Disclaimer: While the analyses presented in this report are based on research funded by the Andrew W. Mellon Foundation, any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the Foundation.

FINAL REPORT
THE OPEN ANNOTATION COLLABORATION PHASE I:
DATA MODEL & INTEROPERABILITY SPECIFICATION; AXE / ZOTERO INTEGRATION; SCHOLARLY ANNOTATION ANALYSIS

Research grant provided by the Andrew W. Mellon Foundation

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Annotating is a method by which scholars across disciplines organize existing knowledge and facilitate the creation and sharing of new knowledge. Annotating is used by individual scholars when reading as an aid to memory, to add commentary, and to classify. Annotations can facilitate shared editing, scholarly collaboration, and pedagogy. Over time personal notes and annotations can have scholarly value in their own right as compelling forms of evidence for historians and others studying the evolution of scholarly thinking. The work of the OAC (Open Annotation Collaboration) focuses on enabling annotation sharing and interoperability through the promulgation of data models and guidelines supporting the development of tools and services allowing scholars working in disparate locations to share and leverage annotations of digital resources across the boundaries of individual annotation applications and content collections.

The overarching goals of the OAC, to be accomplished over multiple phases of work, are:

- To facilitate the emergence of a Web and Resource-centric interoperable annotation environment that allows leveraging annotations across the boundaries of annotation clients, annotation servers, and content collections.

- To demonstrate through experimentation and concrete implementations an interoperable annotation environment encompassing a variety of annotation client/server contexts, content collections, and scholarly use cases.

- To seed widespread adoption by deploying robust, production-quality applications conformant with the interoperable annotation environment in ubiquitous and specialized services and tools used by scholars.

Phase I Project Description & Objectives

The focus of the OAC Phase I Project was on annotation data modeling informed by our analyses of scholar requirements and the needs of tool and service developers and by limited experimentation with existing scholarly tools. Phase I had five primary objectives:

1. **Data Modeling Review:** An analysis and review of existing annotation data models, ontologies, systems, and architectures in order to inform the development of a shared annotation data model supportive of interoperable annotations, potentially adaptable by existing systems, and rooted in scholarly practice.

2. **An OAC Data Model & Ontology:** A publicly released (late alpha level) annotation interoperability specification describing a unifying data model of scholarly annotation and an associated ontology.

3. **Proof of Concept Experiment:** The successful integration of Ajax XML Encoder (AXE) code libraries (Maryland Institute for Technology in the Humanities [MITH]) into the Zotero research tool (Center for History and New Media [CHNM]).

4. **Analysis:** An analysis of existing annotation tools, scholarly practice, and use cases suggested by the literature, members of Advisory Board, and our prior work with scholars, laying a foundation for a subsequent phase of work that would feature an implementation(s) meeting the needs of advanced, real-world annotation use cases.

5. **An Initial Reference Implementation**: A complete or nearly complete first-draft minimal reference implementation (distinct from the AXE-Zotero implementation), embedding the OAC data model and demonstrating proof-of-concept feasibility.

Accomplishments, Challenges Identified & Addressed, Key Findings

Summary

Work on Phase I began in July 2009 and completed in December 2010.

Objectives 1, 2 and 3 were achieved. Objective 4 was achieved; however, our analyses of still emerging scholarly practice with regard to annotation of digital resources suggested an even broader diversity of use cases and modeling challenges than initially anticipated. Types of annotations and classes of annotation target and body constraints needing to be expressed can be quite complex and vary significantly by discipline and use case. Our analyses also suggest that current scholar motivations to share annotations and interoperate across annotation tools and services are diverse and vary greatly in scope, both by domain and context. In many scholarly contexts, interest in sharing annotations broadly, i.e., beyond a few chosen colleagues, a seminar, a research group, or discipline peers, is limited. (NB: Since advanced methods of annotating and sharing annotations of scholarly digital resources are currently limited, motivation to share more broadly may be constrained currently by limited expectations and/or an insufficient appreciation of what might be possible.). Finally, our research also suggests that in a majority of scholarly annotation use cases Web resources, when needing to be referenced in the context of a particular annotation, must be segmented, constrained as to version, or otherwise considered in a limited fashion, often in complex ways. This made clear that subsequent work should span multiple disciplines and a broad range of use cases. This in turn suggested that a single, generic reference implementation would not be useful at this time. Accordingly Objective 5 was deferred.

Additional details about specific accomplishments, challenges and obstacles identified and addressed over the course of Phase I, and our key findings from Phase I are provided below. See also the subsequent section of this report describing **"Dissemination of Results (links)."**

Notable Accomplishments, Additional Details

- **Data Modeling Review:** Two Technical Review Panels were convened. Both included a mix of core participants from OAC Phase I funded institutions, as well as outside experts. Both featured presentations of annotation tools, use cases, and experimental results in combination with intense, extended discussions (before, during and after the actual face-to-face meeting) of issues pertaining to data modeling and semantics. Presentations drew on a range of disparate projects from the US, Australia, and Europe. Technical Review Panel 1 led directly to the articulation of *12 Guiding Principles* for our work (http://www.openannotation.org/documents/OAC_GuidingPrinciples_20091106.pdf) and contributed to the creation of the Alpha-1 version of the OAC Data Model. Technical Review Panel 2 contributed directly to the creation of the Alpha-2 version of the OAC Data Model. Additional input to our data modeling review was facilitated by the OAC discuss Google Group (http://groups.google.com/group/oac-discuss) which, for example, facilitated a discussion of intersections with *Annotation Ontology* work in progress.

  Dates and non-OAC participants for the two technical review panels:

  - **Technical Review Panel 1**
    Held 12-13 October 2009 at University of California, Berkeley.
    Guests: Bernhard Haslhofer, Ray Larson, Clifford Lynch, Michael Nelson.

  - **Technical Review Panel 2**:
    Held 18-19 May 2010 at the University of New Mexico, Albuquerque
    Guests: John Bradley (via Skype), Muriel Foulonneau, Bernhard Haslhofer, Michael Nelson, Ronald Snyder

- **Data Model Specification:** After a few initial internal iterations, the first public release of the *Guide to the Open Annotation Data Model* (version Alpha-1) occurred on 19 April 2010. This release established a separation between the annotation content (annotation body as termed in subsequent releases), the annotation target, and the annotation itself. These distinctions remain core to the most recent release of the OAC Data Model. However the Alpha-1 release modeled annotations as events and included a context-based model (suggested by the *Annotea* work) for describing target segmentation. This approach proved less than satisfactory for some use cases. The Alpha-2 release, 30 June 2010, treated annotations as non-information resources and a sub-class of OAI-ORE aggregations. This approach provided an alternative way of specifying target and body

segmentation (i.e., the ore:proxyIn / ore:proxyFor construct). Ultimately, continuing discussion from Technical Review Panel 2 and via the oac-discuss Google group suggested that while arguably an improvement over the Alpha 1 approach, community consensus favored treating annotations as information resources. Accordingly, the Alpha-3 release of the *Guide to the Open Annotation Data Model* treats annotations as information resources (in the nomenclature of the Web Architecture). Alpha-3 also introduces the concept of oac:constrains / oac:constrainedBy as a more flexible and robust way to specify target and body version, segmentation, etc. Note also that effective with the Alpha-3 release, illustrative examples of Data Model features are more extensive and maintained as external pages to facilitate reading of the Model Guide on its own.

Since its release in October 2010, the Alpha-3 release has been well received. We anticipate a Beta-1 release of the *Guide to the Open Annotation Data Model* in April or May 2011 that will closely follow the Alpha 3 release. Summary of release history and links to OAC Data Model releases:

- Alpha-1 release 19 April 2010: http://www.openannotation.org/spec/alpha1/
- Alpha-2 release 30 June 2010: http://www.openannotation.org/spec/alpha2/
- Alpha-3 release 15 October 2010: http://www.openannotation.org/spec/alpha3/

- **Proof of Concept Experiment:** The Ajax XML Encoder (AXE) code libraries supporting annotation of Web resources were initially developed at the Maryland Institute for the Humanities (MITH) as part of an earlier project (grant provided by the National Endowment for the Humanities). For the OAC Phase I project, this code base was updated, modified as necessary to work within Zotero (version 2.1a1), and extended as to functionality and what kinds of Web resources could be annotated using the code libraries. In progress results from this work were shared with other members of the OAC through the Technical Review Panels mentioned above and through other communication channels in order to inform development of the OAC data model. Though AXE has its own internal, native model of annotation, ongoing communications and participation in the OAC Technical Review Panel also ensured that mapping of annotations into and out of the OAC data model was possible.

  A screencast of the successful pilot integration of the AXE libraries for annotation into Zotero was created showing that an end-user could annotate arbitrary regions of a Web-accessible still image collected into Zotero, storing a description of the annotation(s) of the image in Zotero as a note(s) on the Zotero entry for the resource. A copy of this screencast is available at: http://vimeo.com/7184265. A summary and overview of the AXE-Zotero integration effort was presented by Doug Reside, Dave Lester, and Trevor Owens at the Spring (April) 2010 Coalition for Networked Information (CNI)

Membership Meeting (see "**Dissemination of Results (links)**" section below for links to CNI presentation and handout).

- **Analysis & Advanced Use Cases**

  To facilitate the ongoing evaluation of and feedback regarding OAC data model development, we identified from the literature and from discussions with annotation tool developers, members of our Advisory Board, and other scholars, a number of hypothetical use cases. These use cases allowed us to explore features and assumptions of the OAC data model in more concrete terms.

  An initial set of 7 scholarly annotation use cases were identified early on in the project and were refined and revisited over the 18 months of work. These 7 use cases are listed here. More detail about each use case is available on the OAC wiki at http://wiki.openannotation.org.

  - Annotations involving targets and potentially bodies that are segments of streaming media [e.g., dance performance video, video commentary]
  - Commentary on remote resources [e.g. video held in one repository commenting on video held in different repository]
  - Sharing annotations across interfaces
  - Harvesting, aggregating, ranking, and presenting annotations targeting resources duplicated in multiple disparate repositories [e.g., PictureAustralia, Flickr, ...]
  - Annotating relationships between multi-component, mixed media resources
  - Annotations which capture scholarly netchaining practices
  - Annotations involving compound Targets [i.e., a target that is assembled for purposes of annotation from multiple other resources, whole or part]

  In addition to this initial set of basic use cases, the participants in the OAC Technical Review Panel #2 (May 2010), assembled additional use cases, some more specific or concrete and/or drawn from real, ongoing projects. These are listed here:

  - Annotating a resource in situ; e.g., annotating a part of an image, but only when that image is considered as part of a particular Web page.
  - Annotating one or more representations or a resource that disseminates different representations using HTTP content-negotiations, etc.; e.g., annotating a text that is returned in different languages based on accept-language headers.
  - Time-dependent annotations.
  - Europeana use cases, including annotation of annotations
  - Annotations of conceptual or real-world objects (aka non-information resources, aka bibliographic digital instances sharing the same provider-neutral catalog

record); e.g., annotating a passage of 1912 edition of Huckleberry Finn in all digital instances.

- Single resource annotations; e.g., turning the marginalia on a page image into an OAC annotation of that page image digitized.
- Annotations where versioning / tracking changes in annotation intent over time is important; e.g., an annotation that reveals annotator's initial reaction and then subsequent changes in reactions to a resource.
- RDFa embedded annotations
- Annotations that identify text changes (towards preparing critical editions) and that subsequently are annotated (updated?) to reflect editorial action.
- Annotations that function as transcripts of handwritten or unclear text on image.
- Propagating annotations across views of a resource
- Preserving tool-specific annotation details, e.g., Pliny note location on canvas
- Annotation content (body) used for multiple annotations

Finally, to better understand use cases dealing with the persistence of Web resource annotations, use cases dealing with the propagation of annotations across different renderings of the same intellectual resource, and use cases involving mapping from an existing annotation tool's data model (e.g., from John Bradley's *Pliny* scholarly note-taking tool) into the OAC data model, additional more in-depth analyses and some limited experimentation was undertaken over a handful of the above use cases. Results of these in-depth analyses and experiments appeared in formally and informally published papers and in screencasts as listed below in "**Dissemination of Results (links)**" section.

Challenges Identified & Addressed

While on the whole, work progressed smoothly during the project, we did face some challenges and obstacles of greater than anticipated magnitude.

Scope: The range of scholarly annotation use cases encountered and the breadth and diversity of scholar interest in annotation was greater than anticipated. While not surprising that scholars perceive a need for more than the minimalistic digital "post-it" note and tagging annotation services ubiquitous on the Web today -- there is nothing wrong with such services, but they are not all that is needed -- the range of annotation functionality of interest to scholars in this domain was quite broad and their appreciation of annotation tool functional design quite nuanced (at least in the abstract). Scholars appreciate the potential for annotating Web resources and clearly have individually and collectively developed ideas and incomplete models of how annotation should work in their individual domains. Scholars readily recognize distinctions between classes of annotation, as evidenced by the distinction between annotation and personal note taking articulated by John Bradley and others, and the anecdotal reporting from *Pliny* users as to the utility of being able to color-code (i.e., class) notes made

in *Pliny* to facilitate subsequent organization and retrieval of notes taken. While we ultimately were able to move beyond the simple 6 classes of annotations recognized by *Annotea*, and able to develop an adequate, workable definition of scope for the purposes of Phase I, we feel that more systematic work with discipline experts is needed to better capture the full complexity of scholarly annotation typing. This in turn will help us progress in better understanding the full scope of annotation as understood by scholars.

Finding concrete examples of scholarly annotation of digital resources: At the same time, while clear that many scholars have given thought to annotation of Web resources as a scholarly practice and hold diverse and broad ideas about annotating scholarly resources on the Web, concrete examples of such annotations are hard to come by. In part this is because much of this thinking is abstract and as of yet ahead of concrete systems and tools for creating annotations; in part also it is because of a reticence on the part of many scholars to share work in progress (which annotations and personal notes typically are). Thus, though able to identify a scholar who had used the note-taking tool *Pliny* to create literally thousands of notes in connection with a current book project, we were not able to get even a sampling of these notes to study since the book remains for now a work in progress. For the purposes of Phase I we relied on published literature, a very limited number of concrete examples, in-depth discussions with scholars, and extrapolation from scholarly annotation practice involving non-digital resources. However, it will be critical for the next phase of work to build in planned opportunities to generate and capture additional concrete examples and illustrations of scholarly annotations. Concurrently, to help motivate the sharing of annotations and the creation of annotations with sharing in mind, it would be useful to include in subsequent work opportunities to demonstrate and make more concrete use cases that show value-added through annotation interoperability and sharing.

Negotiating intellectual property terms and conditions: Finally, as a purely logistical obstacle, it took longer than anticipated to finalize and put in place sub-awards for the all of the members of the Collaboration. In particular, discussions regarding intellectual property terms and conditions were protracted. In combination with the obstacles mentioned above this attenuated the period of performance for the project, effectively delaying the start date for work by 2 months and necessitating a net 4 month no-cost extension at the back-end; however, these changes in schedule did not adversely impact results, and arguably facilitated our ability to engage the community and maintain continuity into Phase II of the Collaboration's work. Nonetheless, in the future, it will be desirable to address intellectual property terms and conditions as early in the process as possible.

Key Preliminary Findings from Phase I

Finally, work done during this project and observations so far synthesized suggest a number of preliminary findings, subject to refinement and validation through more extensive,

concrete experimentation, demonstration and application prototyping proposed for later phases of work. Key among these findings:

- General-purpose annotation models should allow the use of any media type to annotate any media type.
- There are real-world scholarly annotation use cases for which it is required to separate annotation from annotation body, including to allow annotations referencing ontologies and to support distinct authors for body and annotation.
- Annotations are optimally modeled (in Web Architecture terms) as information objects rather than as events, non-information resources, or OAI-ORE aggregations; this is for a variety of reasons including alignment with community intuitions about the nature of an annotation.
- In most if not all scholarly disciplines, the ability to target/reference a precise segment, version, or representation of a resources is critical.
- Descriptions of annotations must capture something of the intent of the annotator, e.g., as to whether an annotator is annotating the syntax of a text fragment or the sense of the idea being expressed by that text; though impossible to capture with absolute certainty, a data model that supports typing of annotations and the inclusion of contextual information regarding the creation of the annotation can improve confidence that the meaning of annotation has been captured. More work is needed.
- Truly compelling (to scholarly users) use cases involving annotation interoperability are still evolving and more work is needed to show value-added through annotation sharing and interoperability in scholarly contexts.
- Given careful definition of semantics and guidance on practice, RDF (in any generally accepted serialization) provides a sufficient (and suitable) foundation for a shared, interoperable data model of scholarly annotation
- Similarly, given the same care in definitions and guidance on practice, RDF-based descriptions of annotations will naturally conform to Linked Data principles.

Leadership and Staffing Summary, including changes over the course of the project

1. The OAC Phase I Project Advisory Board was appointed in July 2009. There were no changes in Board Membership over the course of the Project.

Advisory Board Members:

- Maristella Agosti, Professor of Computer Science, Department of Information Engineering, University of Padua
- Geoffrey Bilder, Director of Strategic Initiatives, Crossref
- John Bradley, Senior Analyst for Humanities Computing, Centre for Computing in the Humanities, King's College London
- Gregory Crane, Professor of Classics, Tufts University
- Paul Eggert, Australian Research Council Professorial Fellow, Australian Scholarly Editions Centre
- Julia Flanders, Director, Women Writers Project, Brown University
- Cliff Lynch (Chair), Executive Director, Coalition for Networked Information
- Cathy Marshall, Senior Researcher, Microsoft Research
- Martin Mueller, Professor of English & Classics, Northwestern University
- Geoffrey Rockwell, Professor of Philosophy and Humanities Computing, University of Alberta
- David Ruddy, Director, E-Publishing Technologies, Cornell University Library
- Joyce Rudinsky, Associate Professor, Communication Studies, University of North Carolina at Chapel Hill
- Mackenzie Smith, Associate Director of Technology, MIT Libraries
- Amanda Ward, Head of Platform Technologies, Nature Publishing Group
- John Wilbanks, Vice President, Science Commons

2. Staffing at participating institutions (dates of participation noted where appropriate):

a. University of Illinois at UC:

Tim Cole (PI)
Allen Renear (co-PI)
Carole Palmer (co-PI)
Tom Habing
Kevin Trainor
Larry Jackson
Jacob Jett (from Nov 2010)

b. Los Alamos National Laboratory

Herbert Van de Sompel (PI)
Rob Sanderson

c. University of Maryland

Neil Fraistat (PI)
Doug Reside
Nik Coukkouma
Elisabeth Kvernen

Dave Lester

d. The University of Queensland
Jane Hunter (PI)
Anna Gerber
Stephen (early in project)
Ron (early in project
Chih-Hao Yu

e. George Mason University
Dan Cohen (PI)
Sean Takats

Dissemination of Results (links)

Publications

- Gerber, A. Hyland, A. Hunter, J. (2010.) "A Collaborative Scholarly Annotation System for Dynamic Web Documents - a Literary Case Study", Lecture Notes in Computer Science, Volume 6102/2010: 29-39. DOI: 10.1007/978-3-642-13654-2_5. Available: http://www.springerlink.com/content/cq83274mk5r177l4/
- Hunter, J. and Yu C. (2010.) "Supporting Multiple Perspectives on 3D Museum Artefacts through Interoperable Annotations", IFIP Advances in Information and Communication Technology, Volume 333/2010: 149-159. DOI: 10.1007/978-3-642-15214-6_15. Available: http://www.springerlink.com/content/m8pw77273u5lq2x1/
- Sanderson, R. and H. Van de Sompel. (2010.) *Making Web Annotations Persistent over Time*. [Pre-print of JCDL 2010 paper.] arXiv:1003.2643v2. Available: http://arxiv.org/abs/1003.2643v2

Conference Presentations, Posters, & Tutorials

- Slides form CNI Dec. 2010, "Annotating Scholarly Resources: An Update from the Open Annotation Collaboration." Available: http://www.slideshare.net/azaroth42/cni-dec10-slides
    - Handout for CNI Dec 2010, available: http://www.cni.org/tfms/2010b.fall/Abstracts/Handouts/cni_annotating_sanderson.pdf
- Slides from JCDL 2010 "Making web annotations persistent over time." Available: http://www.slideshare.net/azaroth42/making-web-annotations-persistent-over-time

- Slides from CNI April 2010, "Report on AXE integration into Zotero." Available: http://www.openannotation.org/documents/OAC-AXE-Zotero-CNI-April2010.pdf
    - Abstract for April 2010 CNI Briefing, available: http://www.cni.org/tfms/2010a.spring/Abstracts/PB-interoperable-reside.html
- Slides from CNI December 2009, "Preliminary OAC Data Model." Available: http://www.slideshare.net/azaroth42/oac-presentation-at-cni-09-fall-forum
    - Video from CNI December 2009, available: http://vimeo.com/8481040
    - Handout from CNI Dec 2009¸ available: http://www.openannotation.org/documents/CNI_Dec-OAC_Handout.pdf
- Slides from CNI April 2009, "Project goals and objectives." Available: http://www.slideshare.net/tcole3/open-annotation-collaboration-briefing
    - Handout from CNI April 2009 Presentation, available: http://www.openannotation.org/documents/OAC-HandoutForCNIApril2009.pdf
- Sacchi, S. (2011). Annotation evolution: how Web 2.0 technologies are enabling a change in annotation practice. *Proceedings of iConference '11*, 765–766. doi:10.1145/1940761.1940898
- Van de Sompel, Herbert, Robert Sanderson, and Michael Nelson. (2010.) *Memento and Open Annotation*. [Tutorial at ECDL 2010, Glasgow, UK.]
- Van de Sompel, Herbert. (2010.) *Annotating the (scholarly) Web*. TICER Digital Libraries a la Carte Summer School. Tilburg University, Tilburg, The Netherlands.

Other Web accessible documents, screencasts, etc.

- Press Release Announcing Phase I Project http://www.openannotation.org/phaseIannouncement.html
- Guiding Principles to support Annotation Interoperability http://www.openannotation.org/documents/OAC_GuidingPrinciples_20091106.pdf
- (Screencast) Preview of AXE-Zotero Integration http://vimeo.com/7184265
- (Screencast) Migrating Annotations Across 3D/2.5D Models Using OAC http://www.openannotation.org/documents/3dAnno.wmv
- (Screencast) Exporting Notes from Pliny to Danno http://www.youtube.com/watch?v=RTbrqdmHFlg
- Wang, Yan. (2010.) *Annotation Data Model and Implementation Research: Analysis & Experimentation with the Annotation Tool Pliny*. [Practicum Project Report.] Available: http://hdl.handle.net/2142/17347

- Jackson, Larry S. (2010.) *RDF-encoding Pliny annotations in the Open Annotation Collaboration Project*. Available: http://hdl.handle.net/2142/15418

Plans for Additional Work

Building on the successes of the Phase I project, OAC Phase II is underway as of 31 January 2011. The following goals have been established for Phase II:

1. Demonstrate practical applicability, utility and benefits of implementing the OAC data model to support scholarly annotation for 8 demonstration experiments spanning multiple domains and involving content in a range of formats; each demonstration will result in a report detailing process, benefits realized, and implementation successes, difficulties and failures.

2. Resolve open issues and residual uncertainties to do with the current alpha version of the OAC data model and ontology; this will allow us to refine and improve the OAC data model and ontology, moving from an alpha 3 release (expected before the end of 2010) to a version 1.0 production release by June 2012;

3. Observe demonstration experiments in progress and synthesize results reported, yielding:
    a. augmented documentation helpful to assist would-be implementers of the OAC data model and ontology; and
    b. an overview report summarizing common themes and core requirements of scholarly annotation on the Web and highlighting ways in which scholarly annotation of digital resources differs across domains and models of content.

4. Proactively encourage (e.g., through the 8 annotation demonstration experiments included as part of OAC Phase II) the adoption and adaptation of the OAC data model for shareable annotation as the foundation for an environment supportive of scholarly annotation tools and services that span boundaries of annotation clients, annotation servers, and content collections.

Financial Report

The Project Financial Report for OAC Phase I is attached (Mellon-C6079-Final-Financial.pdf) and was separately transmitted from the UIUC Office of Sponsored Projects & Research Administration to the Foundation on 15 March 2011. As planned more than 85% of grant dollars were spent to pay for salary and benefits of researchers and staff working directly on the Project, with the bulk of the remainder going to cover the cost of in-person meetings and travel by PIs to conferences (e.g., Digital Humanities 2010, 4 CNI member meetings) to give papers related to work in progress.

Variances from proposed/planned project budget were small. Rather than 1 in-person Technical Review panel and 1 in-person meeting of the Project Advisory Board, the Board convened together only once by conference call, while there were 2 in-person Technical Review Panel meetings. Separately some members of the Advisory Board (e.g., Martin Mueller, John Bradley, Julia Flanders) were invited to Illinois (in whole or in part, with reimbursement dollars contributed by the Project as appropriate) for in-depth discussion of OAC Phase I work in progress. Still, because the second Technical Review Panel was much smaller than the budgeted in-person Advisory Board meeting would have been, because we were able to secure technical review meeting venues at essentially no cost (at U. of California Berkeley and at U. of New Mexico), and because the project PIs were able to take advantage of separately funded in-person attendance at some discipline conferences for ad hoc project meetings, we underspent planned travel budget by about 10% ($4,478). Website and wiki hosting proved less expensive than originally anticipated (i.e., less funds on computer services), and we spent about 0.4% less on sub-contract awards. These savings plus the interest earned on grant funds ($185) allowed us to increase direct labor on the Project at Illinois by $7,096, a bit over 15%. This facilitated additional analytic work on use cases and made it possible to better coordinate logistics for meetings and the grant overall.

Otherwise expenditure totals matched budget totals over the course of the Project.

Specifications & Software Created (will remain freely available on the Web at the following locations for minimum of 3 years):

The focus of OAC phase I was on development of the OAC data model and ontology, so the primary outcomes of the Project in regard to specifications and software were the iterations of the Guide to the OAC Data Model:

- Alpha Data Model Guide [19 Apr. 2010] (http://www.openannotation.org/spec/alpha1/)
- Alpha2 Data Model Guide [30 June 2010] (http://www.openannotation.org/spec/alpha2/)
- Alpha3 Data Model Guide [15 Oct. 2010] (http://www.openannotation.org/spec/alpha3/)

Some substantive improvements were also made in the MITH AXE software as part of the collaboration with Zotero (George Mason University). An implementation of AXE is publicly available at:

http://mith.umd.edu/AXE/

Acknowledgements

The authors and participants in OAC Phase I wish to thank the Andrew W. Mellon Foundation and our home institutions for their support of the work described in this report.