Niels Bohr Library & Archives at the American Institute of Physics

Preservation and Stewardship of the History of Physics

Abstract: To ensure long-term care and preservation of rare books and manuscripts informing the history of the physical sciences, culture, and society through the creation of a vault storage space. The project focuses on retrofitting an existing secure space with high density shelving and mechanical systems to provide appropriate environmental controls.

Part 3: Narrative

Introduction

Overview of project

The Niels Bohr Library & Archives at the American Institute of Physics (AIP) requests $300,000 from the National Endowment for the Humanities in the form of an implementation grant for the purpose of improving our capability for long-term stewardship of our collections, including transformative collections on the horizon. This proposal outlines our existing storage areas, projected growth and related challenges, and our plan for expanded storage for rare books and archival collections. We have explored options for increasing our stewardship capacity and we have identified a sustainable solution that utilizes existing space without requiring a new structure or the expansion of the existing building.

Institutional profile

The American Institute of Physics (AIP) is a 501(c)3 tax exempt federation of ten leading professional societies in the physical sciences, located in College Park, MD. The AIP Niels Bohr Library & Archives and its companion program, the Center for History of Physics, were founded in 1962 to preserve, promote, and support the history of modern physics and related physical sciences.

The Niels Bohr Library & Archives (NBL&A) is a library and archive which serves as a repository for information in the history of physics, astronomy, geophysics, and related physical sciences, as well as a clearinghouse for information on physics and related science collections held elsewhere. In recognition of our work, the NBL&A and the Center for History of Physics received the Distinguished Service Award of the Society of American Archivists for offering "a model that has been emulated by others and has shown that it is possible to document fields that previously seemed beyond our ken."

The NBL&A occupies a 3-floor section of a much larger building, the American Center for Physics, and our renowned collections include 2,300 linear feet of archival holdings, 30,000 photographs, 1,500 oral histories and 25,000 book titles. Our researchers are primarily historians of science, as well as journalists and other science writers, and STEM educators. Our collections allow researchers to trace the evolution of physics education, the formation of professional scientific societies, the advancement of women and minorities in the sciences, and notably, the development and impact physics primarily in the modern era (*ca.* 1840 – present). The NBL&A has an annual operating budget of $1.75M, and staff includes six full-time professionals (4 archivists, 1 librarian, 1 photo librarian), and five part-time library and archives

assistants. The NBL&A is open to the public without charge Monday-Friday from 8:30 AM to 5:00 PM, receiving an average of 300 in-house visitors annually and a much larger digital presence – an average of 22,000 searches conducted in our online catalogs per month, and 200,000 monthly pageviews of our online collections and other resources.

Significance of collections

Existing collections

The history and philosophy of science is a long-established discipline in the humanities with robust literature and graduate programs at more than 57 academic institutions in the U.S. and 28 abroad. With increasing availability of detailed collection descriptions and digital content relating to the history of the physical sciences, researchers can access far more resources than in the past, and conduct searches across entire collections to identify and link multiple, sometimes obscure or contradictory, sources. The result has been a more comprehensive humanistic understanding of the new scientific revolution that began in the late 19th century and continues today.

The Niels Bohr Library & Archives and the Center for History of Physics were founded before history programs in other science disciplines were created and before most archives began documenting physics or other fields of science. From our founding in 1962, we have specialized in the archival areas that we could do best—collecting personal materials like unpublished biographies and autobiographical accounts, photographs, oral histories, and the institutional records of AIP and its member societies. At the same time, we have encouraged and supported other institutions in collecting the papers of their physicists and the records of their research, and AIP has served as an information clearinghouse for other institutions' collections through our online catalog, the International Catalog of Sources for the History of Physics and Allied Sciences (ICOS, a union catalog that describes about 10,000 archival collections in the history of physics/allied science world-wide, and it is the starting point for most humanities researchers in the history of science.

As a result of our focus and early start, we have amassed the largest and most comprehensive collection of personal accounts of physicists, astronomers, and related scientists and histories of their programs, creating a scientific humanities collection that illuminates and expands upon the human stories that fuel scientific discovery. (See Appendix A, for letters of support.)

Humanities research

The humanities research interest of our library and archives is highlighted by our collection of oral history interviews, photographs, manuscripts, and unpublished biographies and autobiographical accounts. These collections cover an extraordinary range of international leaders and practitioners in 20th and 21st century science and include much about their personal lives and concerns. The men and women who created the modern scientific revolution were not disembodied intellects who communicated only in formulas and symbols. They were fully rounded human beings who made a living, had families, lived in their own time and culture, and responded to the pressures that all of us confront. Being able to see these images and read their own accounts of their lives gives researchers a glimpse into the people, personalities, and human lives behind otherwise esoteric specialties. We also collect histories of academic physics programs,

observatories, laboratories, and similar programs, and comprehensive surveys of major organizations in our field.

Additionally, in our institutional role to preserve the records of the American Institute of Physics and the member societies in our federation, we provide a unique view of how and why these institutions were founded. People are motivated to form professional societies for many reasons – the need to draw together for intellectual discussion and support, the need to differentiate themselves from another similar group, a feeling of exclusion from other similar or related groups, and sometimes simply for financial reasons. Many of the member societies of the AIP federation were founded in the late 19th and early 20th centuries, marking the beginning of a time of professionalization of science fueled by the strengthening of research universities, the founding of the National Academy of Sciences, and the establishment of the Nobel Prize. Other scientific societies represented in our collections were formed in the 1920s and 1930s, as a reaction to financial insecurity and global political unrest.

The archival holdings also include the records of the AIP Publishing, LLC, a major scientific publisher and wholly-owned subsidiary of AIP. These collections include referee files that provide a history of scientific thought and research, as well as a history and evolution of the writing and communication of science. The science and discoveries that are accepted and vetted for publication change over time, and these changes reflect an invaluable history of human thought.

The same can be said for the evolution of educational texts in the physical sciences. Our book collection includes rare physics monographs, and an extensive historical textbook collection. It is a collection so unique that an original classification scheme had to be developed for our library. Our textbook collecting policy is to acquire each successive edition of key textbooks in the field, allowing researchers to chart the progression of science and how it's taught. The effects of this acquisitions policy are such that NBL&A's resources are matchless in preserving the progress of physics education over the past ~170 years. We additionally focus on collecting new and historic books highlighting the advancement of minorities in the physical sciences, placing particular importance on books pertaining to the education of women and minorities.

Some examples of notable histories that relied on resources in our collections:

Lise Meitner: A Life in Physics (1996) by Ruth Lewin Sime is a detailed biography of the woman who helped discover fission leading up to World War II and was then famously snubbed by the Nobel Prize in favor of her male collaborator.

*J. Robert Oppenheimer and the American Cent*ury (2005) by David Cassidy is a biography of one of the great figures of the 20th century, focusing mostly on his scientific career.

The Universe in a Mirror: The Saga of the Hubble Space Telescope and the Visionaries Who Built It (2008) by Robert Zimmerman is a history of the Hubble Space Telescope from its infancy in the 1940s, through the bureaucratic quagmire of the 1970s and 80s all the way to its launch in 1990 and the amazing research it has produced in the 21st century.

The Day We Found the Universe (2009) by Marcia Bartusiak, a history of astronomy in the early 20th century, focuses on the story of Edwin Hubble's discovery of the Andromeda galaxy, proving that the universe is filled with multiple galaxies.

Nuclear Forces: The Making of the Physicist Hans Bethe (2012) by Silvan Schweber, an extensively humanistic and detailed biography of the first part of Bethe's life (1906-1940) by one of Bethe's former postdocs.

Rare opportunity – expanding our scope to include earlier works in physics

Until recently, the focus of our collecting was on the archival records, books, and manuscripts in the history of modern physics, a timeframe which we defined as post-1840. In the nineteenth century, physics evolved from "natural philosophy" to a science, in the modern sense. The various topics of physics – light, sound, heat, electricity, magnetism, and energy – began to converge in a recognizable form. However, the roots of physics were grounded in natural philosophy, which goes back to the Scientific Revolution of the 17th century.

AIP will soon acquire a substantial curated collection of rare books and documents covering this earlier history of the physical sciences, going back over 300 years. David Wenner, the private collector of these history of physics books, states: "it contains the first published accounts of most of the important discoveries in physics during the past 350 years." The collection (200 linear feet in over 3,800 volumes) has been carefully organized and annotated, is in excellent condition, and contains works by Ptolemy, Galileo, Huygens, Halley, Newton, Laplace, and many early 19th-century natural philosophers. Topics include classical mechanics, theory of matter, electricity and magnetism, and thermodynamics, and also the standard model, unification theories, and condensed matter physics. The Wenner Collection is currently housed in the private library of the collector. Significantly, for the importance of our acquisition of the Wenner Collection, it is currently inaccessible outside of Wenner's inner circle and thus remains essentially invisible to the global audience of scholars, students, and authors who would value it. We are thrilled to acquire this collection, to provide for its long-term preservation, and to make the collections accessible to the scholarly community and general public.

The acquisition of the Wenner Collection has given AIP the opportunity to expand our scope to include the foundations of physics. We have broadened our collecting and acquisitions policies to allow for an increased focus on the research value of our rare book collection and we will grow our special collections through targeted acquisitions and donations in 2018 and beyond.

The Wenner Collection will arrive into the care of the Niels Bohr Library & Archives in mid-2018. We will create space in our existing storage areas to temporarily house the books, but we must create a space that is appropriate for housing these books in a sustainable way that also supports access. Support for this project will strengthen our work in the humanities and ensure that we are able to properly care for this unprecedented acquisition, while also improving our stewardship of existing collections.

Not only will this project help preserve the Wenner Collection of rare books, it will also help secure the legacy of the physical sciences as a whole. According to Michael DiRuggiero of The Manhattan Rare Book

Company, the Wenner collection "is a comprehensive and coherent whole that tells the story of the history of physics through primary sources in a way that (at least in my experience) is unprecedented in its breadth and depth. As a result, the Wenner collection cannot be fairly evaluated as a simple sum of its parts; unlike most other collections it has a substantial value as a collection." Additionally, creating more storage space for other collection materials will allow for growth far into the future.

Current storage conditions and challenges

Overview

The AIP Niels Bohr Library & Archives houses its collections in environmentally controlled spaces for the sake of preservation. There are three separate storage areas: archival materials on the 2nd floor, a small photographic vault on the 3rd floor, and book stacks on the 4th floor. The existing storage areas of the Niels Bohr Library & Archives are constrained by the dimensions and layout created during the design and construction of the American Center for Physics (ACP), the building which houses the AIP and the NBL&A. With the imminent acquisition of the Wenner Collection, it is clear that we are quickly reaching capacity.

The existing archives stacks include approximately 3,000 linear feet of storage space, with about 700 linear feet of open space. Based on current patterns, this would normally allow growth space for the next five to seven years. We must reserve this archives growth space for large AIP and other institution records that will arrive in coming years. The book stacks contain approximately 5,000 linear feet of shelving. Based on prior growth rate, we would normally have about three years of space in the book stacks. Neither space is large enough, nor has the appropriate environmental and security controls, as a permanent solution for storing rare books and special collections.

Transformational growth and impact

The Wenner collection of rare books is anticipated to arrive in mid-2018 – approx. 3,800 volumes, or 350 linear feet. We can create space in the archives stacks to *temporarily* house the books for condition assessment and inventorying, but we must create a storage space that is appropriate for the long-term stewardship of these books. The current library spaces do not offer enough space or the appropriate conditions (security, fire suppression, environmental controls) for rare and fragile collections and would be too expensive and inadequate to modify to meet the collection's needs (see Appendix B for a detailed analysis of our collection spaces from the Image Permanence Institute). This project plan provides the best, most sustainable approach to accommodating and preserving a highly important collection and our existing collections, and will allow us the capacity to grow our special collections in the future.

The acquisition of the Wenner Collection and our newly expanded scope of collecting is certain to lead to increased donations of books and other areas of the NBL&A. With an increased focus on the research value of our historical collection, we will continue to grow through targeted acquisitions for years to come.

History of stewardship

Background

As the NBL&A infrastructure within the AIP headquarters was being designed in 1992-1993, staff worked with Garrison Lull, Inc., a highly regarded library and museum environmental consulting firm, to develop a comprehensive and systematic conservation plan for our holdings, including passive and active environmental controls, a water-based fire suppression system, and security. The environmental goals for our storage spaces reflected then-current thinking on reasonable and appropriate standards for the kind of mixed collections that we have.

Data loggers for temperature and humidity were installed during construction, and through the first few months of occupancy we found that the environmental controls were not working adequately. William Lull of Garrison Lull was called back to diagnose the problems and supervise repairs. He found that cost cutting during construction had created three major problems: inadequately sealed vapor barriers, an air leak from the elevator shafts into the archives and book stacks, and improperly sized HVAC components. The leaks from the elevator shafts were sealed and repairs were made to the areas of the vapor barrier that could be reached. The HVAC system has received regular repairs and maintenance, and components have been replaced as needed. However, inherent installation problems combined with unrealistically rigid goals for the subtropical climate in the Washington, D.C. area have impeded our efforts to maintain consistent environmental controls with this equipment.

As the HVAC system has aged over the last eight years, we have taken an increasingly proactive approach to retain basic temperature and humidity controls, and to prevent damage to the collection. The collection spaces are monitored and controlled 24/7, and our building engineers maintain and routinely upgrade equipment as needed. Library staff consistently perform collection-level preservation and conservation work, including a 2001 NEH-funded brittle book microfilming project, collection-wide surveys, and basic treatments of photographs, books and archival materials. We are currently doing selective digitizing of collections for preservation and access, and archival collections are stored in acid-free and alkaline-buffered enclosures.

The environmental systems in our existing storage spaces have never performed within specified ranges, despite equipment upgrades and ongoing maintenance and repairs, leading to humidity which routinely falls below the goal ranges in winter and rises to as high as 70% in summer. The equipment, while never optimum, is slowly deteriorating due to age, making it increasingly difficult to maintain the limited control we have. While the collections are not in immediate danger, this difficulty in controlling humidity creates risks including oxidation of materials, damage due to cycles of contraction and expansion, chemical decay in color photographs, and increased brittleness due to winter dryness. We are currently exploring options to replace the equipment serving the existing areas, but even a major change to the environmental controls in that area will not solve the issue of lack of space and inadequate security (see below) to store the Wenner Collection in that area.

This background information is included here to highlight that our commitment to the stewardship of the history of physics does not end at the point of acquisition, cataloging, and research—we believe it is

only possible to preserve and maintain collections for perpetuity if we have better knowledge of our space and equipment limitations, and a plan for improvement. We recognize the importance of working with professionals in collections storage and standards for long-term stewardship of rare and fragile objects of various materials. We will continue to optimize the operation of the existing equipment to achieve the best possible preservation condition the equipment is capable of, but we recognize that our existing storage environment challenges will result in harmful conditions for the long-term care and preservation of the delicate rare books and publications in the Wenner Collection.

Environmental, security, and other risk conditions

NBL&A archival collections are located behind locked doors—only staff members with electronic ID badges have access. Our photograph collection is inaccessible without staff permission (although more than 85% of our photo holdings are represented in our online photograph catalog). The existing book stacks, however, are open to the public for browsing, with minimal oversight by staff. Our special collections and rare books are shelved in locked cages in this public browsing area, but the locks are only minimally tamper-proof. Books in our modern collection are all tagged with adhesive security strips linked to alarmed security gates located at the entrance and exit of the reading room. The Wenner Collection of rare books will also have security tags on an enclosure, but not adhered to the book itself.

Preventative policies, procedures, and practices

We adhere to a collections-specific disaster plan which is reviewed and updated annually. This disaster plan includes instructions for natural disasters, focusing on water damage events resulting from storm damage, burst water pipes, elevated humidity events, and other moisture concerns stemming from our local climate. All staff members are familiarized with emergency kit locations, triage of materials, and are trained in basic materials salvaging and preservation.

Solution to stewardship challenges, and rationale for project

Expansion to underground vault

We worked with the Image Permanence Institute (IPI) to perform an analysis of our existing storage areas and explore alternative areas for storing the Wenner Collection, including the possibility of transforming a file room located adjacent to a dedicated reading room (see Appendix C for IPI assessment of file room feasibility). After consultation with our building engineer and an HVAC professional, it became clear that the file room was not an option for proper storage of the rare books – the room has no envelope, it has two exterior walls, three windows, no security, and the environment is only controllable to human comfort levels. Adding HVAC to that room would reduce the footprint such that there would not be enough room for growth of the collection. Instead, another opportunity arose within the American Center for Physics building.

Until 2015, the ACP maintained a large number of on-site computer servers in the underground level of the building to support the tenants in the building, including the American Institute of Physics and the NBL&A. In 2015, ACP moved to cloud servers and decommissioned the secure and climate-controlled server room. The removal of the IT systems from the ACP basement created a space that is ideal for an expansion of the library and archives storage space. Based on an assessment by SpaceSaver, Inc (the

company that replaced our archives moveable shelving system in 2014), the basement could yield up to 3,000 linear feet of secure and climate-controlled storage, at a cost of about $253,000 for construction and installation of a combination of moveable and static shelving (see Appendix D for draft layout of proposed vault). There are other costs associated with the project, such as incremental energy expense, the cost of new equipment for environmental control, and reactivating the FM-200 fire suppression system.

Risks, benefits, other considerations for this space

Water and flood risk: Moisture is the dominant risk for any underground storage. According to FEMA Floodplain Maps for Prince George's County, MD, the American Center for Physics is located in a Zone C, which is considered an area of minimal flooding beyond the 500-year flood boundary (Zone A is considered within the 100-year flood area; Zone B varies between the 100-year and 500-year flood areas). In addition to external water danger, *any* collection space – basement or above ground – is susceptible to water damage from burst or malfunctioning water pipes within the building.

The former IT systems room in the ACP basement has an existing raised floor (estimated 18") which allowed for cables to run underneath the floor. During the construction and installation of moveable shelving in the newly constructed vault, this raised floor will be reinforced and kept as additional protection against water damage. In addition to the 18" raised floor, the moveable shelving track raises the shelving an additional few inches. We will also avoid using the lower level of shelving, which will give an additional 12" of protection. There is a water sensor system already installed in the floor of the vault area. The floors above the vault area are poured concrete with drainage systems, which would divert the flow of water from floors above in the case of a water event in the higher levels of the building. There is a sump pump system already in place in the vault area. The sump pumps are tested monthly and serviced on demand. The basement has not taken on water in the 23 years since the building was constructed.

Established security system: Even if there was appropriate environmental control and available space in the existing book stacks, the security is not in place in our existing book stacks for rare books to be stored there. The basement vault space is already set up for key-card ID entry for staff-only access, which will allow us to properly secure valuable and priceless materials.

Quality fire suppression system: From its previous life as an IT server room, the basement vault already has a sophisticated fire suppression system – Vesda smoke detection system and FM-200 for fire suppression – which has historically been the gold standard for preservation storage areas. FM-200 is electrically non-conductive, safe to use in occupied spaces, and it leaves no residue on materials. It extinguishes fire by removing the heat elements (free radicals) from the fire triangle (oxygen, heat, fuel), not through application of water. (For comparison, our existing collection spaces are equipped with water sprinklers for fire suppression.) The FM-200 system is currently decommissioned but will be reactivated or replaced with a similar waterless fire suppressant system.

Flexible expansion space: The draft layout of the vault space allows for approximately 1,100 linear feet* of archival storage space PLUS approx. 7,000-9,000 volumes of rare books. This is adequate space to

house the Wenner collection (~3,800 volumes) as well as our existing rare and brittle books (2,000 volumes), with generous room for growth. By moving our existing rare books to this basement storage area, we gain much needed space for growth in our modern book collection in the existing book stacks. All shelving will be adjustable and compatible with archival storage containers and books and book enclosures. This vault will also give us space for a small cold storage system for color photographs and negatives, as well as growth space for archival collections beyond the near horizon.

*These estimates exclude the potential storage space on the lowest level of shelving, as further protection from water. If we choose to use that lowest level of shelving, we would gain even more storage space.

HVAC: The HVAC machines that controlled the environment for the IT server room have been decommissioned; new equipment will be purchased upon recommendation from an engineering firm specializing in the care and preservation of archives and library collections.

Methods and standards

As described in the earlier section, History of Stewardship, we have faced challenges in our existing collection storage areas since our building was constructed, stemming from cost cutting and errors during construction and design of the spaces. We understand the value of employing preservation strategies from the very start of a project AND seeing those strategies completed through the construction phase. We have worked with Linden Preservation Services over the last year, to evaluate our existing areas and assess the potential of the proposed vault area.

Preservation, architectural, and mechanical considerations for vault design

Recommendations from Linden Preservation Services, upon a review of the proposed vault space, include:

> The following are critical aspects to be considered as AIP moves forward with renovation plans, from the architectural, mechanical, and preservation perspectives.
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> Preservation
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> Preservation goals for the future environment – recognizing that the space will include storage for the rare book collections, as well as potential archival collection growth – should focus on minimizing the rate of chemical decay and managing potential risk from physical expansion and contraction of materials. In order to achieve long-term preservation that is appropriate for both the material and the building, AIP should target year-round temperatures between 60-62F, with RH ranging seasonally between a summer maximum of 55% and a winter minimum of 30-35%. The preservation index (PI), which indicates the relative rate of chemical decay, at each condition would be:
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> |---|---|---|---|
> | Summer: | 62F/55% RH max | Dew Point: 45 | PI: 56 |
> | Winter: | 60F/35% RH min | Dew Point: 32 | PI: 125 |
>
> which should yield a year-round PI of around 75-80. While not as good an environment as might be available in a “cool storage” setting, this is a significant improvement over the preservation

conditions in the existing library and archives storage areas, is an appropriate condition for these collections materials, and may be achievable with either the existing or similarly designed building chillers. The winter condition could be allowed to drop in temperature (at the same %RH) if it would do so naturally – surrounding space temperatures and the sub-grade space make this unlikely, and the preservation benefit likely would not be worth the additional expense of greater mechanical cooling in winter.

Architectural

Mitigation of Heat/Moisture Loads: As currently configured, the data center can feel both its own internal heat load from the remaining equipment, as well as heat load coming from the mechanical room to the east, the hallways to the west and south, and (likely) heat loss along the exterior north wall. With a new, cooler and drier preservation environment, the heat and moisture transfer along the surfaces will be increased; intervention to increase both the thermal insulation and the vapor barrier should be considered to minimize the heat and moisture loads on the new preservation environment as well as to keep the necessary mechanical design as small as possible. Strategies may include:

Minimizing any existing equipment that must remain. Currently, the security and phone panels at the west end of the room represent the single largest heat load in the room – their removal would significantly reduce any potential heat loads on AHU-11 or a new mechanical unit.

Walling the remaining communications and power equipment into insulated closets at either end of the data center – this would minimize the heat load being transferred into the collections area. These walls could follow the currently proposed cage wall locations.

Considering built-in walls as necessary in the room to add a layer of thermal insulation and vapor barrier to the space. Cooler temperatures and lower dew point conditions will increase the rate of heat and moisture transfer across these surfaces, adding load to the space and necessitating a larger capacity mechanical system to control the environment. Using initial, non-mechanical room envelope upgrades will reduce the energy cost of the environment over time and better protect the collection during system shutdowns or power outages.

Fire Suppression: The Vesda and FM-200 systems (or an equivalent waterless suppression system) should be brought back online as an initial option before the activation of the wet sprinklers.

Mechanical

Zoning: It is critical that the new collections storage area be treated as an independent air-handling zone and building environment. This would likely necessitate a new AHU and the

disconnection of the data center space from AHU-11's zone. The collections space should be considered unoccupied, with no workspaces included in the design.

General System Design: As a long-term investment in preservation for a significant collection, the selected mechanical system should have an expected operational life-span of 25+ years, have the ability replace or upgrade individual components, and should be as easy as possible to access and maintain. Package and CRAC units should be avoided – they are rarely able to provide the desired preservation conditions over the long-term and typically face parts obsolescence and the need for replacement after 10-12 years.

Dehumidification: Summer dew points in the collections environment should be no higher than 45F. This should be achievable with a sub-cool/reheat system design and the existing building chilled water, although desiccant technologies are also a reasonable option.

Humidification: A humidifier will be necessary to maintain winter RH conditions at 35% or above. Ideally, this capability would be provided at the primary air-handling unit.

Filtration: At minimum, the system should provide for two-phase particulate filtration, with a minimum of MERV 8 at the pre-filter and MERV 13 at the final filter. Gaseous filtration should not be necessary, but the filter section (with actual filters to be installed if need were established) could be included if AIP desired.

Outside Air: As an unoccupied space, outside for human needs should be unnecessary. If required by code, the system should include CO2 sensors and modulating dampers to reduce the outside air quantity whenever possible.

See Appendix E for the full analysis of the vault location by Linden Preservation Services.

Description and development of storage plan and methods

The proposed storage plan was developed under consultation by Spacesaver, Inc., a company with many years of trusted experience serving libraries, archives, and museums. We have worked with Spacesaver before, including a two-year project to replace the moveable shelving tracks in the archives storage space on our 2nd floor, culminating in 2014. This proposed storage plan provides ample space for the housing of the Wenner Collection, as well as our existing special collections books. The proposed vault will also include an area for additional storage for archival records and space for a small cold-storage unit for color photographs and negatives.

In the information gathering phase, NBL&A leadership staff visited rare books collections in the area, including the Folger Shakespeare Library and the Dibner Library, both located in Washington, DC. NBL&A staff also hosted a site visit from the special collections and conservation staff of the Maryland State Archives. The purpose of these visits was to speak with librarians and conservators with long experience in the care of rare books, and to receive input and advice regarding our plan to expand storage into an underground vault (see Appendix F for letters of support and commitment for the proposed vault).

Managing environmental conditions

The proposed plan will conclude with a year-long phase of commissioning and monitoring (see Work Plan, below). This commissioning and monitoring phase will include working with Linden Preservation Services to:

> Monitor and assess data logs of mechanical processes over a 12-month period;
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> Review and analyze the as-built, installed system operation and performance for both preservation and energy; and
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> Provide recommendations for experimentation and altered control sequences to improve preservation and energy performance.

Beyond the grant period, AIP staff are committed to the ongoing monitoring of the systems that maintain our environmental conditions, as further described in the previous section, History of Stewardship (page 6). Our building engineer, Victor Garrett, has worked with our unique systems for ten years and is familiar with the special requirements and priorities of preserving library and archives collections.

Work plan

Phase I: Integrated Design – 1 year, 1/2018-12/2018

During this phase, AIP project staff will convene a team of professionals to contribute their skills toward a complex design for the proposed vault area, integrating elements of preservation and care of materials, engineering, maintenance, architecture, and shelving structure and layout. This team will meet several times through the course of the project to ensure the integrated design is successful.

Note – we will not need to relocate any collections in preparation for this construction project.

Phase II: Construction – 1 year, 1/2019-12/2019

Installation of high density shelving in the basement vault, and construction of interior walls of vault.

Phase III: Commissioning and Monitoring – 1 year, 1/2020-12/2020

Linden Preservation Services will monitor the basement environment and conduct a final in-depth analysis of the environmental conditions of the space and provide recommendations on the appropriate settings for the system. Staff will continue to do their own monitoring as well.

Beyond grant period – 2021-2022+

AIP will continue to partner with Linden Preservation Services to perform an in-depth analysis of our other collection storage areas, and to identify areas to improve the environmental performance and sustainability.

Implementation grant

Phase I Integrated Design January 2018 – December 2018	During this phase, AIP project staff will convene a team of professionals to contribute their skills toward a complex design for the proposed vault area, integrating elements of preservation and care of materials, engineering, maintenance, architecture, and shelving structure. AIP building engineers will assess, calibrate, and test the fire suppression system. Library staff will inventory, accession, and evaluate the needs of the rare books collection, plan shelf height settings, and draft layout of vault space based on collection needs.
Phase II Construction January 2019 – December 2019	SpaceSaver will install the high density shelving in the vault; construction of interior walls and other architectural needs of the vault. Once construction is complete, Rein will move existing rare and brittle book collections, plus the Wenner Collection, into the vault.
Phase III Commissioning & Monitoring January 2020 – December 2020	Linden Preservation Services will work with AIP staff to monitor the vault environment and conduct a final in-depth analysis of the environmental conditions of the space and provide recommendations on the appropriate settings for the system.

Results, post-grant period

2021-2022+	AIP will continue to partner with Linden Preservation Services to perform an in-depth analysis of our other collection storage areas, and to identify areas to improve the environmental performance and sustainability. Rein will remove cages from old rare and brittle books collections and expand current general collection materials to fill these spaces. Rein will hire contractors to conduct a formal conservation assessment of the Wenner collection and our other rare books collections

Project team

See Appendix G for resumes and/or company profiles.

AIP staff leading the grant project:

Melanie Mueller, Director of the Niels Bohr Library & Archives, will serve as project director. Melanie Mueller has experience with successful grant projects. Mueller managed a project (NHPRC grant # RD-10029) to digitize and provide online access to the papers of physicist Samuel Goudsmit. The scanning was performed by a vendor and Mueller spent three years performing quality review of scanned images, working in coordination with vendor staff, and supervising AIP support staff. Mueller also directed the project to rebuild the moveable shelving system in the 2nd floor archives, which involved working with a vendor, Spacesaver, to coordinate a massive move of archival materials in order to prep for the construction.

Allison Rein, Assistant Director of Special Collections at the Niels Bohr Library & Archives, will serve as project co-director. Allison Rein maintains our book preservation and disaster policies, and has one year experience as the head of our special collections. Rein spent four years working in a conservation lab as a conservation technician and has extensive experience dealing with preservation issues, the needs and space issues of physical collections, and moving special collections.

The Integrated Design Team will include:

Victor Garrett, Project Engineer, Chief Engineer, Cushman & Wakefield, is contracted to support the facilities of the American Center for Physics. Victor Garrett has diligently maintained our current climate control system for ten years, and has unique knowledge of its capabilities, its faults, and the capacities of the building for accommodating new equipment.

Chip Calhoun, Digital Archivist, AIP Niels Bohr Library & Archives. Drawing from his experience installing and monitoring our current environmental data logging system, Chip Calhoun will participate in the Integrated Design Team as needed, as well as during the final stage of the project – working with Jeremy Linden to commission and monitor the environmental control systems.

Jeremy Linden, Principal, Linden Preservation Services, Inc. Linden provides consulting services related to preservation of cultural materials and managing the environment for preservation, including environmental monitoring, data analysis, mechanical system analysis and optimization, mechanical system design review and recommendations, and preservation commissioning of HVAC equipment for cultural institutions. We have worked with Jeremy for several years, during his time as Preservation Environment Specialist at the Image Permanence Institute at the Rochester Institute of Technology. In September 2017, Jeremy left the IPI to start his own preservation services firm, Linden Preservation Services. We chose to stay with Jeremy instead of starting over with a new consultant from IPI. Jeremy is very familiar with our systems and the challenges inherent to the construction of our building, and he is precise, professional, and thorough. He has a dual Master's degree from the University of Maryland - Archives and Records Administration, and History - and a B.A. in History from Vassar College. He was Head of Archives and Special Collections, SUNY Fredonia, for four years, before moving to the Image

Permanence Institute at RIT for seven years. He comes from a family business in HVAC installation and service, which gives him a unique background and ability to converse deeply with our building engineer.

James Farley, Account Executive, Spacesaver, Inc., along with a team of engineers and storage specialists the Spacesaver company. AIP staff has worked with James Farley since 2012 on projects to reconstruct and maximize the shelving in our existing collection storage areas.

(b) (4) [redacted]

Project results and dissemination

To augment the acquisition of the Wenner Collection and the enrichment of the library and archives, the Center for History of Physics will work with the Niels Bohr Library & Archives to attract more science historians, science writers, and other creative users of historical materials to work at AIP for extended periods. The stories drawn from AIP's collections will communicate the importance of science to the general public and will also help to attract the next generation to careers in our fields. A new fellowship program will reinforce AIP's mission to advance, promote, and serve the physical sciences for the benefit of humanity. The sciences need not only scientists but interpreters and popularizers who will explain to broad audiences and tell the stories of how science is important in an open society: how it affects people's lives, how it informs policy development, etc.

We intend to collect and report data on our own, with the assistance of data loggers as well as with the help of Jeremy Linden who will conduct post installation and move analyses to collect and report data on conditions and energy use. Currently, we use HOBO loggers installed and monitored by NBL&A staff to collect data on environmental conditions. Data is now downloaded using HOBOware software and added to the IPI eClimateNotebook online tool.

Finally, we will summarize what we learn from this project in a white paper for the NEH website, and will share our sustainable approach to preservation of these critical humanities collections with the larger humanities community: through the various outlets of the History of Science Society, the Society for the History of Technology, the Consortium for History of Science, Technology and Medicine (of which AIP is a member institution), the Physics, Astronomy, and Mathematics Division of the Special Libraries Association, and through the community of archivists and information professionals associated with the Society of American Archivists. We will also write articles for our blog and provide regular updates about the progress of the project on Twitter and Facebook and other social media, with as much visual documentation as possible. Lastly, we will write and publish the progress and results of the grant, including lessons learned during the process, final outcomes, and the impact of the project in our AIP History Newsletter, which is widely read by physicists, historians of science, general historians, librarians, and archivists.

NATIONAL ENDOWMENT FOR THE HUMANITIES

Budget Form

OMB No 3136-0134
Expires 6/30/2018

Applicant Institution: *American Institute of Physics*
Niels Bohr Library & Archives
Project Director: *Melanie Mueller*
Project Grant Period: *10/1/12018 - 09/30/2021*

click for Budget Instructions

	Computational Details/Notes	(notes)	Year 1 10/01/2018-09/30/2019	(notes)	Year 2 10/01/2019-09/30/2020	(notes)	Year 3 10/01/2020-09/30/2021	Project Total
1. Salaries & Wages								
Project Director - Melanie Mueller	% of salary (adjusted for average 4% increase per year)	5%	(b) (6)	2%	(b) (6)	2%	(b) (6)	(b) (6)
Project Associate Director - Allison Rein	% of salary (adjusted for average 4% increase per year)	5%	(b) (6)	2%	(b) (6)	10%	(b) (6)	(b) (6)
Technical Archivist - Chip Calhoun	% of salary (adjusted for average 4% increase per year)	2%	(b) (6)	1%	(b) (6)	2%	(b) (6)	(b) (6)
2. Fringe Benefits								
Project Director	% of project salary	30.00%	(b) (6)		(b) (6)		(b) (6)	(b) (6)
Project Associate Director	% of project salary	30.00%	(b) (6)		(b) (6)		(b) (6)	(b) (6)
Technical Archivist	% of project salary	30.00%	(b) (6)		(b) (6)		(b) (6)	(b) (6)
3. Consultant Fees								
Linden Preservation Services	See Appendix H for detailed quote		$28,792					$28,792
(b) (4)	See Appendix I for detailed quote for consulation, and design		$70,000					$70,000
4. Travel								
								$0
								$0
5. Supplies & Materials								
								$0
6. Services								
Spacesaver Inc - construction and installation of compact shelving	See Appendix J for detailed quote				$253,161			$253,161
Construction and HVAC	Ballpark cost, provided by (b) (4) for discussion purposes, Appendix I				$500,000			
7. Other Costs								
								$0
8. Total Direct Costs	**Per Year**		**$112,950**		**$759,253**		**$15,856**	**$888,059**
9. Total Indirect Costs								
	Per Year							**$0**
10. Total Project Costs					(Direct and Indirect costs for entire project)			**$888,059**

11. Project Funding	**a. Requested from NEH**	Outright:	$300,000
		Federal Matching Funds:	$0
		TOTAL REQUESTED FROM NEH:	**$300,000**
	b. Cost Sharing	Applicant's Contributions:	$588,059
		Third-Party Contributions:	$0
		Project Income:	$0
		Other Federal Agencies:	$0
		TOTAL COST SHARING:	**$588,059**
12. Total Project Funding			**$888,059**

Total Project Costs must be equal to Total Project Funding ----> ($888,059 = $888,059 ?)
Third-Party Contributions must be greater than or equal to Requested Federal Matching Funds ----> ($0 ≥ $0 ?)

Budget Narrative Attachment Form

The federally negotiated indirect-cost rate agreement for the American Institute of Physics expired in 2015. We are not including indirect costs in this project.