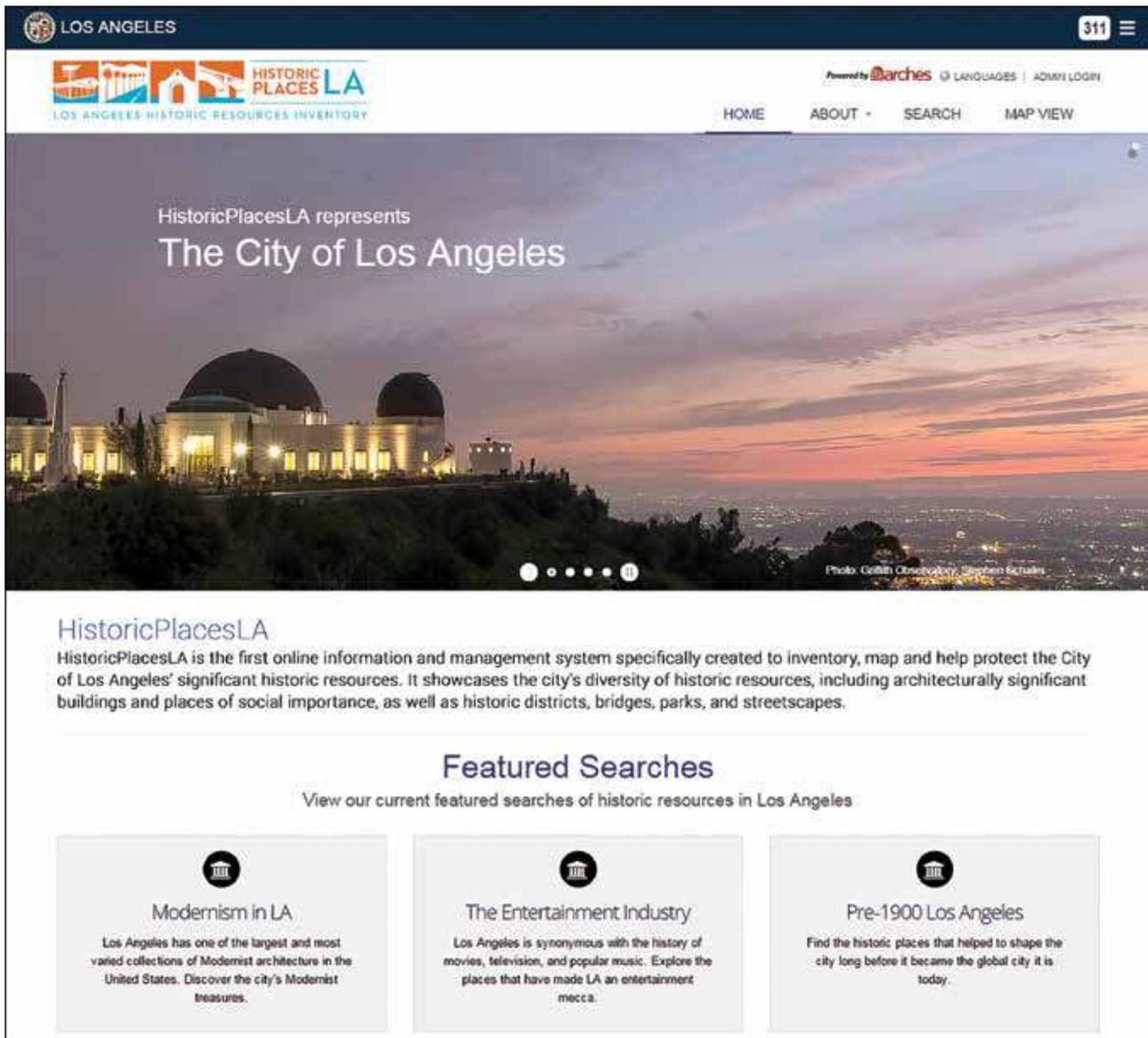
Arches: A Free Software Platform Purpose-Built for Cultural Resource Inventories

By David Myers, Alison Dalgity, and Yiannis Avramides

Inventories are an essential tool for organizations responsible for heritage preservation. They are critical for making proactive, timely, and informed planning decisions, applying preservation-related laws and policies, as well as disaster preparedness and response. The Getty Conservation Institute (GCI) and World Monuments Fund (WMF) are both U.S. – based, private nonprofit organizations working to protect cultural resources in the United States and internationally. The value of inventories to preserving and understanding cultural heritage is being borne out with the GCI's work on a citywide survey of Los Angeles, which dates back to 2000 and has reached fruition through a partnership with the City of Los Angeles implementing SurveyLA. (See *The Alliance Review*, March-April 2015 for another story on SurveyLA).

Internationally, the GCI and WMF also partnered to support the Iraq State Board of Antiquities and Heritage after the 2003 invasion of Iraq, one component of which was to establish a national heritage inventory system. This work led to our

joint partnership with the Jordanian Department of Antiquities to develop and implement in 2010 an online national archaeological inventory system, the Middle Eastern Geodatabase for Antiquities (MEGA) – Jordan.



Screenshot of HistoricPlacesLA, the Los Angeles Historic Resources Inventory.

These experiences with both inventories and surveys, as well as our discussions with heritage organizations around the world about best practices and common challenges, led the GCI and WMF to invest in creating the Arches Heritage Inventory and Management System. Arches is an open-source, web-based, geospatial software platform built for managing inventories of all types of cultural resources — including buildings and other structures, archaeological sites, cultural landscapes, and historic districts. Arches is free for heritage organizations to independently deploy and customize to meet their own needs.

Heritage organizations face a number of challenges in developing and maintaining digital inventories and sustaining related data. Recognizing the pervasiveness of those challenges has been

fundamental to our rationale for creating Arches, and has informed our software development approach. They include:

- *Managing, updating, and sustaining inventory records over the long term:* Heritage organizations periodically carry out or commission cultural resource surveys, which generate substantial amounts of data. Organizations are challenged with transitioning from managing survey data, representing conditions at a particular point in time, to incorporating survey data into an inventory system which allows for updating information over time. The GCI’s experience working with SurveyLA shows that before embarking on a major survey, a heritage organization should ideally have a digital inventory system in place to manage the



The default version of Arches includes six different types of resources (shown below) that can be recorded and related to each other. These six resources can be modified or added to.

 <p>Heritage Resource</p> <p>These are culturally significant places such as archaeological sites, buildings, structures, monuments, shipwrecks, or any place regarded as heritage.</p>	 <p>Heritage Resource Group</p> <p>These are collections of heritage resources that are best regarded as a group. Examples include heritage ensembles, historic districts, and thematic groupings.</p>
 <p>Actor</p> <p>These resources are persons or groups of people. Examples include architects, surveying firms, historical figures, or cultural groups.</p>	 <p>Historical Event</p> <p>These are culturally significant occurrences. Examples include armed conflicts, natural disasters, and sporting events.</p>
 <p>Activity</p> <p>These are actions that occur over a period of time. Examples include surveys, investigations, excavations, literature review, and other actions.</p>	 <p>Information Resource</p> <p>These are objects that encode information such as images (either digital or traditional photographs), documents, reports, audio, or video recordings, and 3D models.</p>

Arches default resource types.

survey data collected. In the absence of well-designed information management systems, data, and thereby knowledge about cultural resources, can be lost permanently. Data can become inaccessible because it is created in proprietary formats that are no longer supported. Lost data can represent years of effort invested by multiple generations of contributors.

- *Rapid technological advancement:* Information technology continues to advance rapidly and heritage organizations are challenged to be well-informed when deciding on which software applications to invest in for their inventory systems.
- *Cost:* Software is expensive to develop, customize, and maintain, and cultural heritage organizations are often chronically underfunded.

In sum, heritage organizations often have significant resource constraints while also making duplicative investments in creating separate inventory systems that address very similar needs. The GCI and WMF have pooled resources to create an

open-source software platform – Arches – that is purpose-built for cultural resource inventories. The net result is a robust inventory platform available to all organizations, which can, when needed, make marginal investments to tailor it to meet their particular requirements.

ARCHES IMPLEMENTATIONS

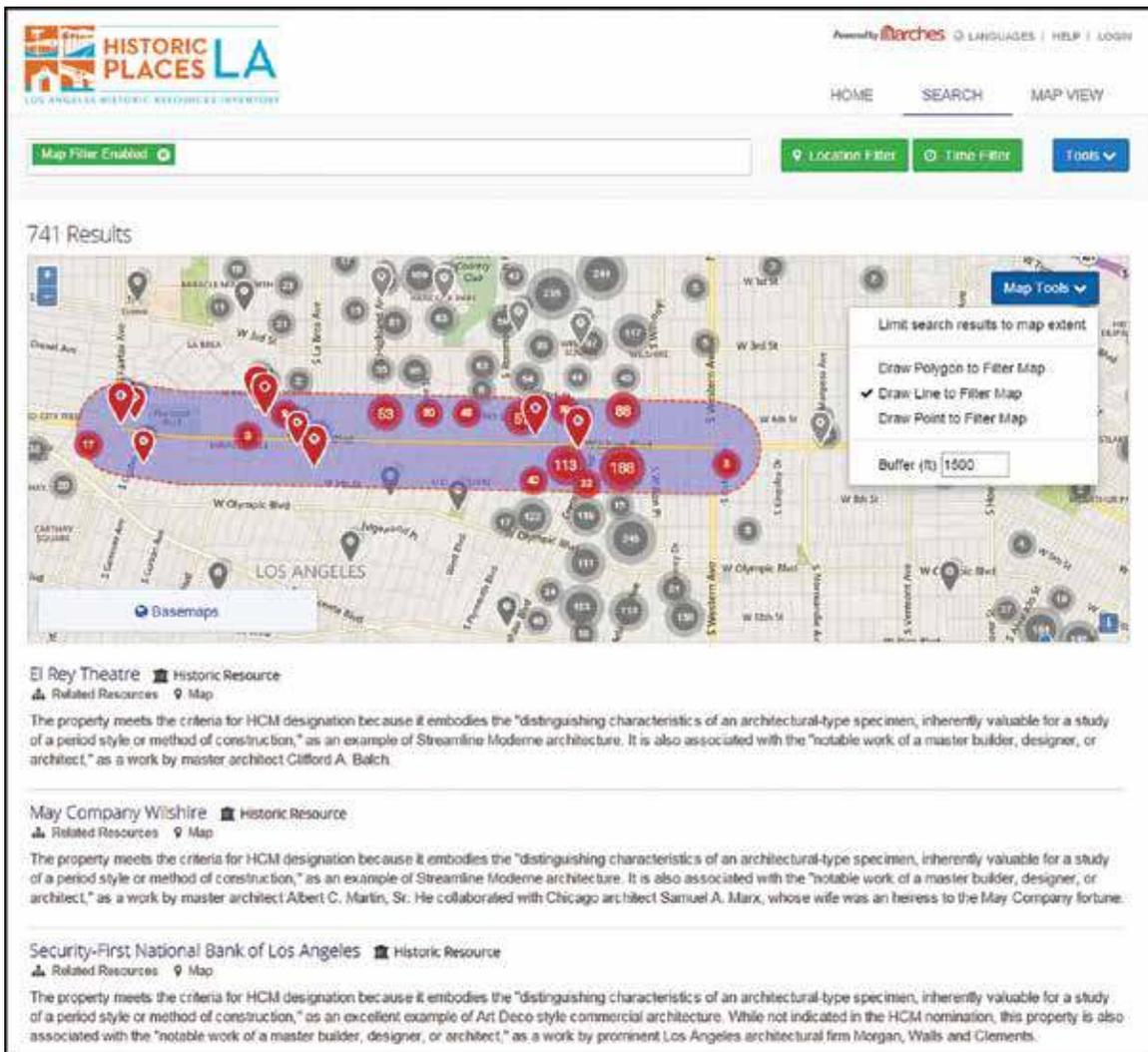
We are very excited by the range of organizations and projects that have already implemented Arches. Some of them are:

- *City of Los Angeles:* The City of Los Angeles has customized Arches as HistoricPlacesLA (<http://historicplacesla.org>), the official Los Angeles Historic Resources Inventory, both to make information publicly and easily accessible and as

Credit: Arches Projects

a tool for meeting its obligations under federal, state, and local historic preservation laws.

- *Cane River National Heritage Area:* The Cane River National Heritage Area in Louisiana has implemented Arches as the Cane River Heritage Inventory and Map (<http://crhim.canerivernha.org>) to manage information on heritage resources and to promote public knowledge, appreciation, and interest in them.
- *Queen Anne’s County, Maryland:* Queen Anne’s County is implementing Arches to present and help preserve more than 300 years of its history of individuals, properties, and events that are significant to the nation, Maryland, and Queen Anne’s County. This Arches deployment is slated to go public in spring 2017.
- *Armed Forces Retirement Home:* The Armed Forces Retirement Home, a 272-acre historic residential campus in Washington, DC, established in 1851 for military veterans, is using Arches as a tool to inventory and manage its important cultural resources.



Credit: City of Los Angeles

Using the location filter in Arches, resources that would be impacted by a proposed development project can be quickly identified.

- *ASOR Cultural Heritage Initiatives for Syria and Iraq*: The American Schools of Oriental Research (ASOR) is using Arches in its collaboration with the U.S. Department of State to document damage, share information with other organizations, and plan emergency and post-war responses to the war-torn heritage of Syria and areas of Islamic State activity within Iraq.
- *Endangered Archaeology in the Middle East and North Africa*: This Oxford University-based project is using Arches to record archaeological sites and landscapes that are under threat across the Middle East and North Africa.
- *Philippine Heritage Map*: A Manila-based non profit has implemented Arches as the Philippine Heritage Map (www.philippineheritagemap.org) to manage and publish online information collected through an ongoing nationwide heritage survey.

Other Arches implementations are currently under preparation around the world, including national inventories in Asia and the Caribbean, city inventories in England, and an inventory of ancient sites across Egypt.

ARCHES DESIGN AND FEATURES

Arches has been designed to address the challenges mentioned previously. Advantages include:

- Arches is economical to adopt. As open source software, Arches is free. Organizations implementing Arches can pool resources for software maintenance and enhancements.
- Arches is freely customizable. The software code is open, and the system is structured in modules designed to be extended. Any geographic location or region can be configured as the area of interest.
- Arches is designed to be as intuitive as

possible, so that most end-users require minimal training.

- Arches incorporates internationally adopted standards for heritage inventory, semantic data modeling, controlled vocabularies, and information technology, leading to better practices in data creation and management. The incorporation of standards facilitates data exchange and structures data to remain viable as technology advances.

Arches supports activities that are essential to historic preservation practice: planning for investigations, resource identification and inventory, research and analysis, impact assessment, monitoring and risk assessment, emergency preparedness and response, conservation and management activities, and providing information to the public, governmental authorities, and decision-makers.

The default version of Arches is structured to manage information on six Arches resource types:

- Heritage resources (e.g., archaeological sites, buildings, structures, landscapes)
- Heritage resource groups (e.g., districts, thematic groupings)
- Actors (e.g., persons, organizations, cultural groups)
- Historical events (e.g., floods, epidemics, battles)
- Activities (e.g., surveys, interventions), and
- Information resources (e.g., documents, images, videos, 3D models)

Data within Arches is structured to enable the creation of networks of relationships among all six

Arches resource types. This allows, for example, multiple roles of persons or organizations to be distinguished—such as an architect who was both the designer and owner of a cultural resource—and allows such roles to be clearly noted within a timeframe. Arches can record location information in multiple formats (with a text description, street addresses, through the identification of cadastral parcels) and in different geometry types simultaneously. An Arches resource record can use any combination of points, lines, and polygons, in addition to other attribute data, to describe a location. This is not easily accomplished using traditional GIS.

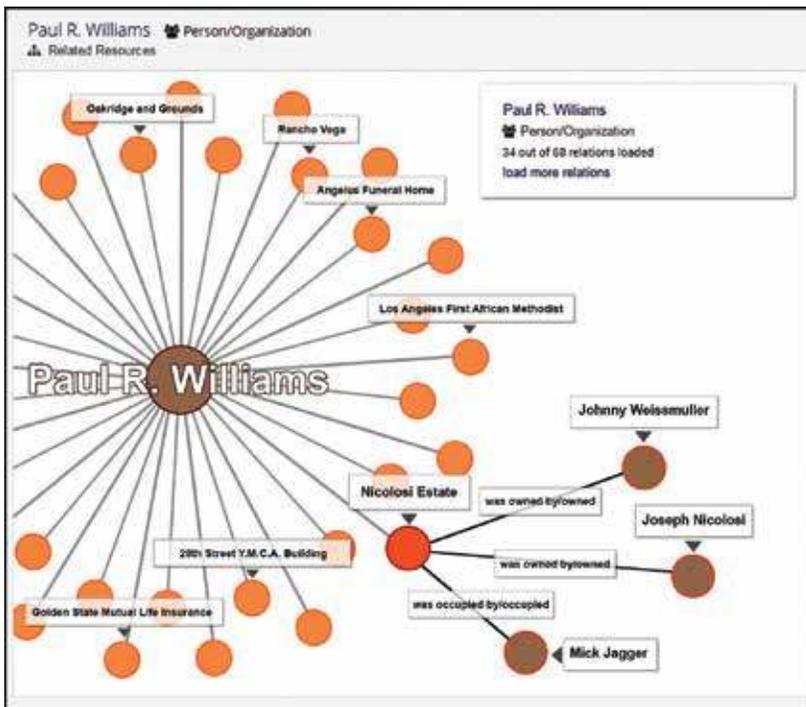
A range of basemaps and satellite imagery can be used in the system, such as OpenStreetMap, Google, and Microsoft, as well as online aerial imagery and historical maps offered by other services. Its compliance with Open Geospatial Consortium (OGC) standards ensures that the system is compatible with desktop GIS applications (such as ESRI's ArcGIS, Google Earth, or Quantum GIS), modern web browsers, and online mapping services. Arches incorporates a Reference Data Manager (RDM) module designed to manage terminology within the system. The RDM facilitates the creation of customized word lists that are relevant for each implementation. Terms in the RDM can then be included in dropdown menus in data-entry forms. Using the RDM enforces data validation and adherence to standards, which enhances the searching process.

Open source software is not the same as open data. Security controls for data access within Arches are customizable to meet sensitive and individualized requirements. Organizations can control data access to the level of individual data-fields based on individual or group privileges. An implementer of Arches can also specify what types

Credit: Cane River National Heritage Area.



Screenshot of the Cane River Heritage Inventory and Map.



Credit: Arches Project

The Related Resources graph reveals relationships between Arches resources, in this instance between an architect and heritage resources as well as other persons related to those heritage resources (such as owners and occupants).

of data will be visible to public visitors. The system preserves changes to records over time, creating an audit history that includes a time stamp and author for all edits. As an enterprise-level software platform, Arches can be used for an entire organization or on a project level. Organizations will need a server or access to cloud-based services to host the Arches platform. As with any enterprise-level software, they will also need to have access to a qualified database administrator or manager to maintain it.

The latest version of the software, version 3.1, was released in November 2015. The Arches project is now preparing a number of substantial software enhancements that will be included in the release of Arches version 4.0, planned for the end of 2016. These include a mobile data-collection app; a mobile data-collection project manager to allow a system administrator to define the scope, area, timeframe, and users for field data collection activities; an installation wizard and an application manager to ease software deployment and configuration; a user profile manager; enhancements to allow the incorporation of locally-stored satellite imagery and other basemaps; and a data import/export manager.

BENEFITS OF OPEN SOURCE AND PROJECT ASPIRATIONS

For heritage organizations to effectively protect

cultural resources, a primary requirement is the ongoing management and updating of its cultural resource inventory. It is also essential that inventory records are accessible, in many cases to a broad range of stakeholders, such as scholars, professionals, and the public. Our collective experiences with heritage inventories and surveys over more than a decade have shown that fulfilling even these basic needs over the long term is often fraught with difficulties.

The GCI and WMF have chosen to invest in creating Arches to build a robust inventory platform that meets many of the needs of most heritage organizations. Choosing an open source software approach offers a number of benefits. The Arches open source license obligates those who enhance the software to share improvements with the entire community. Given that the software code is openly modifiable, organizations wishing to use Arches do not need to wait for a proprietary software company to release needed features. Customizations and enhancements are immediately possible for those with resources to implement them. In addition, multiple organizations that share common requirements may pool resources for software maintenance and enhancements.

Through Arches, the GCI and WMF aim to break the cycle of heritage organizations expending scarce resources on making duplicative expenditures to independently create digital inventory systems. This saves precious resources for the ultimate higher aim of preserving our heritage.

For more information on Arches, visit the project website (<http://archesproject.org/>), where you can participate in the community forum, interact with an online demonstration version, download the software code, access documentation, view the project roadmap, and sign up for updates. ■