NATIONAL ENDOWMENT FOR THE HUMANITIES

DIVISION OF PRESERVATION AND ACCESS

Narrative Section of a Successful Application

The attached document contains the grant narrative of a previously funded grant application. It is not intended to serve as a model, but to give you a sense of how a successful application may be crafted. Every successful application is different, and each applicant is urged to prepare a proposal that reflects its unique project and aspirations. Prospective applicants should consult the NEH Division of Preservation and Access application guidelines at http://www.neh.gov/divisions/preservation for instructions. Applicants are also strongly encouraged to consult with the NEH Division of Preservation and Access staff well before a grant deadline.

Note: The attachment only contains the grant narrative, not the entire funded application. In addition, certain portions may have been redacted to protect the privacy interests of an individual and/or to protect confidential commercial and financial information and/or to protect copyrighted materials.

Project Title: Building a Life Cycle Assessment Tool & Library of Preventive Conservation Methods

Institution: Foundation for Advancement in Conservation

Project Director: Eric Pourchot

Grant Program: Research and Development

Significance

Preservation of cultural heritage requires extensive understanding of interactions among the cultural object, the treatment materials, and the housing environment. Many custodians of cultural heritage have indicated interest in preserving objects using materials and products that are not harmful to the environment or the practitioner, but lack resources to make effective choices. Others remain unaware of the potential environmental impacts of their actions and the products involved. Sufficient information concerning toxicity and impact is often difficult to access, and understanding it remains challenging for those without specialized training. The tools and training that this project develops will arm professionals with the ability to understand and evaluate costs to their health and the environment and choose effective alternatives for more sustainable preservation and exhibition practices.

Industries, public agencies, and researchers have begun to explore and quantify the potential environmental and human health impacts of their actions using Life Cycle Assessment (LCA). LCA is an environmental-systems modeling tool developed to analyze the environmental impacts associated with a product or process. It examines emissions and impacts over the life cycle of products, including the entire supply chain, use, and disposal. This approach enables a holistic analysis of sustainability, expanding from narrow conceptions focused just on product use. The goal is to expose 'hotspots' or the high impact contributors so as to inform decisions and product design. With LCA, information previously hidden becomes available to the practitioner, providing data to support decisions based on his or her particular needs and priorities. LCA studies designed for our professional goals will help collection care professionals to make informed choices that protect their own health and the health of the environment while continuing to preserve and exhibit humanities collections. Informed choices will advance the field's professionalism by identifying and broadly sharing standards and best practices.

Cultural heritage professionals do not currently have the tools they need to make educated decisions concerning the environmental and health impacts of their choice of cleaning systems, packing materials, and exhibition and storage approaches. Resources such as Safety Data Sheets provide basic, categorical toxicity data, but comparing substance to substance, especially when dealing with complex, and multiple materials remains challenging. Consequently, the choice remains with the cultural heritage professionals, often based on unsubstantiated information. Decisions such as those outlined below remain challenging:

- Given an entire cleaning or treatment system using distilled water, buffered solutions, solvents, cotton swabs, and gel systems, what aspects result in the highest carbon footprint?
- For packing art, what materials are the most sustainable, producing the least amount of greenhouse gases in production and disposal?
- When storing art, are passive systems using silica gel or zeolites more environmentally sustainable than conditioning entire rooms?
- Concerning health impact of treatment methods, which solvent or action has a higher health risk?

LCA helps answer those questions and provides quantitative, science-based information that leads to informed decision-making. LCA is defined by the International Organization for Standardization (ISO) as "a compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle." (ISO 14040/4/67). LCA reports explain and share data and conclusions gathered during an in-depth exploration of process and materials for economic comparisons, human health indications, and environmental impact assessment.

Encouragement from the Field

Nunberg and Eckelman are awaiting publication of their work in a Getty Conservation Institute (GCI) Technical note *Long Term Thinking for Conservation Planning. Managing Collection Environments: Preserving Collections in the Age of Sustainability*. Peer review is extremely positive. The comments say "definitely" that the material is likely to be read and used by students and practitioners. Most importantly, one reviewer described LCA work as "concepts that are not yet mainstream in conservation practice but

practitioners need to become aware of. As mid-career conservators won't have come across the concepts as part of their original studies this is a great introduction for them."

The AIC Materials Working Group (MWG) in August 2018 surveyed field practices of conservators, collection manager, registrars, curators, conservation administrators, librarian/archivists, conservation scientists, exhibit designers, technicians, mountmakers, conservation educators and vendors. The MWG received 441 responses. The questions addressed in this summary (see attachment) and the results are of significant importance, and strongly justify the need for this Tier II project. Listed below are the top responses to three survey queries that give the strongest justification for this project:

- "When evaluating a material for purchase that you REGULARLY use, what information do you review?"
  - Discuss with a colleague (319)
  - Group recommendations such as listservs, C2CCare forum, Consdist List (314)
  - Online information posted by a colleague such as grey literature from a blog or wiki (301)
  - Peer reviewed published information such as mention in a journal article (295)
- "When presented with the need to choose a NEW material, what information do you review in order to feel comfortable in trying it (Please rank in order of preference):
  - Group recommendations (listservs, C2CCare forum, Consdist List) (317)
  - Peer reviewed published information (mention in a journal article) (313)
  - Online information posted by a colleague (grey literature like a blog or wiki) (305)
  - Discuss with a colleague (302)
- "How important is the life-cycle cost or sustainability of the material when making your decisions?
  - 37% "a great deal"
  - 43% "a moderate amount"
  - 17% "a little"
  - 3% "none at all"

These results tell us that professionals use a variety of sources for decision-making, and that they will usually reach for the information that is the easiest to access, either by contacting peers or searchable listservs. This project creates an easy-access look-up tool and easy-to-understand case studies, and responds to the unmet need for the 80% who feel sustainability has great or moderate importance to their decision-making. It provides access to reliable, relevant information for current Professionals and reaches students still in the early stages of adopting sustainable practices. This effort will prevent (as much as possible) instances where information is verbally passed along without regular scientific evaluation or "check points." The project will allow all Professionals, not just specialists, to explore queries on their own, but with science-based, accessible resources.

The survey also asked if respondents used prepared lists to simplify selection and decision-making for materials uses. Only 15% reported using a list of pre-approved materials for decision-making; 38% reported not having a list; and 42% reported sometimes choosing from such a list. Those who did choose from a list reported in 32% of cases that a conservation scientist had created the list. The rest used lists provided by collections managers, registrars, curators, purchasing officers, or a preparator/technician. These figures demonstrate an absence of and need for easy-to-access, properly researched recommendations, and the lack of peer-reviewed direction for purchases. The peer process of this project will create a resource with peer-reviewed choices supported with scientific data.

Outcomes (Changes for the Field)

- Professionals who previously depended upon word-of-mouth, educated-guesses or time-consuming research, will now easily access more reliable and professionally appropriate information concerning the environmental and human health impact of the products and processes they commonly use when preserving and sharing cultural heritage materials;
- The profession will begin to take responsibility for its impacts on the planet in line with similar efforts spreading across the cultural heritage profession and many industries internationally; and

- Colleges and universities will have access to LCA in collection care as part of their learning focus, with a field-generated resource for teaching and continued professional development.

Outputs (Products)

- An LCA Tool with a user-friendly database for independent, professional use. The Tool will enable comparisons of materials and methods for 3500 items used in caring for and displaying objects, covering both greenhouse gas emissions and chemical hazard metrics;
- Six to eight (as time allows based on the prioritized list) new LCA Library case examples assessing complex processes and situations that are common in caring for cultural heritage (e.g., evaluating the environmental and human health impact of an entire treatment system from solvents to gels; examining the environmental impact of the materials required to pack and ship a loan, producing and disposing the materials cradle to grave);
- Two preferred-purchases lists or recommendation wallet cards based on the Tool to help professionals choose among commonly-used materials;
- A May 2021 workshop led by the PIs to instruct professional teaching program leaders more fully in LCA design and use;
- Two editions of three-dimensional multi-paneled exhibit describing the project, LCA, and its application in the cultural heritage field for exhibiting, caring for, storing, and shipping objects and materials;
- A recorded webinar on the Tool and the Library for free on-demand access through AIC; and
- A white paper on lessons learned during the project.

Related Work

Changing Perceptions Among Cultural Heritage Professionals: Similar to the roll-out of environmental sustainability, generally, in cultural heritage work, in conservation there are bright spots where individuals or institutions are creating change, but there is no widespread or coordinated effort to align professional standards with growing public expectations and understanding the impact of human choices on the environment and climate. Professionals have commented on the importance of identifying and reducing the negative environmental impacts of cultural heritage preservation practices, and have begun exploring ways to blend environmental sustainability with mission-driven work. Former museum director Robert Janes discusses in his book *Museums in a Troubled World* (Routledge, 2009) the importance of museums setting an example and educating the public in climate change and sustainable practices. Janes comments that for museums to remain sustainable enterprises they must become the bridge between science and public interest. Sarah Sutton (co-PI on Tier I and Tier II of this project), a sustainability consultant and author of *Environmental Sustainability at Historic Sites and Museums* (Rowman & Littlefield, 2015), writes about a vision for the future of history museums and historic sites that supports the work of this application: cultural heritage institutions will "manage what they buy, use, and produce, in ways that are thoughtful and ultimately advantageous to both humans and the environment."

Other organizations, such as the American Association for State and Local History (AASLH), the American Alliance of Museums (AAM), and the Society for American Archivists (SAA), are also examining steps toward environmental and climate response in their work. AASLH is updating its Standards of Excellence in History Programs (StEPs) to include environmental sustainability and climate action, and convened a Sustainability & Climate Task Force to make recommendations to the AASLH Council on how to proceed (co-PI Sutton is a co-chair). AAM's Environment & Climate Network hosted a Sustainability Summit with the Historic House Network (2019) and is discussing with AAM leadership how to add sustainability to the Code of Ethics. SAA has been updating its standards to include energy-efficient approaches to collection care. FAIC's proposed project will provide the data to contribute to this shift in cultural heritage management, supporting the work of these three organizations and benefiting their professionals.

Current Status of Materials Information: Dr. Eric M. Breitung, Conservation Scientist at the Metropolitan Museum of Art, has been developing preventive conservation methods and policies for the analysis and use of materials for display and storage of art objects. In doing that work he first acquired lists of materials used frequently through a survey of materials. He then tested materials, developing a list referred to as the Metropolitan Museum list of Oddy-tested materials (see attached bibliography). He is making both lists available to this project as a source for materials (300-500 possible) to be tested for the LCA Tool. Likewise, Michele Derrick of the Museum of Fine Arts, Boston will share more than 9,000 materials listed in the CAMEO database. Rachael Arenstein, e-Editor for AIC, oversees the AIC wiki and the MWG content, which list about 5000 items. The Tier II approach incorporates these other efforts while adding new value.

Background of Applicant

FAIC's mission is "to save cultural heritage for future generations, protecting it from decay and destruction. We advance research and education, lead treatment and collection care initiatives, and deploy conservation expertise to where it is most urgently needed. Our work empowers conservation professionals, strengthens cultural institutions, and engages stakeholders, including public audiences, as we work together to protect cultural heritage for humanity." The foundation was established in 1973 to support conservation education, research, and outreach activities that increase understanding of our global cultural heritage. In a continuation of its long history of managing complex projects, FAIC was awarded a 2017 Tier I grant preceding this proposal, successfully managing it to completion in December 2018.

FAIC's programs are wide-ranging. In 2018, FAIC presented and co-sponsored 27 professional development events that reached 864 individuals. FAIC trained and maintains the National Heritage Responders (NHR), a group of more than 100 conservators, curators, librarians, and archivists who volunteer their services to institutions affected by disasters. FAIC's Alliance for Response helps form networks between local cultural organizations and emergency responders. FAIC operates Conservation OnLine (CoOL), and the related ConsDistList, with more than 12,000 international participants. Connecting to Collection Care supports allied professionals who do not have conservation training. Since December 2014, the program produced 65 webinars and three courses, viewed by at least 19,385 individuals. A collaborative agreement with IMLS supports up to 80 conservation assessments each year for small to medium-sized museums.

FAIC works closely with AIC and is able to draw upon AIC's strong volunteer network and deep knowledge base. AIC is the national membership organization of conservation professionals dedicated to preserving the art and historic artifacts of our cultural heritage. AIC's Sustainability Committee and Collection Care Network have been especially active in sustainability issues and preventive conservation. The Materials Working Group (MWG) was formed in 2017 to develop materials specifications for use by collecting institutions and standards for testing materials used for exhibit, storage, and treatment. See http://www.conservation-wiki.com/wiki/Materials_Working_Group for more information.

AIC's mission is to advance the practice and promote the importance of the preservation of cultural property. It establishes and upholds professional standards, offers education programs, and coordinates the exchange of knowledge, research, and publications. It plays a growing international leadership role as it expands its services to the field and serves a membership that has grown to over 3,500. AIC members are based in all 50 states and the District of Columbia. AIC provides an array of services and publications. The AIC Annual Meeting, with over 80 educational sessions, workshops, tours, and related events draws an average of 1,200 attendees each year. AIC publishes the award-winning, peer-reviewed journal, *Journal of the American Institute for Conservation* (JAIC). AIC maintains a website of conservation information and resources for its membership, cultural institutions, and the public, including a wiki (http://www.conservation-wiki.com) for conservation professionals. AIC's *Find a Conservator*, available as a searchable database on the AIC website, helps the public and cultural institutions nationwide locate conservators with the expertise to meet their specific needs.

A full-time executive director serves both AIC and FAIC. Twelve additional staff positions provide full-time support for administration, education, emergency programs, publications, website, marketing, membership services, public relations, and outreach. AIC is governed by a board of eight elected members. FAIC is governed by a separate board consisting of selected AIC board members and additional members drawn from professions who bring added financial, corporate, and organizational experience (see board lists in Attachments).

History, Scope, and Duration

HISTORY

The Advent of LCAs in the Profession: 2012 -2016

Sarah Nunberg, conservator in private practice, part-time conservator and teacher at Pratt Institute, (and a PI in this project) has been interested in this issue for some time, and commissioned five of the six known LCAs conducted in the field. (The other known LCA was carried out by Simon Lambert (https://sustainablemuseums.blogspot.com/2010/06/guest-blog-museum-loans-and-climate.html) in 2010. It examined the carbon footprint of museum loans. Lambert won the UK's 2010 ICON award for his carbon footprint analysis of museum loans.) Of the LCAs to which Nunberg contributed, LCAs 1-4 were case studies in collaboration with Pamela Hatchfield, Robert P. and Carol T. Henderson Head of Objects Conservation at the Museum Fine Arts, Boston, and LCA 5 was based on a treatment plan Nunberg devised to treat a Louise Nevelson chapel at the Saint Peter's Church, NYC. All five LCAs were conducted by co-PI Eckelman and his students at Northeastern University.

- LCA 1 considered the environmental impact related to loan preparations and object shipment. The study found that the largest carbon footprint of a loan was the courier for the art, who travels round trip for every one-way delivery.
- LCA 2 compared efficiencies of the cost and life cycle of halogen lamps with light-emitting diode lamps (LEDs) in a single MFA gallery. This study concluded that in addition to long-term cost savings, LED use results in lower environmental impact, lower eco-toxicity, and fewer negative human health indicators than halogen lamps.
- LCA 3 addressed cost and energy savings resulting from the on-off cycling of air-handling equipment for one newly constructed gallery at the MFA. The study showed that electricity usage was reduced by ~20% by using the on-off cycling.
- LCA 4 examined the environmental and human health impact from three consolidant systems: Acryloid B-72 (a methyl methacrylate copolymer used extensively in objects conservation), alkoxy silanes (a consolidant used for silica-based stones such as sandstone) and calcium hydroxide nanoparticles (a consolidant used for frescos). This study found that all treatments carried direct risks to users, including ocular and/or dermal irritation, and reproductive toxicity in the case of B-72. On a life cycle basis, B-72 had the highest greenhouse gas emissions, while silanes carried higher risks of ozone layer depletion.
- LCA 5 evaluated three possible cleaning systems (Nanorestore Gels ®, PVA Borax Gels, and Klucel M gel) to remove restoration paint from the Louise Nevelson installation in New York City. The study found that Klucel M resulted in the lowest environmental impact and it provided lists of cleaning materials to populate an initial beta LCA Tool.

These early LCA projects demonstrated that the analysis process makes the invisible visible: information previously hidden becomes available to the practitioner making decisions based on his or her particular needs and priorities. Nunberg, Eckelman, and Hatchfield published three of these LCAs in 2016 in the *Journal of the American Institute for Conservation* (JAIC). Colleagues have assigned this publication to students in classes and have used it to help guide decisions in their related work. More recently Nunberg and Eckelman published their work in a Getty Conservation Institute (GCI) Technical note. By 2016 Eckelman and Nunberg had gained more expertise on the applications of LCA in conservation than anyone in the field.

NEH Tier I Planning Project 2017-2018

Eckelman, Nunberg and Sarah Sutton (all co-PIs in this application) and consultants Pamela Hatchfield, and Michael Henry, architect and engineer at Watson & Henry Associates, created and completed three more LCAs during that project:

- LCA 6 was a first-in-the-world life cycle assessment of historic cultural objects, applying standard modeling methods to understand the evolution of energy use and emissions associated with an object over centuries. The study considered the primary energy use from cradle to the present of three similar silver objects from the 18th century, including original mining in Bolivia, raw material transport to the US, crafting the silver products, use in private homes, registration in museums, exhibit housing, polishing, coating, and maintenance. The results show clearly the influence of background changes in the energy system, including the introduction of fossil fuels and the use of electricity.
- LCA 7 focused on cleaning treatment materials and methods and was divided into two parts. The first part examined 40 cleaning agents such as solvents, water, and detergents, from cradle to gate (production to use) and was the basis for the beta Tool. The second part compared five specific cleaning systems involving solvents, buffered water, and gel systems. The results were illustrated with bar charts comparing various environmental impacts (such as acid rain, carcinogens, ozone depletion, etc.)
- LCA 8 examined object storage, evaluating three methods of displaying objects in a conditioned space: cases with passive desiccants; cases with active environmental controls; and in an open gallery with environmental controls for the entire space. The study found that, despite the additional display materials required, the use of either passively or actively controlled cases was less life cycle energy and emissions-intensive than conditioning the entire space to a narrow range of temperature and humidity, and that this environmental advantage was more pronounced the longer the cases are in use. Through studying these scenarios, an open-source tool was developed using the building energy model eQUEST. Cultural heritage professionals can use the tool to model their own spaces and designs, simulating energy use for a user-defined space and external and internal conditions.

The Tier I project also prototyped the format and desired content focus of a user-oriented data tool for conducting basic LCA on common items (LCA Tool) (see screenshot in attachments), a training workshop, and multiple blog posts. The PIs were particularly encouraged by feedback from participants in the workshop indicating that the project must continue and would be well-received on a broad basis by the field. By the grant conclusion, Eckelman and Nunberg had become the most experienced team of professionals in the field on this topic, integrating Eckelman's materials engineering experience and Nunberg's conservation and LCA experience to create a new field of study and practice for the profession. The design of the Tier II project has been driven by what the team learned during Tier I.

LCA Tool Tier I Discoveries

For the Tool, we needed a list of items curated based on common or priority products, but as the PIs worked to identify LCA relevant materials and activities to populate the LCA Tool, we learned that, with the exception of one major museum, the eight cultural heritage professionals we contacted had minimal, if any, existing inventories or preferred-purchases lists for most commonly-used materials. PI Nunberg combed through recently-published articles concerning treatment of cultural heritage objects and exhibition preparation, and her own lists of materials ordered for conservation workshops. She then sorted the materials into spreadsheets: solvent wet cleaning, dry cleaning, inpainting and varnishes, fill materials, packing materials, adhesives and consolidants, papers, exhibition construction, pest control, and environmental monitoring. PI Eckelman selected 500 products from Nunberg's lists of cleaning and packing materials as the basis for the beta LCA tool. He then cross-referenced the component materials in each product with existing Life Cycle Inventory databases, including public data from the US Federal Data Commons and commercially published data that was purchased for this purpose, to estimate the life cycle greenhouse gas emissions (carbon footprint) associated with each product. He combined this data with occupational hazard information from the US Occupational Safety and Health Administration (OSHA) and the European Chemicals Agency (EChA), so that both environmental and health metrics could be evaluated

simultaneously. All data were built into an MS Excel spreadsheet model, with look up functions for users to query products of interest.

LCA Library Tier I Discoveries

The three LCAs described above were carried out by Dr. Eckelman's graduate and undergraduate students to fulfill assignments required for class credit. Although the students' reports were comprehensive and provided useful information, because of the limits of a semester, issues could not be revisited after the class timeframe. An even closer collaboration between the cultural heritage collection professionals and the engineer/LCA practitioners, without such time barriers will improve the process. As a result, for the Tier II project Eckelman will assign one full-time graduate student to the entire LCA work, allowing for consistency, accumulation of information instead of continuously re-introducing students to the project, and closer, more efficient collaboration.

LCA Tier I Workshop Discoveries

Since independent work during Tier I was not building enough knowledge or momentum as we had hoped or needed, we organized a workshop to provide additional training, gather feedback, discuss continued work and learn how our discoveries and thinking would be perceived by professionals most likely to use these materials. We invited fourteen professionals for two days in June 2018 to learn the basics of LCA and its best uses for the field of cultural heritage preservation. Attendees included museum and private conservators, registrars, and curators, conservation students, and training leaders from New York University, University of Delaware, UCLA, and Buffalo State University, Pratt Institute faculty, and staff at private arts services. (See the workshop participants list and agenda in the Appendices.)

The first day of the workshop focused on leveling everyone's understanding of the project, teaching the basic principles behind LCA, and the application of LCA to cultural heritage collections work. We demonstrated the beta LCA Tool developed by Eckelman based on Nunberg's lists. We explained our intention to expand beyond cleaning, and packing and exhibition materials, but the workshop participants recommended we focus on these two categories and build them out as thoroughly as possible.

During the second day, participants practiced modeling their own LCAs using a streamlined tool developed for the workshop and concluded with a discussion of the possibilities for future work. The discussion revealed pronounced interest in the LCA project and identified interest in connecting LCA work with graduate programs and other colleagues. Based on the learning experience of the workshop, attendees requested lectures for their students; Eckelman and Nunberg later taught a webinar to students attending the UCLA Interdisciplinary Program in Conservation of Archaeological and Ethnographic Materials, and Nunberg taught in-person at NYU Institute of Fine Arts Conservation Center, and will present at the SUNY Buffalo State Art Conservation training program during Fall 2019.

SCOPE

Tier II Tool

To create a useful, robust Tier II LCA Tool, we will revise our approach to developing lists. For Tier II we will provide larger stipends and recruit mid-career Peers who will commit to participate in the collaborative effort to compile and cull data. The Peers will select and supervise graduate students to cull and organize the relevant portions of materials originating from, but not limited to, these resources:

- AIC wiki page that includes the work of the AIC Materials Working Group Initiative (MWG)
- Museum of Fine Arts Boston materials site CAMEO
- Metropolitan Museum of Art Oddy-tested Materials List and the Metropolitan Museum of Art Survey of Materials List
- Smithsonian Institution National Museum of Natural History exhibition materials lists

Nunberg will oversee the Peers and provide guidance about relevant materials to the Tool during online working meetings led by Sutton. The scheduled meetings allow PIs to review the Peers' progress, create

shared accountability, and provide direction or redirection to build a quality list. We anticipate adding 3,500 items to the 500 already in the beta LCA Tool. The graduate student working with co-PI Eckelman will assess these items for cradle-to-gate life cycle GHG emissions and use-phase chemical hazards and enter the supporting data in the Tool.

The Tool provides a resource for professionals looking for simple comparisons of one material with another using the data and equations embedded in its database. It will focus on the greenhouse gas emissions, ecotoxicity, and human health impact that result from producing, transporting, and consuming a selected amount of a material. The Tool will be quantitative, allowing easy comparison of scores between product options for the professional to make an educated decision. For example, the practitioner can use the Tool to evaluate a set of packing materials and determine the aspects that result in the highest impact according to production, use, and/or disposal. S/he can also compare components of a conservation treatment and determine aspects that are the least and most sustainable or most toxic. The Tool provides values in kilograms of greenhouse gas emissions (GHG) per kilogram of individual components. It will also specify the human health hazard according to exposure resulting from the amount the user specifies in kilograms. Calculation results will yield bar graphs to help users visualize results for effective comparisons, but it does not replace complete LCAs that compare complex system choices.

Tier II LCA Library

The project team will develop six-to-eight new LCAs for the Library. These case studies will formulate original research projects developed around well-defined but complex issues that cannot be analyzed by simply combining information from the LCA Tool. So, the LCA Library will contain case studies relevant to a range of situations. Decision-making among multiple metrics is a critical aspect of sustainability work, and interpretation of the complex LCA results will be highlighted in each LCA Library case study. The case studies will be divided into sections so users can reference issues according to their query. For example, an LCA in the Library might examine preserving a sculpture created as a work of art consisting of various materials, but also as an installation piece, if it incorporates video or film. The LCA would study preservation of the sculpture (treatment, storage and exhibition) and preservation of the video recording (storage of the video, digitizing the video and preserving the digitized format). When using the Library, a registrar or curator considering purchase of a digitized work of art could pull out just the section of this LCA that addresses digital preservation in order to understand the long-term energy use involved in committing to a collection of time-based media. Or a conservator could pull out the section addressing treatment for environmental impact and human toxicity.

We learned from workshop attendees (2018) how much more education users require concerning LCA and its parameters to understand the context for decisions made during the larger studies, align case studies appropriately with specific situations, and understand how an LCA might relate to their specific query. So, for Tier II, each case study in the Library will come with a short guide for how to interpret the project and results, in order to educate users about the parameters to apply the LCA results.

Tier II Dissemination

Tier II Dissemination involves four educational formats (described in the workplan): a workshop, webinar, two preferred purchases cards, and an exhibit using a combination of preferred materials identified in developing the Tool and recommended practices from the Oregon Museum of Science & Industry (www.exhibitseed.org) and the Madison Children's Museum (www.greenexhibits.org).

DURATION

This is a two-year project, with pre-award activities beginning January 1, 2020 and ending December 2021.

Methodology and Standards

Building the Tier II based on data methodology for building the beta LCA Tool: While the beta Tool covers many products of interest, it requires building out. Adding new, more complex products will require

additional data sources and the use of top-down models. For Tier II, Eckelman and his student will consider the full set of environmental impact categories specified by the U.S. EPA's Tool for the Reduction and Assessment of Chemicals and Other Environmental Impacts (TRACI) life cycle impact assessment model, expanding from the focus on greenhouse gases and chemical hazards in the beta LCA Tool.

Platform Rationale: The LCA databases that will support this proposed Tier II work include the Swiss non-profit database Ecoinvent, the European Union's ILCD: International Resource Life Cycle Data System and ELCD: European Lifecycle Database, thinkstep's GaBi database, the US Lifecycle Inventory Database hosted by the federal US Data Commons, and the US National Institute of Standards and Technology's tool, Building for Environmental and Economic Sustainability (BEES), for inventory and impact analysis of building materials that may be used in storage or exhibit construction. Materials and products that cannot be evaluated using existing engineering databases will instead be modeled using economic top-down LCA models, specifically the USEPA Environmental Extended Input-Output (USEEIO) model. Eckelman has extensive experience with these models but they have not previously been applied to cultural heritage preservation and constitute novel information.

Existing LCA databases contain data on energy, water, inputs, and emissions for 4000+ materials and processes, including many relevant for cultural heritage professionals such as solvents, packaging, transport, energy conversion and supply, and infrastructure processes. By using existing data building blocks for individual components and materials, more complex supplies and objects can be modelled in open source software such as open LCA, allowing the project team to estimate environmental impacts of nearly any product of interest and to share the results and models openly.

Standards Use and Recommendations: All LCA work will be carried out by Eckelman, Nunberg, and the engineering graduate student, following ISO standards (14040/4/67). Each case will begin with detailed scoping of the research boundaries for each LCA, followed by a Life Cycle Inventory (LCI) of material and energy inputs, specific to the case. LCI is the accounting method used to track the input and output (including emissions) flows associated with each step in a process or in the production of a product.

We will use a cradle-to-gate approach encompassing all data pertaining to resource extraction, manufacturing, and transport. Eckelman will guide the student's work determining the material composition of each item through a combination of supplier inquiries, LCI database, literature review, material characterization (spectroscopy), and destructive testing. Together they will collect transport, packaging, storage, and waste information from procurement and facilities management staff (and alternate origin/fate scenarios considered in sensitivity analyses), and match materials with existing US and international LCI data (unit process descriptions that quantify air and water emissions that occur from producing each input, (e.g., 928 kg of carbon dioxide are released during the production of 1 megawatt-hour of electricity).

Once a full inventory of all emissions has been compiled for the cradle to gate life cycle of each product, Eckelman and his student will use an environmental fate-transport-effect model that links emissions of a substance from a specific location to environmental and health impacts that it has downstream. As the project is based in the U.S, we will use the U.S. EPA's TRACI model to quantify multiple categories of environmental impacts, including global warming impacts from greenhouse gas emissions (expressed in CO_2eq), as well as (for the Library case studies) other standard categories of environmental and human health outcomes considered in this analysis: stratospheric ozone depletion, allowing higher levels of short-wave ultraviolet light through the atmosphere and increasing health risks of skin cancer; respiratory disease from inhalation of primary and secondary particulate matter and ground-level ozone (smog) stemming from emissions of criteria air pollutants; cancer and non-cancer disease through inhalation and ingestion routes of chemical exposure; environmental effects of acidification (from formation and deposition of acid rain) and eutrophication (algae blooms from excess nutrients) in soils and surface waters; and ecotoxicity that describes the toxic burden of all emitted chemicals to aquatic organisms.

A parallel effort will collect chemical hazard data for every chemical in the LCA Tool and LCA Library case studies, using hazard classification data from the USEPA ACtoR chemical toxicity database the European Chemicals Agency (EChA) chemical hazard database. Each chemical will undergo screens for PBT (persistence, bioaccumulation, toxicity) and CMR (carcinogenicity, mutagenicity, reproductive toxicity). The LCA and chemical hazard results will be loaded into the LCA Tool, so users need not do their own LCA modeling. However, if community members wish to explore or adjust the back-end modeling, all Life Cycle Inventory data that are compiled in order to generate the results will be formatted and stored in standard formats for LCA software, including EcoSpold2 and JSON, in order to enable other LCA practitioners to download datasets, conduct quality checks, and update the core modeling data on which the Tool is based.

Nunberg and Pratt graduate Professor Eric O'Toole will share the NEU research and analytic methods with communication design graduate students at Pratt Institute who will learn the basics of LCA through two class presentations and assigned readings and will apply their design skills to create an interface for the Tool and the LCAs of the Library. Proper, clear, and attractive design for relaying the Tool and LCA results will encourage easy and continued use of the Tier II (Library and Tool) products.

The budget for the project includes funding to pay for data subscriptions from commercial Life Cycle Inventory databases that will fulfill copyright obligations for use of their data in a stand-alone tool. We have verbal agreements for sharing data but for the project we will procure clear, copyright-free use of the materials for these needs from all participants and providers.

Work Plan *(see also chart in attachments for a visual representation)*
The main project components are the LCA Tool, LCA Library, and dissemination. The Tool and Library will be developed individually and scheduled to reflect team time and academic schedules. Dissemination begins after each product is completed.

LCA TOOL: Data compiling, organizing and culling; tool creation; tool dissemination
January-February 2020: PIs Nunberg and Sutton will collect and organize data lists and instructions for Peers and their students and review with Peers Arenstein and Derrick before distributing. This step will be essential for agreement on decisions and priorities for data inclusion in the Tool database. After distributing this material, Sutton will organize and lead Tool Peer call #1 at the end of *January* for all Tool Peers. Nunberg, Derrick, & Arenstein will introduce the project and methods for reviewing and sorting lists, and set the work and call schedule. Peers begin individual work with lists of materials within their strength areas.

March-May 2020: Tool Peer calls *March* Call #2 & *May* Call 3: the group will review the compilation process and results, discuss items culled from the lists, compare recommendations, omit duplicates, and plan final steps in refining the lists. During Tool Peer call #3, Peers discuss any issues concerning the methods. Sutton, Nunberg, Eckelman, Arenstein, & Derrick review and finalize lists.

May-August 2020: Nunberg transfers the lists in excel format to Eckelman and NEU students. Eckelman & student will create the LCA tool. It will be open to Peers and PIs in *August* 2020.

September-December 2020: Nunberg and Peer O'Toole work with Pratt Institute Communication Design students to create the Tool interface. *November*: Peer call #4. *December:* Pratt group incorporates edits.

January-March 2021: Tool available for a two-month test period with the Tool Peer Group, and share comments with Eckelman, Nunberg and O'Toole for refinement. NEU & Pratt students address Peer and PI recommendations.

April-June 2021: Nunberg works with Arenstein & Derrick to create links on both AIC wiki and CAMEO to the LCA tool. Tool is live *June* 2021.

LCA LIBRARY: Library Peer Group Meeting; Library Case Study Creation
April-May 2020: Preparation material distributed to Peers in *April*. The LCA Library Peer Group attends a one-day workshop in Salt Lake City in *May*, preceding the AIC Annual Meeting. Nunberg, Sutton, and Eckelman will lead: 1) introduction to the project; 2) introduction to LCA, and its application for cultural heritage collections; 3) guide Peers through a sample LCA step by step; then the group will carry out a simple LCA with Eckelman guiding each part; and 4) a moderated brainstorming session to identify up to eight LCAs to be completed for the Library. Each Peer formulates continued research for LCA study.

June 2020-May 2021: During *June* and *July 2020*, Peers summarize their research and LCA goals in a one-page document submitted to Nunberg. During a group call, the LCA parameters will be finalized and the student will carry out case studies under Eckelman's supervision with regular consultation by Nunberg and a Library Peer. Each Peer works with the student on the LCA s/he helped design. Sutton will organize three calls (*August 2020*, *December 2020*, *February 2021*) for the PIs, Peer team, and student to review the LCAs. *August-May 2021:* Eckelman, Nunberg, NEU student, and appropriate Peers work on and complete LCAs.

July 2021-October 2021: Nunberg, Arenstein, and Derrick will link the Library to CAMEO and the AIC Wiki, working with each peer from each LCA to confirm appropriate links. The Library is live by *October 2021*.

COMBINED INTERFACE WORK
September 2020-June 2021: Pratt students will work with O'Toole & Nunberg to design the LCA case study templates and overall design of the Library interface. In *January 2021*, the Pratt & NEU students will meet in Brooklyn with Nunberg, Eckelman, & O'Toole to review the current status of the Tool interface and discuss the Library case study templates and interface as they continue their design work.

DISSEMINATION
January 2021-May 2021: From *February* through *August* Sutton, Eckelman, Nunberg, O'Toole, and the Pratt students will design and create the LCA traveling exhibit. In *May*, Sutton, Nunberg, and Eckelman, Arenstein, and Derrick will present the Tool use and access during a May AIC workshop, and provide an update on the Library. In *June* the PIs will record a free, on-demand webinar for the AIC website on how to use both resources.

September-December 2021: The exhibit will open at Pratt Institute in *September* and then at NEU in *November*. It will then be available for travel to Peers' institutions and then to others for the cost of sustainable packing and shipping to each host site. Nunberg will manage exhibit loans and repairs; users will coordinate shipping onward to the next recipient. In *October*, Nunberg & Sutton will create the recommended purchases lists of materials for cleaning, packing, shipping, and exhibition for the most-commonly used items as recommended by the Tool Peers (similar to a Sustainable Seafood Watch cards recommending "Best Choices," "Good Alternatives," and "Avoid"). The lists will be made available for free on the AIC website.

Staff
This project depends on collaboration between LCA practitioners and cultural heritage professionals. Conservators of cultural heritage form a natural bridge between the two professions, with their focus on the chemistry of material composition and their effects on objects. LCA practitioners and conservators examine and study components of materials and products: LCA practitioners by following materials back to their origins and exposing every component, and conservators by focusing on the ways materials affect the objects they treat. LCA practitioners identify the environmental and health impacts of materials, and conservators understand how they are used in the cultural heritage preservation and exhibition. Because of this marriage, conservators with LCA training are the appropriate guides through the LCA process for allied professionals such as curators, registrars, and art handlers/shippers who do not have the chemistry background, but need LCA information for sustainable practices. The team of Peers reflects our audience,

and students from Northeastern University (NEU) and Pratt Institute bring engineering and design skills to complement them. Accordingly, the project can integrate materials engineering and cultural heritage care to create new ways of understanding materials and products, how we use them, and ultimately their effects on the environment and our health. (Resumes can be found in the attachments.)

The project administrator is PI **Dr. Eric Pourchot**, Director of Institutional Advancement at FAIC. He has a BA and MFA in theatre, a Ph.D. in dramatic structure, and an MBA in business management. He has presented on conservation topics and has managed FAIC's programs since 2001. He will devote 5% of his time to the project. He will manage the budget, contracts, and payments; provide access to FAIC and AIC communications resources; and ensure that financial and narrative reports are submitted.

Dr. Matthew Eckelman, PI, is an Associate Professor at NEU in Civil and Environmental Engineering, with secondary appointments in Chemical Engineering, Marine & Environmental Science, and Public Policy. His research covers life cycle assessment, environmental systems modeling, and green engineering, with a focus on modeling the environmental and human health impacts of novel materials and the built environment. He received a doctorate in Chemical and Environmental Engineering from Yale and a BA in Physics and Mathematics from Amherst College. He will devote 120 hours per year for two years to this project, half of which will be contributed as cost-share. His role is to supervise the student building the LCA Tool and completing the Library LCAs, and to lead workshops and webinars. He will participate in LCA Tool, Library, and team calls, and review dissemination materials.

Sarah Nunberg, PI, is principal of The Objects Conservation Studio, LLC, and Chief Conservator and Head of Collection in the Center for Research of Art and Design Materials, Department of Math and Science, Pratt Institute. She has published in materials research, environmental management and life cycle assessment as it relates to preserving cultural heritage. At Pratt she teaches about examination and preservation of cultural heritage, and the degradation of the materials conservators and artists use in their work. She is a Professional Associate of the American Institute for Conservation (AIC) and served as chair of the AIC Sustainability Committee. She has an MA in Archaeology from Yale University, and an MA in Art History and a Certificate in Conservation from New York University, Institute of Fine Arts. She will spend 332 hours a year on the project. She will oversee culling and organizing materials lists for the LCA Tool; work with Eckelman, his student and the Peers to propose, design, discuss, and review Library LCAs; and work with Eckelman and his graduate student to further design and carry out the Library LCAs. She will also promote, encourage and oversee collaboration between NEU graduate students and Pratt Institute graduate students to design a web interface for the Tool and the Library. She will collaborate with colleagues at Pratt to teach participating students about the project and will work with the PIs, Pratt teachers and students to design, create, and display an exhibition illustrating this work.

Sarah Sutton, PI, is Principal of Sustainable Museums, a consultancy focusing on environment and climate issues in the cultural sector. She consults with organizations such as the Detroit Zoo, Minnesota Historical Society, Strawbery Banke Museum, and Dumbarton House on sustainability projects and institutional planning. She has served on NEH grant projects in sustaining cultural heritage with Philbrook Museum of Art, Minnesota Historical Society and Dumbarton House. She is the Cultural Sector Lead for United States institutions signing on to We Are Still In and committing to environmental and climate action. She has an M.A. in History from the College of William & Mary and trained in history administration at The College and The Colonial Williamsburg Foundation. She is a Salzburg Global Fellow and a LEED-Accredited Professional. She is co-author of *The Green Museum: A Primer on Environmental Practice* (Rowman & Littlefield 2008 & 2013, with Elizabeth Wylie). Sutton will devote 30-36 days to the project annually, organizing team calls, leading workshops and the webinar, testing the LCA Tool, preparing blog posts and promotional content, and helping Nunberg with the preferred purchases lists.

Peers

There will be two teams of Peers, each composed of a range of specialties, with one team to focus on design and implementation of the Tool, and the other to focus on the Library (with some overlap). The Peers on the LCA Tool team will include conservators with specialties in preventive conservation and treatment,

exhibition and packing. This team will be responsible for culling and organizing the data from the provided materials lists. The Peers on the LCA Tool team are Rachael Arenstein, Michelle Derrick, Ellen Pearlstein, Hannelore Roemich, and Joelle Wickens. Arenstein and Derrick have additional duties developing the interface between the Tool and their associated databases. Additional peers will be identified.

Rachael Perkins Arenstein is a Professional Associate member of AIC. She worked at Smithsonian National Museum of the American Indian, Peabody Museum of Archaeology and Ethnology, American Museum of Natural History, and Metropolitan Museum of Art. Rachael's degree in art conservation is from the University of London where she studied at the Institute of Archaeology. She co-founded A.M. Art Conservation, LLC in 2009. She is Co-Chair of the MuseumPests Working Group and e-Editor for AIC where she oversees and promotes the development of professional content on AIC's online platforms.

Michele Derrick is the Schorr Family Associate Research Scientist at the Museum of Fine Arts, Boston where she has worked since 1995. She was instrumental in the development of CAMEO, an online database for information on materials used in conservation and works of art. She worked as a scientist at the Getty Conservation Institute in Los Angeles for 12 years. Her expertise is in the area of infrared microspectroscopy and she is the author of *Infrared Spectroscopy in Conservation Science*). She was also the editor–in–chief of the *Journal of the American Institute for Conservation* from 2002-2014.

Ellen Pearlstein is a professor at the University of California, Los Angeles in Information Studies, and is a founding faculty member in the UCLA/Getty Program in Archaeological and Ethnographic Conservation. Her research interests include American Indian tribal museums and how museum staff defines cultural preservation; effects of environmental agents on ethnographic and natural history materials; introducing context into cultural materials' conservation education; and curriculum development. She is co-director of the UCLA and Getty Conservation Institute feather research project and a Fellow of the AIC.

Dr. Hannelore Roemich is Professor of Conservation Science at the Conservation Center, Institute of Fine Arts, New York University (NYU). Dr. Roemich teaches *Preventive Conservation* and *Materials of Art and Archaeology* as well as advanced conservation science courses at NYU. She served for eighteen years as a conservation scientist at the Fraunhofer-Institut für Silicatforschung, where she conducted research on the deterioration and conservation of stained glass and outdoor bronze sculpture and use of glass sensors for environmental monitoring. Dr. Roemich is currently Program Director for the Time-based Materials initiative at NYU. Her PhD in Chemistry is from Heidelberg University.

Joelle Wickens is the Preventive Conservator for Winterthur and the WUDPAC Associate Director, where she directs a team that develops and implements preventive conservation policies and practices. Her WUDPAC responsibilities focus on curriculum oversight and support of student and faculty learning and teaching. She co-leads the development and implementation of a plan for economically, financially, and socially sustainable accessible storage for all collections at Winterthur. She co-founded AIC's Collection Care Network and served as its first chair. Her PhD and an MA are from the Textile Conservation Centre, University of Southampton, UK, and B.A. in American Civilization from the University of Pennsylvania.

The Peers on the Library team will be Peers from the LCA Tool Ellen Pearlstein and Hannelore Roemich and five Tool and Library Peers yet to be identified (registrar, curator, art packer, paintings conservator, and paper conservator) with the addition of Joel Taylor and Eric O'Toole. All will attend a workshop at the AIC 2020 meeting to identify Library LCA priorities and select one LCA each as their focus.

Joel Taylor is a Senior Project Specialist, Getty Conservation Institute (GCI) and Co-Manager for the 'Managing Collections Environments' initiative. He has been with GCI since 2015 and was previously a researcher at the Norwegian Institute for Cultural Heritage Research on Conservation and Policy, Management & Society, specifically focusing on preventive conservation and heritage value. He has a PhD from Cardiff University (2009) where his thesis on the validity and reliability of collection condition surveys has become the underpinning of the English Heritage Collections Audit.

Eric O'Toole is an Associate Professor at Pratt Institute, teaching communications design in the graduate program of Communications and Packaging Design. He is co-founder of Exhibit A Design Group in Brooklyn, operating since 1998, creating museum exhibits for history and children's museums, and state

and national parks. He has a Bachelor's degree in Industrial Design and an MFA in Interactive Digital Arts from Pratt Institute. He just completed a year as Pratt's Design Department Sustainability Coordinator integrating sustainability into the Design curriculum. Pratt will donate his time to the project.

Students

Graduate Engineering Student qualifications: The project will fund a full-time graduate student in civil and environmental engineering at Northeastern University. The student will work as a research assistant on the project, with weekly update meetings with co-PI Eckelman, who will be the primary advisor on the modeling work. The LCA team will meet monthly with the rest of the project team to provide updates on progress and any modeling complications. The graduate engineering student will have had previous formal training in environmental chemistry, chemical process engineering, statistics, and life cycle assessment. Because the LCA Library case studies will be much more complex, they will require collaboration between Eckelman advising a full-time graduate student, and Nunberg providing guidance concerning the specifics of field practice. The funding for Eckelman and the student is sufficient to identify and complete six-to-eight complex, multistep case studies and to implement the full version of the LCA tool. For comparison, similarly-complex LCAs conducted for industry in advance of public consumption, generally requiring one-to-six months to complete, cost $20,000 to $50,000 each.

Communication Design Student qualifications: O'Toole and Nunberg will select three Pratt students for assistantships for design work on the LCA Tool, Library and Exhibit. They will be selected for their background in informational graphics, graphic design, visual hierarchy, typography, and UX/UI systems and methodologies, along with their ability to work as a team and independently. One student will be paid through grant funds (8 hrs/wk for 30 weeks @ $15/hr). Pratt will support two additional students as a cost-share contribution (2 students @ 10 hrs/wk x 30 weeks @ $15/hr).

Evaluation and Sustainability

We will evaluate the project using leading and lagging indicators. Leading indicators show if we are on track to complete the project on time and if we have taken continued steps to ensure quality. Lagging indicators focus on end-results: numbers of activities, and final evaluations of the products or activities.

Tool Leading Indicators

- At least two Peer working calls from March to May 2020 to support and focus time spent on reviewing cleaning and materials lists as they select items to enter into the Tool;
- Monthly check-ins among the co-PIs and the full-time graduate student to report database completion rates for Tool entries and to review rate of progress during the four-month process. Once the lists have been generated, each entry will require approximately 5-15 minutes to complete if it is a simple product that can be modeled using its constituents, or 30 minutes to complete if it is a complex product or service that must be modeled using top-down models such as USEEIO from the USEPA. Similar products can be grouped, and there is the potential to semi-automate the process using text-recognition software and tags to indicate material types and quantities;
- During the Tool interface design period, bi-weekly real-time check-ins between the Pratt students and Nunberg, with at least one review online/phone call by Eckelman.

Tool Lagging Indicators

- On-time completion of the Tool lists by the end of May 2020 and Tool interface by November 2020.

For quality review of the Tool, Nunberg and Eckelman will monitor and review student work; Sutton will test the expanding tool twice for ease of use, and then share her results with Nunberg and Eckelman. Sutton will also organize the peers in a group gathering online to test the tool's appearance and ease of use.

Library Leading Indicators

- PIs share preparatory materials for the AIC 2020 Library Workshop at AIC by end-of-April 2020;

- Full attendance and participation by Library Peers at the AIC workshop with closing recommendations for eight LCA in prioritized sequence; and
- Monthly check-ins (Nunberg, Eckelman, Sutton & Pourchot) August 2020 and May 2021 to review progress and plan the beginning of the next LCA. Complete at least three LCAs by December 2020.

Library Lagging Indicators
- Complete of at least six LCA case studies by May 2021;
- Complete of the graphic design for the Library and case studies by November 2021; and
- The Library is live by October 2021.

For quality review of the Library and each individual LCA study, Nunberg and Eckelman, along with the Peer(s) responsible for identifying the LCA, will co-design the LCA with the NEU graduate student, then monitor work by reviewing material mid-way and nearing completion. They will review and edit the case study before entering it into the Library. The general workshop participants during the AIC conference in 2021 will complete a workshop evaluation to be shared with the PIs.

Dissemination Lagging Indicators
These aspects of this project are less complicated and require no leading indicators to demonstrate progress; lagging indicators of on-time delivery with qualitative evaluations will suffice.
- Complete the recommended purchases lists by December 2021;
- Complete the exhibit by August 2021 and display in two locations;
- Deliver the AIC Workshop May 2021; and
- AIC hosts fall 2021 webinar delivered by the co-PIs providing an introduction to LCA, the Tool and the Library, and demonstrating their use.

Sustainability: just as FAIC and its professionals have developed and supported research for professional advancement for decades, they will continue to support this work. The alignment with other active projects of materials resources on the FAIC website embeds this project as part of FAICs collaboration, cooperative funding, and professional commitments. The LCA Tool will be maintained in MS Excel, which can be easily migrated to CSV format as needed. There will always be new materials identified for inclusion in the Tool and cases for LCA studies for the Library, and FAIC will enable additions in the future based on professional interest and available funding. This project will raise awareness and then develop a resource for field use that will contribute to its future support.

Intended Audience
The audience is professionals associated with the care and exhibition of cultural heritage collections: students, conservation training program directors, facilities managers, registrars, collections managers, curators, conservators, librarians, archivists, exhibit designers, preparators, shippers, and handlers. The LCA Tool and Library will be freely available through the AIC website https://www.culturalheritage.org/ with links through the AIC wiki http://www.conservation-wiki.com/wiki/Main_Page, through CAMEO at the Museum of Fine Arts Boston http://cameo.mfa.org/wiki/Main_Page, and FAIC's Conservation OnLine http://cool.conservation-us.org/. CoOL is a freely accessible platform to generate and disseminate vital resources for those working to preserve cultural heritage worldwide. The AIC Wiki is sponsored by AIC and contains content created by the various AIC Specialty Groups, Networks, and Committees.

These direct, intuitive connections create easy access that facilitates timely collaborative updating and provides broad access to these resources, ensuring that innovative methods and materials are documented and widely disseminated among practicing conservators and conservation scientists.