

## **CyArk 500 – 3D Documentation of 500 Important Cultural Heritage Sites**

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### **ABSTRACT**

The world is continuously exposed to profound changes and transformations. This affects the achievements of the world's societies, which are at risk. Powerful forces of globalization, from trade to telecommunications and computers, offer new economic and technical opportunities. We communicate easily, use the Web anytime and anywhere, and travel for pleasure sometimes to see the most important cultural heritage sites.

Conversely, we are confronted with natural hazards, witness war amongst conflicting cultures, and above all, struggle to improve conditions for the more than 2/3 of mankind living in sub-standard conditions. Consequently, cultural heritage sites, which are testimonies of individual uniqueness and the roots of an individual society, are in great danger. Some of them will disappear, others have already disappeared forever. How can we preserve these cultural achievements for future generations?

CyArk's mission is to meet this problem. It is dedicated to the digital preservation of cultural heritage sites through the CyArk 3D Heritage Archive offered on the Web. The CyArk 500 project will attempt to digitally preserve 500 of the most important sites within the next five years.

### **1. INTRODUCTION**

What is CyArk? It is a non-profit entity whose mission is to digitally preserve cultural heritage sites through collecting, archiving and providing open access to data created by laser scanning, digital modeling, and other state-of-the-art technologies. CyArk was founded in 2003 as a project of the Kacyra Family Foundation (KFF), located in Orinda, California USA. As a result of Mr. Kacyra's experience running Cyra Technologies from the early 1990s until 2001, the concept of CyArk seemed an evolutionary way to use static LIDAR in combination with high definition photographs to collect 3D point clouds and photos of heritage sites.

#### **1.1. The CyArk Pilot Project**

The CyArk Pilot Project started in 2003 to validate the use of the technology for heritage applications. To take advantage of the Open Access evolution it seemed to us that we needed to overcome the challenges of implementing these new technologies for the purpose of 3D heritage preservation. In more detail, the following challenges have been identified: (1) overcoming the cost of 3D laser scanning and digital documentation (2) creating meaningful deliverables (3) overcoming the bad reputation of some early failed scanning experiences (4) managing the huge volume of media captured and extracted, and (5) viewing 3D clouds of points on the Web in real time. The pilot project took five years to test the premise, to create the tools, and to achieve valid results. These results refined the digital preservation process and created a workflow to face the overall problem. We were overwhelmed by the support of many people, and as a result, CyArk is in the process of being spun off into an international non-profit organization.

The achievements of the pilot project are amazing: In total, 17 sites have been documented, archived and made available to the public (see fig. 1). Over 60 partners worldwide joined our efforts and contributed to the success of the pilot project. Website visits have increased to over 25.000 hits per month. Above all, we at CyArk are grateful to major in kind contributions from our partners. Today, entities from around the world are seeking to use the CyArk system to archive and to provide a means for public access to their projects.

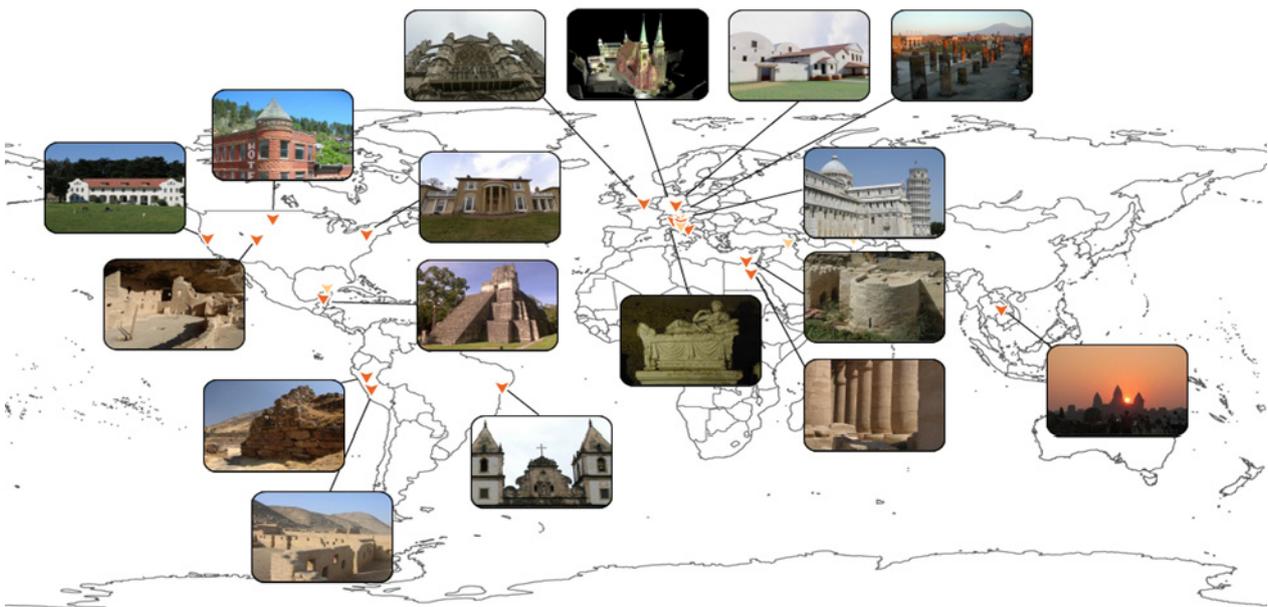


Fig. 1: The CyArk Pilot Project.

Managing the pilot project validated our mission and encouraged us to proceed further. We need both pragmatism and vision going forward. Today we would like to share our experience with all who share the same mindset: making 3D digital preservation of cultural heritage sites operational and public.

## 1.2 The CyArk Process of Digital Preservation

Static LIDAR is one of the emerging data collection technologies currently used in many terrestrial applications. Therefore, the overall process developed at CyArk starts with 3D point clouds rendered with HD photos. Once the data are collected, meaningful deliverables have to be defined. In addition to the point cloud and the photos, 2D CAD drawings, panoramas, video-fly-throughs, scan images, documents, and 3D models are included. All deliverables are stored in a centralized and redundant database. Public dissemination is offered through CyArk's Web Portal. Here, the user can open 3D models and clouds of points using CyArk's 3D Viewer, software developed at CyArk. The web portal fulfills not only the demand for open access but serves education purposes and cultural tourism. Finally, sustainability of experience in 3D preservation is reached through technology transfer and the establishment of Technology Centers all over the world which will be supported by CyArk. The whole line of process is given by fig. 2.

### The Digital Preservation Process

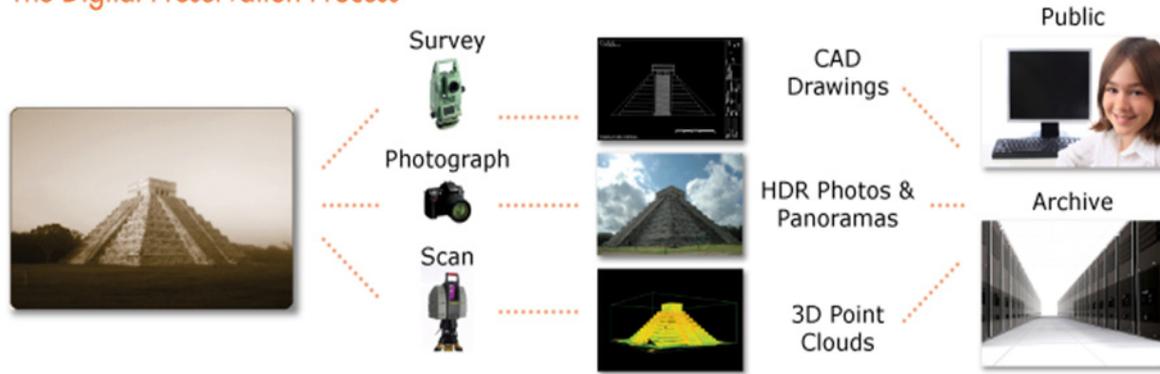


Fig. 2: CyArk's Digital Preservation Process.

In more detail, the process can be described as follows: (1) A cultural heritage site is chosen based upon many factors, specifically individual site need, and its significance to human culture. (2) Upon arrival at a project site, the CyArk team uses a variety of methods to collect and document the site. These include traditional survey techniques, HD photographic images, and 3D laser scanning. (3) Collecting data in such a manner allows CyArk to create a multitude of “deliverables” including CAD drawings, High Dynamic Range photographs, and most importantly, accurate 3D point clouds. (4) Once the files have been created, they are securely stored in the CyArk archives and made available to site managers and the public in the Projects section of the CyArk website.

### 1.3 The CyArk Website

Anyone with a web connection has access to CyArk deliverables through the website: <http://www.cyark.org>. The homepage highlights latest projects, offers a tour to become familiar with CyArk, and gives some rationale behind our initiative. If you click the *Projects* button, a world map is displayed to show the geographic location of published sites as well as sites in progress. A next click onto the individual pins leads to more detailed information on an individual site. The user can even zoom down into the map to see an aerial image of the site. Every site is visited through four channels: through the *Gallery* button, the *3D Content* button (with interactive 3D tools to rotate, measure and explore accurate models of the individual object), the *Project Information* button (with in-depth information), as well as the *Project Map* button (to browse accurate basemaps for geo-referenced multimedia content). By clicking the *Gallery* button, users are brought to thumbnail versions of all media items available including 3D point clouds, 2D CAD drawings, photos, panoramas, video fly-throughs, scan images, documents and 3D models (see fig. 3). By clicking the thumbnail images, users are brought to a larger image and description of the media item. From here users can click the *High Resolution* button to download the media element.

One of the website's innovative highlights is the use of the 3D viewing tool, CyArk's 3D Viewer. Thus, the user can open 3D models and point clouds to manipulate the model in the browser and in real time. Users can also cut sections and take measurements on the fly. Clicking the *Project Map* button takes the user to a map of the site where all the media elements are represented by geo-referenced icons. Clicking the icons allows for access to the media elements and download of high-resolution versions.



Fig. 3: CyArk's Web Gallery (Example: Piazza del duomo, Pisa).

## 2. THE CYARK 500

The CyArk 500 initiative is a global effort to digitally preserve 500 of the most important world heritage sites within the next five years. This will be accomplished through an expansion of CyArk's already established worldwide network of partners, who will utilize new technologies to quickly and cost-effectively digitally preserve these sites. The success of the initiative is easily measured by the number of sites digitally preserved, and by the creation of local technology centers. Why is there a need for the 500? Cultural heritage sites are the tangible testaments of history, a material syllabus of our collective memory. Preserving these powerful, silent witnesses of human history is to preserve our own humanity. We are losing these treasures. The Bamiyan Buddhas, Citadel of Bam, and the Namdaemun Gate are unfortunate examples of just how quickly our heritage can vanish (see fig. 4). In addition to singular catastrophic events, there are increasing, gradual threats to cultural heritage sites. Unfortunately, most of these threats stem from a globally accelerating population. It becomes obvious – the time is now. The advent of laser scanning, widespread internet access, and affordable digital storage means this is the first time in history that we can capture and disseminate information fast enough to make a difference.

Another reason for the 500 is purely pragmatic. 500 is the number of projects CyArk can successfully complete in five years based on its pilot project experience. (1) CyArk has assembled a worldwide



Fig. 4: Lost Cultural Heritage Sites – Examples of the last 8 years.

network of partners who are capable of the highest quality digital documentation work. (2) CyArk has developed and successfully tested project management, work flow, procedures, and standards for major project execution. (3) CyArk has assembled and developed software and methodologies to allow for efficient and cost-effective development of deliverables, archiving and public web access for education and cultural tourism.

What are the benefits of the 500? For education purposes, teachers can download lesson plans that help foster cultural appreciation and create real-world cross-connections between math, science, and history. Students gain a new understanding of history through contextual, interactive 3D information. The public gains the ability to virtually visit hundreds of heritage sites from the same single source on the web. Researchers and archeologists are able to continue their work without having to physically be at the site. Their work can be shared via the CyArk website, furthering their research through collaboration. Site Authorities receive resource management tools to aid physical preservation efforts. They also receive cutting edge training that makes site management more efficient, lifting strain from often inadequate budgets. This allows more funding to be used on restoration efforts, ensuring these sites continue to last for future generations. Local communities receive technology centers and training facilities, enabling them to apply these technologies throughout their region.

### 3. CONCLUSIONS

This paper introduced the CyArk pilot project, which started in 2003. We are impressed by the support we have received through the last couple of years. Today, CyArk is well-known to many who are concerned about the preservation of cultural heritage sites. This is a great success and reaffirms CyArk's commitment to continue its service in digital preservation.

Join the 500. Since its founding in 2003, CyArk has been the leader in digital preservation of cultural heritage, providing the foundation for the "500" (At CyArk, we think of this effort as the

“first 500”!) A true global effort is required for the successful completion of this initiative. Please, join the 500 (see fig. 5) and help CyArk in its digital preservation effort!

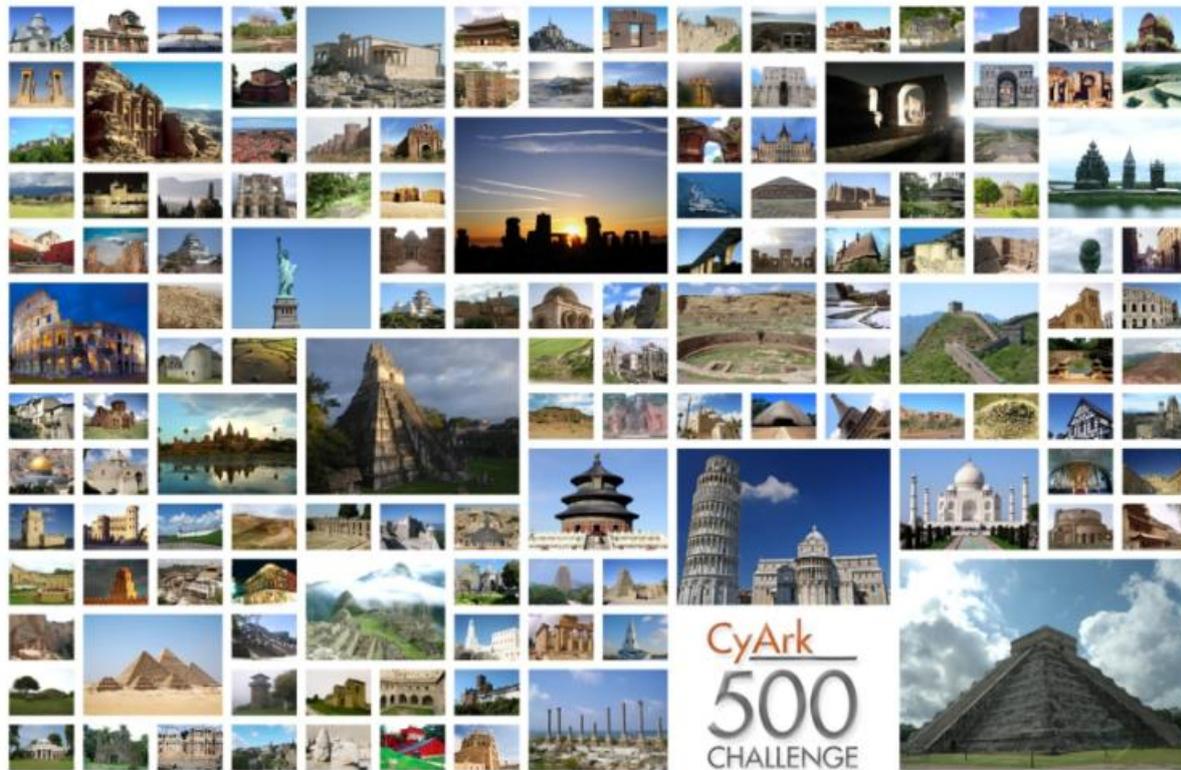


Fig. 5: The CyArk 500 Challenge.

#### 4. REFERENCES

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CyArk: <http://archive.cyark.org>

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