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Archaeological Survey Technologies, Data, Integration, and Applications Workshop and Seminar, Longfellow House – Washington's National Headquarters, National Historic Site, Cambridge, MA

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Executive Summary

The *Archaeological Survey Technologies, Data Integration, and Applications (ASTDA) Workshop and Seminar* introduced new methods for the integration and visualization of non-invasive geophysical and 3D laser scanning survey methods as a tool for historic site preservation and management. The Workshop and Seminar were hosted at the Longfellow House – Washington's Headquarters National Historic Site in Cambridge, MA. The Workshop was held from August 15-21, 2011 and the Seminar on the 21st of October 2011.

The 6 day Workshop trained participants in the practical application of data capture, processing, and 3D visualization, combining sub-surface and above-ground imaging for placing the Longfellow House in context to its broader historic landscape. The main objective of the workshop was to teach participants specific skills of non-invasive data acquisition and fusion of sub-surface features, existing archaeological structures, and landscapes. Equally important, the workshop focused on how to effectively engage these methods in the investigation, planning, and preservation of historic properties.

Results from the workshop produced comprehensive maps of geophysical data including ground penetrating radar, conductivity, magnetic susceptibility, magnetic gradient, and resistance. These were combined with a complete 3D laser scan of the exterior of the Longfellow House – Washington's Headquarters NHS property in a 3D environment for visualization and analysis. The geophysical surveys revealed a variety of potential archaeological features that have previously been unknown to site managers. A project GIS has been constructed that contains all data and interpretations for the geophysical surveys. This GIS will continue to grow through integration of additional spatial information such as historic maps, modern utility maps, and landscaping maps.

The half-day Seminar targeted three specific groups associated with historic properties: managers, developers, and public outreach groups with the aim to teach them not only the benefit of using these methods, but also how to successfully integrate these methods into their work flow.

Survey results from the Workshop formed the core of the material presented in the Seminar. The survey methods, their results, and integration for 3D visualization and analysis enabled a comprehensive presentation of the process for non-invasive surveys and their use in historic site management. The panel discussion raised points of current work being done with these methods, challenges toward advancement of non-invasive survey data integration and applications, and looked toward future development and implementation of 3D archaeological landscape visualization for site management and preservation.

Introduction

It is incumbent on leading preservation organizations and agencies, such as the NPS, to explore and to embrace preservation technology that is responsive to current threats, sets new standards in accuracy, and is cost effective. The value of imaging historic properties through laser scanning is recognized by the Historic American Buildings Survey and Historic American Engineering Record while geophysical surveys of historic properties are ever increasing across the United States. However, the value of combining subsurface and above-ground imaging has not yet been realized within an entire NPS unit or other archaeological properties in North America. Exploring the integration of these two imaging methods is the core of the ASTDA Workshop and Seminar project. This project is one of the first to specifically provide guidance for scoping future historic site preservation and management projects, including sites actively threatened by erosion, property development, and other destructive processes. The potential value of these imaging methods for documenting sites threatened by a variety of impacts cannot be overstated.

The NPS in particular, should benefit directly from the work products and the training opportunity focusing on the Longfellow House – Washington's Headquarters NHS. The property, a National Historic Landmark, contains a cultural landscape, architecture, and collections reflecting the use of its core area from prehistoric native occupation, through its use as Commander-in-Chief George Washington's Headquarters and onward. The house is documented by conventional measured drawings dating to the twentieth century, but there is no unified documentation of both house and landscape approaching the level of accuracy promised by the laser scan. The property has been subject to numerous disparate archaeological compliance projects and to a geophysical survey in 2003. Up until now, there has been no unified way to examine the three-dimensional qualities of known sub-surface features distributed across the site, nor was there a viable way to explore relationships among the subsurface and extant architectural remains. The interpretive benefits of the methods of data integration and visualization proposed by this project are intended to cover not only accurate documentation and analysis, but also to explore innovative ways to expose park visitors to images of otherwise inaccessible parts of the property.

While the application of geophysical surveys and 3D laser scanning are not new techniques for archaeological and historic property investigation (Johnson 2006; Kvamme 2003, 2001a, 2001b, De Vore 1999), the integration of these data through an *affordable* 3D visualization environment is (Prio et al 2009; Cothran et al 2008; Palmer 2008; Watters et al 2008; Piro et al 2007). This project provided an opportunity for practical application training, a resource for guidelines for good practice, and innovative methods for the integration of technological methods for high resolution, fast and cost effective site mapping, modeling, and management.

Workshop

The objective of the workshop was to teach participants specific skills of non-invasive acquisition and fusion of sub-surface features, existing archaeological structures, and landscapes. More importantly, the workshop focused on how to effectively engage these methods in the investigation, planning, and preservation of historic properties.

The workshop was designed to provide a much needed resource for learning about geophysical and 3D laser scanning methods and their application to historic landscapes. The workshop was fully enrolled with 22 students in attendance. There were five workshop instructors that taught principles, field methods, data processing, integration and visualization for geophysical surveys (including ground penetrating radar, magnetometry, conductivity, and resistivity) and 3D laser scanning. These non-invasive survey and mapping methods and results were continually grounded in the archaeological site context at the Longfellow House – Washington's Headquarters National Historic Site in Cambridge, MA.

The Workshop participants represented a broad cross-section of archaeology, history, art history architecture, and anthropology and came from a broad geographic distribution, both within the US and internationally. 13 of the participants were graduate students from: Brown University, Harvard University, University of Colorado, Boston University, Boston College, Salem State University, Tufts University, University of Massachusetts Boston, Rhode Island School of Design, University of Toronto, and Jagiellonian University, Poland. The other 10 participants were from the National Park Service, the Westford Historic Commission, and the Massachusetts Historic Commission. Participant research is being conducted in Tiawan, Rhode Island (Mashpetucket Pequot Museum), England, Mesa Verde, Nevis, Danvers and Upton MA, Greece, Chaco Canyon, US Military Battlefields, Poland, Iceland, and Greenland.

The 6 day workshop August 15-20, 2011 was divided into three sections: (1) Geophysical Surveys, (2) 3D Laser Scanning, and (3) Data Integration, Visualization, and Analysis. Each section introduced the basic theory of its methods, provided hands-on data collection in the field and worked with a variety of post-processing and visualization methods central to this project.

The workshop had two goals in regard to data capture. The first was to provide hands-on experience for the participants; the second was to provide a comprehensive and professional record of the historic property and surrounding landscape to the Longfellow House - Washington's Headquarters NHS manager. To accomplish both of these goals, each day, following the conclusion of the workshop, instructors stayed to collect complete data samples of the entire site. Many workshop participants stayed and assisted in data collection during these after-hours sessions, which provided very informal interaction with instructors. By conducting these surveys after hours, professional standard data for the workshop and reporting was acquired, while the hands-on experience of the students was not restricted.

After an introduction to the history of the site, the first two sections of the workshop focused on teaching participants how to develop a project design and how to successfully collect, process, and interpret geophysical and laser scanning survey data.

(1) Geophysical Surveys provide a technique for looking beneath the surface of the earth for non-invasive mapping of archaeological remains. The workshop taught the principles, data capture, and processing techniques for resistivity, conductivity, magnetic susceptibility, magnetometry, and ground penetrating radar survey methods. Students learned to set up survey grids, assemble equipment, and collect data. Each technique provided a different 'map' of sub-surface features

depending on the contrast of their fundamental physical property values to the site matrix, and in combination, presents an image of the buried landscape at the Longfellow house.

The results from the geophysical surveys were integrated in a project GIS and provide a spatial and temporal base for site query. Resulting interpretations revealed potential new garden features in front of the Longfellow House and in the southeastern area of the survey, suggesting the location of a possible second entrance to the property. The surveys mapped the sondage from previous archaeological investigations and a more complete plan of the basement feature discovered during that excavation. An additional structural foundation may have been mapped in relation to the basement feature as well as possible evidence of a past orchard. The surveys also mapped changes in stratigraphy and modern site features such as gravel pathways, irrigation materials, and utilities.

(2) 3D Laser Scanning is used in archaeological applications, and in particular historic preservation for highly-accurate, detailed, 3D existing conditions survey. By recording millions of precise and accurate point measurements across the entire surface of a structure or environment, a comprehensive understanding of the target can be achieved.

The laser scanning survey had three main goals. The first was to teach participants the fundamentals to effective site survey and the mechanics of collecting accurate 3D survey scans for a historic property and its surrounding environment. The second was to produce a detailed architectural survey of the main Longfellow House and the third, to survey the property grounds for a detailed Digital Elevation Model (DEM) for integration of the geophysical survey.

Workshop participants learned the importance of establishing an effective site survey control, and were introduced to the setup and data capture with the laser scanning, as well as an overview of data processing and imaging.

The third section of the workshop focused on integration, visualization, and the analysis of data from the geophysical and laser scan surveys.

(3) Data Integration, Visualization, and Analysis are only effective when a number of factors are taken into consideration which include: data format, spatial relation, visualization requirements, software analytical capabilities, hardware/software requirements, and cost implications.

The main obstacle for multi-data integration is that currently, there is no single off-the-shelf package that can adequately combine all elements of the survey methods in their native formats that were used as part of the workshop. Each data set was processed within dedicated proprietary software packages and exported for integration. For more standard applications the Workshop introduced ArcGIS as one method for data integration and analysis, mainly for the geophysical and more traditional site survey data types. 3D laser scanning cannot be represented as a 3D entity in GIS, thus a second software program, Pointools was employed. Final visualization used the free version of Pointools that enables integration of multiple 2 and 3D data types for display and basic measurement.

Final data visualization was conducted at the Harvard University Visualization Laboratory making use of their large-scale visualization facility. Students were introduced to some of the 3D visualization projects underway at Harvard University to gain an insight to the use and application of 3D visualization in research. Final integrated Longfellow House – Washington's Headquarters NHS 3D data were presented and explored. Discussion of the visualization method focused on applications for historic site management and preservation.

Seminar

The Seminar was tailored to provide specific knowledge transfer to three distinct groups intrinsic to historic site preservation: (1) Property Managers; (2) Public Outreach Organizations; and (3) Property Developers. The seminar focused on presenting each of the three stages in creation of the 3D property models (data capture, processing, and fusion) and how to use this innovative visualization of integrated data for their particular needs. The 12 Seminar participants represented a diverse group of historic property managers and archaeologists in addition to professional surveyors and a writer[1].

The Seminar presented the survey methods used in the Workshop and focused on the integration of sub-surface and standing features of the Longfellow House - Washington's Headquarters NHS. The three presenters (Steven Pendery, Meg Watters, and Stephen Wilkes) introduced the site history and archaeology, basic geophysical and laser scanning survey methods, and integration of 3D spatial data and its relevance to the preservation and management of historic properties.

The Seminar concluded with a panel discussion that had representatives from each of the targeted groups of the seminar. The panel was moderated by Dr. Steven Pendery (NPS) while discussants included Michael Feldman, President of Harry R. Feldman Survey, Inc., Ellen Berkland, archaeologist for the Massachusetts Department of Conservation and Recreation, Nina Zannieri, Executive Director of the Paul Revere Memorial Association, and Meg Watters, archaeo-geophysicist from the Joukowsky Institute of Archaeology and the Ancient World, Brown University.

The panel members discussed personal use and experience with the various survey methods used as part of the Workshop. A brief transcription of the panel discussion can be found in Appendix 3. Key points that were addressed include:

- Our goals (as survey specialists, property managers & developers) that can be addressed with these remote sensing techniques.
- Specific applications where the panel have applied these techniques
- Obstacles that may exist to the application of these techniques, i.e. Who provides the service? How are these projects funded?
- What is the role of Contractors and Institutions to provide or require these services and what direction should this take?
- Survey and data standardization and regulation. Who sets the standard and how are they set?

[1] Sarah Luria, ed. 2011. *GeoHumanities: Art, history, text at the edge of place*, Routledge.

The final section of the discussion encouraged participation of the Seminar attendees when talking about how these methods can be better integrated into site analyses and become more fundamental tools used in the evaluation, development, and management of historic properties.

The content of the Workshop and Seminar focused on the use and 3D fusion of various non-invasive mapping tools for the management of historic properties. The specific targeted disciplines of the Workshop and Seminar included: archaeology, cultural heritage, and civil engineering. While the workshop and seminars had a mainly archaeological focus, the methods employed were directly transferable to other disciplines such as anthropology, classics, history, architecture, engineering, environmental and earth sciences, and forensics.

Methods and Materials

Workshop

The workshop was presented with the following structure:

Archaeological site introduction and history

The archaeological and geological history of the site was introduced and presented by Steve Pendery, North Eastern Regional director of the NPS and Jim Shea, director of the Longfellow House - Washington's Headquarters NHS. Their presentations and site tours provided a physical and cultural landscape within which we applied our non-invasive survey methods. Both Steve Pendery and Jim Shea were present throughout the entire workshop, providing insight and interpretation to the various mapping results achieved with different geophysical methods daily.

Laser scanning introduction and demonstration

Steve Wilkes, from Harry R. Feldman, Inc. Land Surveyors lectured on basic site survey, installation of a site survey control (and its related fundamental role in all non-invasive, and archaeological investigations), and 3D laser scanning. Due to heavy rain on the first day of the workshop, students were not able to participate in establishing survey control, which was completed by a survey team provided by Harry R. Feldman, Inc. 3D laser scanning was demonstrated in the Longfellow House – Washington's Headquarters NHS library. Data processing and visualization of the survey control and laser scanned data were presented during the final two days of the workshop.

Geophysical survey methods introduction and surveys

Instructors Ken Kvamme (University of Arkansas), Bryan Haley (Tulane University), and Meg Watters (Brown University) presented short lectures (approximately 1 hour) introducing each geophysical method included as part of the workshop. Over three of the workshop days, introductory lectures were followed by an introduction to field methods and hands-on data collection by the workshop participants.

Data processing, integration & visualization

Geophysical and laser scanning data processing, integration, and visualization were conducted during the final three days of the workshop. The 3D visualization component of the workshop was hosted at the Visualization Lab at Harvard University, facilitated through Jason Ur (Harvard University, Dept. of Anthropology) and Matthew Nicholson (Harvard University, Visualization Lab Director).

Student Project Discussion

Three sessions were dedicated to the participants. They were each invited to present their own research in order to get workshop participant and instructor feedback and ideas on how to approach their research goals. These were excellent sessions in both content, participants are working at sites around the world (Taiwan, Greece, Poland, Peru, England, and in numerous sites around the States: military, south western, regional New England, native American, historic, etc…) and in interaction between not only the instructors, but discussions with input from workshop participants as well. These sessions provided a good break from the intense technical work we were doing and enabled the consideration of a variety of sites through which we developed approaches for application of these methods toward individual research goals.

Seminar

The ASTDA seminar was held over half a day. The seminar was divided into two sections: 1 – an introduction to the archaeology and integrated use of non-invasive mapping methods for site recording and modeling and 2 – a panel discussion on the current state of use and regulation of these non-invasive methods in archaeological site management, development, and preservation.

Steven Pendery introduced the Longfellow House site history from the palaeo-occupation to present day. He also discussed the responsibilities and challenges of being a manager of this type of property as well as for cultural heritage properties, specifically as part of the NPS. Following this introduction Meg Watters and Steve Wilkes presented overviews of the different non-invasive survey methods used in the ASTDA workshop. This section concluded with the presentation of the integrated 3D model of the Longfellow house, both the standing structure and subsurface cultural features. After a short break the seminar concluded with a panel discussion with participants representing different agencies, institutions, and private companies that either practice these types of non-invasive surveys or engage these types of surveys as part of their property inventory, management, and preservation.

Results and Discussion

The workshop and seminar were a complete success. Feedback from instructors and participants has been very positive (Appendix 1 includes some comments from participants). Feedback from Jim Shea, the director of the Longfellow House – Washington's Headquarters NHS has also been very positive. We successfully mapped the grounds of the house as well as completed an entire external 3D laser scanned survey of the house itself. The results from the geophysical surveys

confirmed previous excavation finds (i.e. magnetometry and GPR mapped the foundations of a house structure excavated in the 1990s) and in particular, ground penetrating radar mapped a number of new features, previously unknown. The preliminary site report on the workshop surveys as was presented to the Longfellow House – Washington's Headquarters NHS can be found in the 'Deliverables' section of this final grant submission.

Bringing together the different techniques we used as part of the workshop in the Harvard Visualization Lab on the final day took the impact of the workshop up a level. The significance of the integration of data in a 3D viewing environment became evident as did the concept of exploring our data from a different perspective. This workshop enabled participants to experience the process and learn the work flow for complex data integration and analysis as a method for site management and preservation.

The seminar picked up just where the workshop concluded, with a summary of the methods and immediate viewing of the integrated 3D visualization. This sent the tone for the seminar discussions. These methods work, we can continue to combine data in innovative visual and analytical ways, but until they are recognized as viable tools of the archaeological trade by the regulating institutes, they do not carry any weight and certainly fall by the way when considering financially constrained budgets. Without continued exposure to these non-invasive survey methods and without education of property managers and policy developers we are neglecting our remaining cultural heritage and putting it to an even greater risk of disappearing though the 'randomness' of archaeology as well as human and natural erosional factors.

Initial thoughts for developing the format of the workshop so that it might be more effective include:

1. Complete site data collection by instructors prior to the start of the workshop. Data collection and processing takes time, in order for the instructors to more effectively provide processed and integrated results for the latter half of the workshop, more time might be taken to achieve this end.
2. 6 days is long for an intensive lecture and field workshop. We felt that this workshop was rather unique in providing three integrated components: geophysical survey, site survey and 3D laser scanning, and data integration and visualization. Each of these topics could be workshops unto themselves. Perhaps, a finer tuning of lectures to more of an 'introduction' to methods would shorten the overall time. However, a certain amount of material must be presented to provide a fundamental understanding of these methods.

Conclusions

The main goals for the ASTDA workshop and seminar were to provide hands-on training for graduate students and others interested in non-invasive methods for historic property mapping

and management and to introduce these concepts to property managers and organizations that work with preservation and development of these sites. Both goals were achieved through full enrollment for the workshop and seminar and continuing feedback and communication from participants and instructors.

A six day workshop limits the material that can be presented and the experience participants can gain, but it is an excellent format through which to introduce these technologies, to provide hands-on opportunities with equipment, and to inspire participants to continue learning independently about the non-invasive survey methods that were presented. Specific examples of this include:

1. One participant contracted a geophysical survey at a local town site in Upton, MA. Consulting with instructor Meg Watters, he carried out a GPR and magnetometry survey to map historic foundations and garden features of a structure related to the Upton Cave.
2. Another participant is attending a 3D Archaeology field school this summer (2012) at Çatalhöyük, Turkey directed by Prof. Maurizio Forte, University of California, Merced.

Instructors continue to share relevant publications, workshop information, and additional opportunities to ASTDA workshop and seminar participants through a group email.

The seminar provided a short, but intense introduction to the integration and 3D visualization of non-invasive survey methods and engaged participants in targeting issues central to the implementation of these methods in their daily work. The discussants on the panel represented an interesting range of backgrounds that provided diverse perspectives on the main topics of why and how to include this methodology in their work flow. The edited transcript of the panel discussion (Appendix 3) is a valuable insight to the current state of engagement with these technologies as part of the archaeological process in Massachusetts.

Having achieved the main goals of the ASDA workshop and seminar, the next step is to consider how employing these technologies, through the established methodology can continue to be promoted in Massachusetts as well as across the United States. Since completing the workshop and seminar the main instructors Watters, Wilkes, and Pendery have continued to develop this methodology. Pendery has left the NPS for a post as the director of Archaeological Services (February 20112), a CRM firm based in the Department of Anthropology at University of Massachusetts, Amherst. As part of his move, Watters now has an adjunct post in the Department of Anthropology at UMass Amherst and they continue to develop a more formalized strategy toward implementing the methodology established during the ASTDA workshop and seminar. Wilkes and Feldman continue to work closely with Pendery and Watters in the Boston area and intend to begin a collaborative project July or August 2012 (the project cannot be named at this point as they are in negotiation with the host site.)

Watters is involved in a national project funded through a NSF Informal Science Education grant, Time Team America. Time Team America is a television program (broadcast on PBS) with associated field schools (targeting middle to high school age children) that are working with four archaeological sites around the country during the summer of 2012. As co-PI of the grant and on camera presenter, Watters is responsible for the remote sensing and visualization component for each site. The larger format of this grant and project (than the ASTDA workshop and seminar) is enabling Watters to fully engage a variety of remote sensing tools and to

integrate them into 3D environments for site exploration and planning and also for dissemination to the US public through the television program, field schools, and web site. The ASTDA workshop and seminar provided the comprehensive methodology, the 'truthing' of the proposed integration that is acting as the foundation for the remote sensing and visualization component of Time Team America. This was a key component in being awarded the NSF grant and also the development and implementation of the television program and site assessment strategy.

The ASTDA workshop and seminar were vital to bringing awareness of this method for integrating multiple non-invasive methods into a 3D environment for use as a powerful tool in historic property management and preservation. Workshop instructors continue to collaborate as well as reach out to other institutes (Center for Advanced Spatial Technologies, University of Arkansas; Society of American Archaeology; Geospatial Interest Group, Archaeological Institute of America; NSF; PBS) to continue streamlining the process of integrating these methods and integration into the archaeological methods for site management and preservation in the United States. Through collaborative research, education, and public outreach these methods and integrated 3D environments will eventually become part of the archaeological 'tool kit' across the country.

Acknowledgements

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Ken Kvamme, University of Arkansas
Stephen Wilkes, Feldman3D, Harry R. Feldman, Inc.
Steve Pendery, University of Massachusetts, Amherst, Archaeological Services

ASTDA Seminar Discussion Panel Participants
Ellen Berkland, Archaeologist, Mass DCR
Nina Zannieri, Executive Director, Paul Revere Memorial Association
Michael Feldman, President, Harry R. Feldman, Inc.
Steve Pendery, University of Massachusetts, Amherst, Archaeological Services

Jim Shea, Longfellow House – Washington's Headquarters National Historic Site
Sarah Sharpe, Manager, Joukowsky Institute of Archaeology and the Ancient World, Brown University
Kristen McKinnon, Grants/Contracts Accountant, Office of Sponsored Projects, Brown University
Matt Nicholson, Director, Harvard University Visualization Lab
Jason Ur, Harvard University
Jeff Amero, GIS Manager, City of Cambridge

ASTDA Workshop & Seminar Participants
Geophysical Survey Systems, Inc.

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the St. John Lateran Basilica (Rome, Italy)". Presented at the *AIA Annual Meeting*, Chicago, January 4, 2008.

Appendix 1: Workshop Feedback from Participants:

"I found it incredibly informative and inspiring"
– Christopher Beagan, Historical Landscape Architect, NPS - Olmsted Center for Landscape Preservation, MA

"Just wanted to say thank you for the great workshop. I loved the introduction to the equipment and methods and it really helped improve my understanding of geophysics. Things that I learned in undergrad made a lot more sense after this week."
– Nicole Estey, Masters Student, Historical Archaeology, Boston University

"… thanks so much for a wonderful workshop. All the instructors were top-notch."
– David Lowe, Historian, Cultural Resources GIS, National Park Service

"Just wanted say a big "THANK YOU!" again for the workshop opportunity. Learned loads and had a pretty good time in the process."
– Erin Baxter, Doctoral Candidate, University of Colorado and NPS STEP Archaeologist, Aztec Ruins National Monument, New Mexico

"I just wanted to write and thank you for putting together a fantastic workshop last week. I learned a ton and it got me very excited about the possibilities that surveys and 3D visualization offer for making the past come alive. I hope to be able to put this new knowledge to use soon."

"I just gave a talk on Friday that included some maps I made using LiDAR data for a few sites in England and the response was great. People were very impressed, and I have you and the rest of the ASTDA Workshop leaders to thank for turning me on to this great resource. Attending the workshop continues to pay big dividends."

– Austin Mason, Doctoral Candidate, Department of History, Boston College

Seminar Feedback from Participants:

"You were so clear and informative even for someone way outside the field."

- Sarah Luria, Associate Professor, English Department, College of the Holy Cross, Worcester, MA

Appendix 2: Publications and Presentations

Watters, M., S. Wilkes, S. Pendery, and B. Haley, 2012. "Heritage Preservation and Planning at the Longfellow House – Washington's Headquarters National Historic Site, Cambridge, MA", *ISAPNews* 30:2-4.

"Heritage Preservation and Planning at the Longfellow House – Washington's Headquarters National Historic Site, Cambridge, MA," Watters, M., S. Wilkes, and S. Pendery, presented at *High-Tech Heritage*, UMass Amherst, May 2012.

> HIGH-TECH HERITAGE: How Are Digital Technologies Changing Our Views of the Past? May 2 - 4, 2012 at the UMass Amherst Campus.
> http://scholarworks.umass.edu/hightechheritage/

Appendix 3: Archaeological Survey Technologies, Data, Integration, and Applications Seminar Panel Discussion, October 21, 2011 (Edited Transcript)

This Appendix contains an edited transcript of the Panel Discussion; a full recording is available upon request.

Panel Participants:

1. Dr. Steven Pendery, Moderator
   Director, Department of Anthropology, Archaeological Services, University of Massachusetts, Amherst (At the time of the Workshop and Seminar, Dr. Pendery was with the New England regional office of the National Park Service)
2. Michael Feldman
   President, Harry R. Feldman, Inc., Boston, MA 02118
3. Dr. Ellen Berkland
   Archaeologist, Massachusetts Department of Conservation and Recreation
4. Nina Zannieri
   Executive Director, Paul Revere Memorial Association
5. Dr. Margaret S. Watters
   Joukowsky Institute for Archaeology and the Ancient World, Brown University

Steven Pendery: Introduction
Pendery discussed the obstacles and goals of these types of remote sensing survey methods. He mentions the issues of funding, data archiving and data standards specifically mentioning the role of NPS property managers in:

1. Inventory of sites (both cultural and modern). Remote sensing methods are able to expand the capability of managers to collect comprehensive information to help compile a complete inventory of their sites and cultural landscapes
2. Damage control & compliance. The role of remote sensing methods to identify what is significant and important at almost the moment it is threatened.
3. The significance of the dialogue between the experts and users. This is a pivotal time in the development of these technologies and we have a significant role to play in the continuing loop of the development of these technologies, and their application (and modifications) for property exploration, recording and management.

Pendery discussed the application of technology to cultural resource management and proposes the following topics for panel participants to address:

- Our goals (as survey specialists, property managers & developers) that can be addressed with these remote sensing techniques.
- Specific applications that the panel have engaged or applied these techniques
- Obstacles that may exist to the application of these techniques, i.e. Who provides the service? How are these projects funded?
- What is the role of Contractors and Institutions to provide or require these services and what direction should this take?

- Survey and data standardization. Who sets the standard and how are they set? (He cites HABS HEAR and their caution against integrated use of laser scanning until standards are established.)

Pendery suggests that we are entering a period where disparate specializations are being unified through technology. Where by distinct approaches to our cultural heritage such as the cultural landscape, archaeology, anthropology, and architecture are being translated into something physical (through the data produced by non-invasive survey methods) that brings out and actually emphasizes the commonality of material culture.

Michael Feldman:
Feldman began by addressing finances, funding and affordability. He stresses the importance of recording our remaining historical structures and his company's dedication to help recording them. He believes that the 3D scanning of these properties is better than HABS HEAR in that it provides a 3D model with ¼" spatial resolution. This type of recording is more effective for possible future reconstruction, modification, archiving, and educational outreach than traditional 2D mapping and plan methods.

He then discusses today's youth and the generation of 3D visualization. He stresses the future and our need to make these mapping methods affordable and the importance of professional survey / contract companies to contribute to recording our remaining historic structures through pro-bono initiatives.

Nina Zannieri: GPR and 3D scanning applications at the Revere House, Boston, MA.
The Paul Revere Memorial Organization was planning a construction project. The site is compact and in an urban location. Zannieri's first statememt was "We should have come to this type of seminar before we began our work." This led to a discussion of the fact that they did not know anything about the technologies they used as part of their first phase evaluation of the site, both ground penetrating radar and 3D laser scanning.

As a manager trying to get a handle on things before the building began, she realized in retrospect, they did not know the right questions to ask in order to get what they needed from the surveyors.

- What type of information did they need?
- What data should they have?
- What instruments, or methods, would be best?

They needed information on what was potentially buried in order to avoid the contractor coming to her and saying "I have something to show you…" a guaranteed expensive undertaking when unexpected things come up.

They had the opportunity, and responsibility, to do archaeology. Work in 1983 told them there were things in the ground from Paul Revere's back yard. They were hoping that GPR would help pinpoint the randomness of archaeology. Archaeological testing in order to keep within the bounds of reason financially basically picks random locations for excavation, sort of a dig here and not there. GPR did, and did not help. The GPR results confirmed what they thought they knew from other sources but did not identify anything new. Perhaps the data were not analyzed

enough, perhaps there are things remaining in the ground that were not identified which is a concern in going forward with excavations and construction.

Zannieri said they were an uninformed purchaser. They did not communicate well with the vendor, did not know what to ask for or who to choose to do the work. So in the end, they "got what we got." Having attended this seminar she now knows that they had to ask different questions of the vendors. She is comfortable (as many in the field) with archaeology, archaeologists and other contractors (i.e. carpenters). But when it came to laser scanning and GPR they were not comfortable and did not provide enough information.

The laser scanning was done by Harry R. Feldman, Inc. The head of the company, Michael Feldman, approached Zannieri and offered to scan the Revere House because he is enthusiastic about the history of Boston and wanted to contribute to creating a permanent digital record of the structure while contributing to the development of the property. Zannieri commented that she knew so little about the scanning technology, she thought he was talking about laser surgery and was nervous that he would be cutting holes in the building or setting it on fire. However, once she realized what they were able to do (as a manager) she actually talked Feldman into doing the site control survey (which they needed) for free as well.

Commenting on GPR and laser scanning in particular, Zannieri thinks these are good methods to use for preliminary site mapping. They are non-intrusive; they do not require permits, and enable work to go forward. Intrusive work means time and money. But, until the Massachusetts Historical Commission (MHC) is comfortable with these methods, it will never take the place of archaeology, but more importantly, geophysical surveys are not recognized as viable survey methods and they do not have a place in the regulated scope of archaeological work in MA. The MHC is the regulatory power for archaeological work – they say dig or do not dig. They are not on board with geophysical surveys.

One of the unanticipated, and in Zannieri's opinion, the best thing about the GPR and laser scanning work was that the press picked up on it and among a number of publications, the Boston Globe printed and article on this project in the Business Innovation section (Palmer 2008). This brought donors from an unanticipated sector. People became interested in the Paul Revere house, history and archaeology because of the technologies that were being used. This was the first site in the US to integrate GPR and laser scanning data.

Comments:

Feldman: There are people of history and people of technology; putting the two together was exciting and generated interest.

Wilkes: Data from that initial scan was used throughout project as different demands/requirements came up over the course of construction and site development (i.e. elevations, topographic maps, etc.)

Zannieri: This was very cost effective, as manager she is always working the angle to get as much as possible out of every possible thing. But, she needed to be a more informed client with the GPR.

- Seminar attendee with a MHC question: Did the MHC say anything about these surveys?

Zannieri: In the course of getting a permit for the archaeology (excavations) a shot was taken in documentation that basically stated we know you did GPR without a permit (*Zannieri*: which is fine). They said in a way that the Paul Revere organization should not be dependent upon the GPR data in identifying areas for excavation.
Same seminar attendee: Maybe times have changed, they did a GPR survey 3 years ago and applied for an archaeological excavation permit 3 months ago. submitted for a permit to excavate based upon confirmed anomalies that were mapped through a GPR survey and existing plan maps of the area. The MHC did not comment about the GPR survey and they were awarded the permit.

Ellen Berkland: Discusses the need for decision makers to be introduced to these methods and learn more about them.
Education and exposure of these survey methods area essential for regulators, think it is a problem in MA. Berkland is an urban archaeologists, working many times with multi-phase sites focused many times on locating and identifying pre-contact sites as part of compiling the cultural resource inventory.

She cites the example of a project on Peddocks Island last summer where she hosted a cutting – edge GPR technology demonstration, publicized across the state that had one archaeologist (a grad student at that) come out to participate. Berkland talks about the issue of having little to no funding for much of the work she did as the Boston City Archaeologist and the limited budget as an archaeologist now for the DCR where she is responsible for 450,000 acres of property. She calls on her colleagues (that specialize in remote sensing applications) for advice on how to proceed, she can pick their brains, but has no money to put many things into action. She states that geophysical survey methods can certainly assist in her site identification efforts, as well as are applicable in what she considers 'health issues' in the location of unexploded ordnance, unmarked burials and modern utilities.

The DCR had a preservation historic landscape initiative. As part of this they record all known above ground architectural, landscape, vegetation and cultural resources with GPS. Maps are then generated that include these points (and information) that are used by managers as bibles and cookbooks for site management.

Berkland believes that the use of technology – bringing together methods to commonality – maintains the integrity of the data (disciplinary and spatial) of the landscape for the future. Common technology maintains individual characteristics of the landscape and archaeology makes it accessible to all disciplines vs. the 'expert' scenario, having to depend upon someone else to do the work and interpretation. The only way to be successful is continue to develop these methods, incorporate feedback and work on communication. These methods must be accessible to education – people love history and technology.

How do we integrate these methods? How do we make it happen? You need to consider: Where do you find finding?, who do you hire?, how do you write the RFP?, how do you select the right team to do the work?, how do you (as managers) work with the data? The big jump is how to make this accessible to managers. This can be implemented t through:

- Awareness, contacting agencies, how do we work with the agencies that are permitting/funding work? How to help them become aware of the technology alongside traditional methods. These methods do not replace archaeology. Must excavate in the end.
- How do we do this?
    - Lunch time talks?
    - Papers? Would they be read?

Pendery: What about the role of Universities and Institutions in the development and implementation of these methods?
How can you achieve the mix of the specialists, those who understand applications?
Should this be on an institutional basis? What about contractors working with individual agencies? Does it matter?

Watters: This should be on an institutional level, it would be amazing but this is unrealistic. University programs in the US – Arch, Anthro – would embrace someone like me to teach and develop CRM type business (like Fisk center at Umass Boston), but without a traditional archaeology focus (i.e. time period, place) I do not see the investment in the full suite of geophysical survey and remote sensing methods. This statement is in contrast with the UK, where I went specifically for my PhD, as few if any US institutes offered programs on 3D data integration, visualization, and quantitative analysis. A few hubs around the US are doing great work with remote sensing and visualization, but they are few and far between.

Many times, academic work in remote sensing and visualization focuses on research initiatives. These are typically funded projects with specific methodologies and deliverables. To have academic 'practitioners' working on a site to site basis, in a manner that would be more pro-bono vs. profit making, is not the best way to go about integrating these methods into the archaeological process. While well-intentioned, many times the academic 'freebies' may not provide comprehensive results, using the field work perhaps to train students, or putting these types of projects on the back burner while concentrating on their fully funded work.

Professional contract companies (some of which may be based in academic institutes, but not reliant upon their hierarchy and rigorous academic demands) will potentially conduct business with a more legally binding product and specific deliverables.

Berkland – Heritage management and tools that are most applicable in this context
(Pendery) "Ellen, where we are going in the future, what is the development within institutions through education."
Think about the financial issue. We don't have money, we don't have museums; artifacts are being excavated and these resources need care, to be archived, etc. It is in the best interest of archaeology to identify sites, perhaps employ the 'catch and release' method for site interpretation where the site is opened, photographed and documented, closed and the archaeologists move on.

There are many financial and physical problems without existing repositories for the artifacts. Berkalnd argues for more institutional support.

Zannieri: This will come, because those in charge of regulations will ask for it. If they say do it in 3D, or use geophysical surveys in Phase I investigations – it will be done. Higher demand for these methods will cause the cost to come down. We work in a responsive way, do what you are told. The cost of archaeology 'randomly' done, curation of archives is typically ½ to ¾ the cost of a contract. Maybe what we are doing can be done more efficiently.

Feldman: Leaving archaeology to the side let's take a look at Institutions. College campuses and hospitals are recording their data in 3D for planning and construction (buildings, utilities etc.) significant financial investment in this. We do need to educate. People know about the geophysics and laser scanning, but people have to learn what to be done, how it's done, what they need. He has spent a lot of time telling clients that they don't need the entire campus surveyed; educating the clients is a significant part of the job.

Pendery: Looking to the future, institutions will be the repository of digital information, maps. Park superintendents will make archaeological information available to the public, in full compliance to federal arch resource protection act (confidentiality of artifacts and sites) in a controlled site (Longfellow House), it would be a possibility. This opens the potential of availability of all recorded data.

- Utilities
- Cultural landscape (incl. historic photos, vegetation, landscaping, structure)
- Individual query on hand-held devices of site (all info available)

This information would be geared toward individual consumers: managers, developers, specialists, and the public. Information can provide orientation to sites, the reconstruction of historic landscapes, and extend to larger regional contexts. All of this can and should be done at an institutional level.

Grant MT-2210-11-NC-04
Archaeological Survey Technologies, Data, Integration, and Applications (ASTDA) Workshop and Seminar, Longfellow House – Washington's National Headquarters, National Historic Site, Cambridge, MA

Margaret S. Watters
Joukowsky Institute of Archaeology and the Ancient World
Brown University

General Audience Project Summary

For a week in August (2011) anyone visiting the Longfellow House – Washington's Headquarters NHS would have seen a group of people walking along yellow rope lines on the property lawns pulling, poking, and carrying various instruments. They would have also seen a few yellow tripods with blue disks attached to their tops or if they were lucky, the one with a laser scanner spinning. What, they might think, was happening?

As part of a 6 day workshop these people were learning how to use non-invasive survey techniques to map the exterior of the Longfellow House as well as map anything that might be buried beneath the green manicured lawns. Funded by the National Center for Preservation Technology and Training, the Archaeological Survey Technologies, Data, Integration, and Applications (ASTDA) Workshop taught a mix of archaeology students and professionals the fundamental methods for using and integrating geophysical and 3D laser scanning surveys. The innovative component of this workshop is that it brought these different technologies together (Figure 1) in Pointools a free, off the shelf 3D visualization software, and focused on how to use this end product for historical property management and preservation.

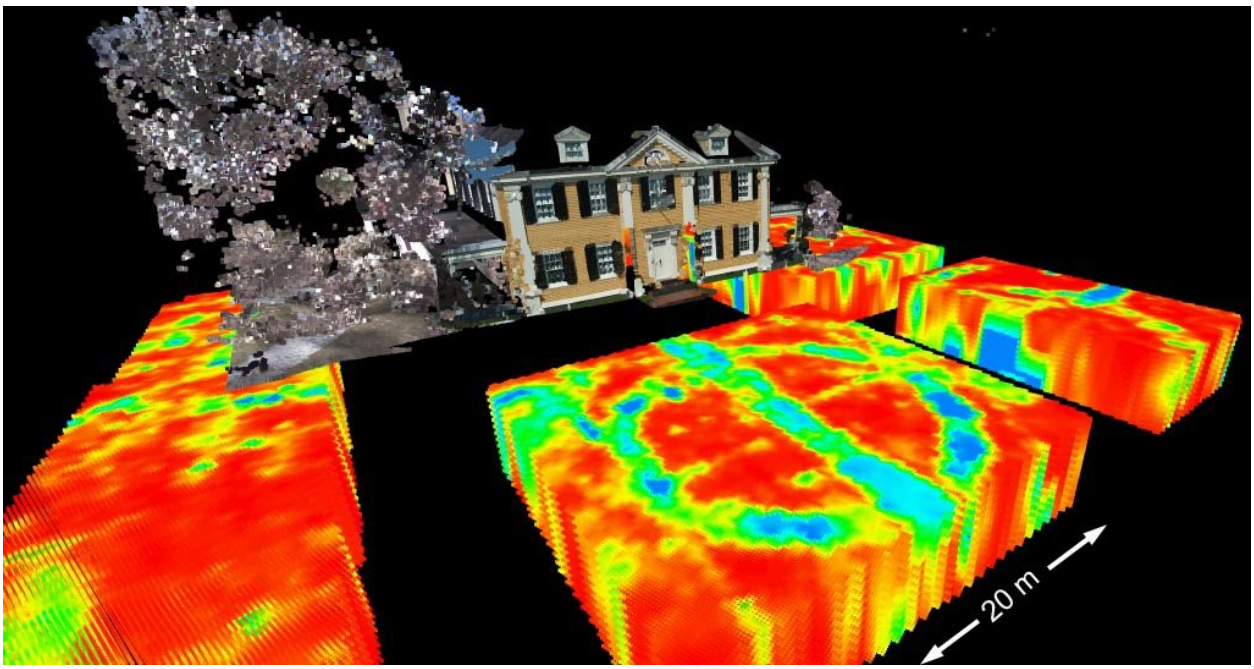

Figure 1 Laser scan and ground penetrating radar surveys of the Longfellow House - Washington's Headquarters NHS 3D model in Pointools.

Laser scanning accurately maps[1] buildings in three dimensions. It can combine scans from the exterior and interior of a structure to create a 3D model from which many types of information can be extracted. Typical output from this type of survey can include: high resolution point cloud images of the target, 2D and 3D plan maps and sections of the target, elevation maps, Digital Elevation Models, orthographic images, and fly through animations.

Geophysical surveys look at the contrast in different earth properties to map the ground beneath our feet. The benefit of this is that we are able to 'look' into the earth without digging. Depending on the earth properties these methods map geology, archaeology including building foundations, garden beds and pathways, privies, pits and ditches, burials and modern features such as utilities, pathways, or plow furrows.

The 3D model from the ASTDA workshop presented this integrated approach to historic property management and preservation at a related seminar hosted at the Longfellow House – Washington's Headquarters NHS in October 2011. The seminar focused on informing historical property managers, archaeological agencies (who regulate archaeological work) and contract companies (survey, construction, utility) that work with these properties about this key method for a non-invasive, combined above and below ground approach for mapping historic properties.

[1] Average spatial resolution is ¼", but this can vary depending on project goals.

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Post-Seminar report of outcome of seminar and panel discussion

The ASTDA seminar provided a short, intense introduction to the integration and 3D visualization of non-invasive survey methods and engaged participants in targeting issues central to the implementation of these methods in their daily work. The discussants on the panel represented an interesting range of backgrounds that provided diverse perspectives on the main topics of why and how to include this methodology in their work flow. The edited transcript of the panel discussion (Appendix 3) is a valuable insight to the current state of engagement with these technologies as part of the archaeological process in Massachusetts.

ASTDA seminar participants included people from: faculty in anthropology, archaeology, English, Journalism, and Science and Mathematics Programs; a preservation gardener, members of Historic New England, the Cambridge Historical Commission, the Westford Historical Commission, and the National Park Service,

It is worth summarizing the comments made during the panel discussion and presenting some conclusions that were drawn as a result of the discussion. Panel participants represented a diverse group of people and industry, or institute, in regard to archaeological practice in Massachusetts.

The ASTDA seminar panel consisted of the following people:

Dr. Steven Pendery, Moderator

Director, Department of Anthropology, Archaeological Services, University of Massachusetts, Amherst (At the time of the Workshop and Seminar, Dr. Pendery was with the New England regional office of the National Park Service)
Pendery was centrally involved in the archaeological work during the Big Dig in Boston. He is a former Boston City Archaeologist and has worked extensively with the NPS in the New England region.

Michael Feldman

President, Harry R. Feldman, Inc., Boston, MA 02118
Following in family tradition, Feldman has a history of working closely with Boston historical organizations to help historic properties on a pro-bono basis. Some of the properties that his company has recorded include: The Paul Revere House, The Longfellow House-Washington's Headquarters NHS, the Old South Meeting House, the Old State House, the Boston Public Library, the Massachusetts Senate, the Glouster Clock Tower, Needham Town Hall, and the Modern Theater.

Dr. Ellen Berkland

Berkland was also centrally involved in the Boston Big Dig archaeology program and a former Boston City Archaeologist. As the current archaeologist for the Massachusetts Department of Conservation and Recreation Berkland is responsible for the guardianship of over 450,000 acres of Massachusetts archaeology.

Nina Zannieri

As the Executive Director of the Paul Revere Memorial Association, Zannieri is responsible for the management of the property.

Dr. Margaret S. Watters

Remote Sensing and Visualization Coordinator, Time Team America (PBS)
Adjunct Faculty, University of Massachusetts Amherst
Research Fellow, Joukowsky Institute for Archaeology and the Ancient World, Brown University (at the time of the workshop Watters was with Brown University)
Watters has done extensive contract, pro-bono and academic work with a diverse set of remote sensing tools around the world.

In his introduction, Pendery discussed the obstacles and goals of the survey methods proposed for historic property management as part of this seminar. The highlights the role of in particular, NPS property managers as responsible for: site inventory, damage control and compliance, and emphasizes that now is a pivotal tie in the development of these technologies and the role they can play in historic property management and preservation. As moderator Pendery posed a list of topics that focus on the integration of the ASTDA integrated non-invasive survey method.

1. Our goals (as survey specialists, property managers & developers) that can be addressed with these remote sensing techniques.
2. Specific applications that the panel have engaged or applied these techniques
3. Obstacles that may exist to the application of these techniques, i.e. Who provides the service? How are these projects funded?
4. What is the role of Contractors and Institutions to provide or require these services and what direction should this take?
5. Survey and data standardization. Who sets the standard and how are they set? (He cites HABS HEAR and their caution against integrated use of laser scanning until standards are established.)

Cost effectiveness, 3D spatial resolution, multiple deliverables

Feldman approaches the list of topics from the standpoint of a contractor, the company that is hired to come and record historic properties. His main point is that 3D laser scanning provides a more robust, and more accurate record of historic properties than the traditional 3D recording as required by HABS HEAR. Not only does this method of recording provide an accurate and high spatial resolution (average 1/4") but it is financially beneficial in that, one scan can provide many types of information and can be returned to over the years for continued property assessment, reconstruction, modification, and educational outreach. This is something that traditional 3D mapping and plans are unable to provide.

User education, key role of regulatory institutions for official recognition of these methods, the public is interested in the combination of history and technology.

Zannieri discusses her experience of using ground penetrating radar (GPR) and 3D laser scanning at the Paul Revere House from the perspective of a property manager. Her comments can be condensed into the fact that they were an uninformed client. As such, some data were good and others ineffective. She states that while she supported the use of these non-invasive mapping techniques she did not understand what they could do. She also states that she really should have attended this workshop four years ago before they did the work so that she would know how to engage and direct this type of work on their property.

Zannieri supports the continued use and integration of these survey methods in property management but discusses the fact that the Massachusetts Historical Commission does not recognize these methods as accepted archaeological tools and thus does not require their use in archaeological investigations in the state. The significance of this statement is that until these methods are approved of and integrated into archaeological work at a State or Federal level, at the regulator's level, they do not have a place in the regulated scope of archaeological work. In the financially restricted environment of archaeology, if these methods are not approved of and required as part of the permitting process toward excavation, then they will not be used.

On a positive note, Zannieri says that an article on the cutting-edge integration of GPR and 3D laser scanning for historic property recording and management generated interest in the Paul Revere Site. The Boston Globe published this article in the Business Innovation section (Palmer 2008[1]) which resulted in monetary donations to the Paul Revere House. People became interested in the Paul Revere house, history and archaeology because of the technologies that were being used. This was the first site in the US to integrate GPR and laser scanning data.

Informed users, continuing education, and awareness of these methods in permitting and funding agencies
Berkland believes that the use of technology – bringing together methods to commonality – maintains the integrity of the data (disciplinary and spatial) of the landscape for the future. Common technology maintains individual characteristics of the landscape and archaeology makes it accessible to all disciplines vs. the 'expert' scenario, having to depend upon someone else to do the work and interpretation. The only way to be successful is continue to develop these methods, incorporate feedback and work on communication. These methods must be accessible to education.

Country-wide use of integrated non-invasive survey methods and the role of institutions and private contractors in promoting them.
Watters discusses the challenge of accepting and main streaming these technologies in archaeological institutions. She contrasts the integrated use of these methods in the UK to the lack of their regular (accepted at the regulatory level) use in the US. Certain programs

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[1] Palmer, T. (2008). A look into the past, with laser precision. *The Boston Globe*, May 19, 2008. http://www.boston.com/business/technology/articles/2008/05/19/a_look_into_the_past_with_laser_precision/

(University and NSF) do promote and engage in the application of these methods, but the regular use of these methods across the United States is not yet in place. Watters also discusses the potential roles of the Institute and private Contract company in effective application of the non-invasive survey methods presented in the ASTDA seminar.

In conclusion, Pendery suggests that we are entering a period where disparate specializations are being unified through technology. Where by distinct approaches to our cultural heritage such as the cultural landscape, archaeology, anthropology, and architecture are being translated into something physical (through the data produced by non-invasive survey methods) that brings out and actually emphasizes the commonality of material culture.

It is interesting to note at this point, that some seminar participants entered into discussion with the panel discussants and others remained silent. This could be interpreted (without naming individuals and their affiliations) as the discussants 'preaching to the choir', those interested in what we are proposing, those who have thought about using, or even used these technologies in their work. One participant in particular, one of the potential policy makers or policy 'influencers,' remained silent throughout the entire seminar. This is the individual that it is essential to communicate with regarding their take on what we are proposing.

Having achieved the main goals of the ASDA workshop and seminar, the next step is to consider how employing these technologies, through the ASTDA established methodology can continue to be promoted in Massachusetts as well as across the United States. After discussion with the ASTDA workshop and seminar instructors and participants a number of suggestions have been made. The top three are discussed below.

1. Target specific policy makers and influencers and communicate with them individually about what these methods are able to provide as part of the methodology toward historic property management and preservation. Listen to their feedback and work with them at developing materials, programs and demonstrations to begin to educate people at this level of regulation.
2. Re-design the seminar format.
    a. The first half to two thirds of the ASTDA were an introduction to the integration method and applications of the non-invasive survey technologies used as part of the ASTDA workshop. While informative, this could be shortened, or presented in another format such as an information brochure or web site.
    b. Instead, begin with the final product and its deliverables. This will have both a visual and an engaging impact upon the participants and would present the argument and evidence for the integration of these methods into the regulated scope of archaeological work.
    c. Engage participants with the experts. Develop a format where participants will engage with experts.
    d. Focus on providing more information and documentation on how to effectively use these methods. How to write a request for proposal and how to hire the most cost effective and expert team to acquire the desired results.

3. Develop a strategy for informing policy makers and their institutions, property managers, academic institutions, and other targeted groups about these methods for site survey. This may include:
    a. Lunch time talks
    b. Invited talks
    c. Training sessions
    d. Workshops
    e. Demonstrations

As stated in the conclusion of the Narrative Report, the ASTDA workshop and seminar instructors continue to collaborate and promote these technologies. They are working together but also reaching out to communicate with other institutes and agencies using these methods in order to help increase awareness among the experts, policy makers, and property managers.