



Title:

A 58-Year history of refrigerated and sub-zero freezer storage for the long-term preservation of photographs, films, and other cultural heritage materials in the United States and Canada: From the NASA Houston, Texas -18°C (0°F) vaults for the preservation of color films taken on the Apollo Missions to the Moon (1969), to the John F. Kennedy Presidential Library (1979), to the Art Institute of Chicago color photography collection (1982), to the Getty Images (Corbis/Bettmann Archives) high-security underground cold storage preservation facility at Iron Mountain in Pennsylvania (2002), to the Toronto Metropolitan University Image Centre (2012), to The Museum of Modern Art in New York (1984, 2019); and finally to the Library and Archives Canada Preservation Centre in Gatineau, Quebec (1997, 2011, 2022), the largest and the most advanced cold storage preservation facility in the world

Henry Wilhelm
Director of Research and Publications
Wilhelm Imaging Research, Inc., Grinnell, Iowa U.S.A.

Tania Passafiume
Head Conservator of Photographic Materials
Library and Archives Canada, Gatineau, Quebec, Canada

Penelope Bertrand
Collections Manager for Private Archives, Preservation and Digitization Branch
Library and Archives Canada, Gatineau, Quebec, Canada

Abstract: Note: This chronological list includes significant museum, archive, library, and corporate refrigerated and sub-zero freezer long-term preservation facilities in the United States and Canada. The list is very much a work in progress, and additional cold storage facilities will be added to the list by the time this presentation is given in Montreal on May 2, 2026.

When a facility has been upgraded or expanded, the date of the most recent upgrade or expansion is listed. This extensively illustrated presentation will cover the history of refrigerated and sub-zero freezer storage facilities for the long-term preservation of photographs, films, and other cultural heritage materials in the United States and Canada:

The National Aeronautics and Space Administration (NASA) Sub-Zero Freezer Vaults in Houston, Texas for the Long-Term Preservation of Color Films taken on the Apollo Missions to the Moon (1969); Lyndon Baines Johnson Presidential Library and Museum (1971); Cinematheque Quebecoise (1975); Human Studies Film Archive at the Smithsonian Institution (1975); Library of Congress in Landover, Maryland (1978); John F. Kennedy Presidential Library (1979); Peabody Museum of Archaeology and Ethnology at Harvard University (1979); Joel Meyerowitz, photographer (1980); Gerald R. Ford Library (1981); Art Institute of Chicago cold storage vault for color photographs (1982); Royal Ontario Museum in Toronto (1984); Hollywood Vaults(1985); Turner Entertainment Film Company–MGM/UA (1986); Universal Pictures (1976-1986); Harvard University Depository (1986); Jimmy Carter Library at the Jimmy Carter Presidential Center (1986); Historic New Orleans Collection (1987); Canadian Centre for Architecture (1988); Paramount Pictures (1990); Ronald Reagan Presidential Library and Museum in Simi Valley, California (1991); National Gallery of Canada (1991); City of Toronto Archives (1992); Warner Bros. (1993); United States National Archives and Records Administration (1993); The Fogg Art Museum at Harvard University (1994); National Geographic Society in Washington, DC (1994); Baseball Hall of Fame and Museum (1994); PRO-TEK Vaults (1994); Louis B. Meyer Nitrate Film Conservation Center at the George Eastman House (1996); Museum of Modern Art Celeste Bartos Film Preservation Center in Hamlin, Pennsylvania (1996); Museum of Fine Arts in Boston (1996); George H.W. Bush Presidential Library and Museum in College Station, Texas (1997); Archives of Manitoba / Hudson's Bay Company Archives (1998); Wilhelm Imaging Research Sub-Zero Preservation Freezer (1999); The Metropolitan Museum of Art (1994, 1999); New York Public Library (2002); Johns Hopkins University Library Service Center (2002); Massachusetts Institute of Technology Library Storage Annex (2002); Getty Images (formerly owned by Corbis, and originally the Bettmann Archive in New York) High-Security Underground Cold Storage Preservation Facility at Iron Mountain in Pennsylvania (2002); Princeton University in the ReCAP preservation facility (2002); National Gallery of Art in Washington, DC (2002); Northeast Historic Film Conservation Center (2003); Provincial Archives

of Alberta (2003); Alaska Film Archive (2003); Munger Research Center at the Huntington Library in Los Angeles (2004); University of Illinois Chicago, Comer Archive of Chicago in the Year 2000 (2004); Alabama Department of Archives and History (2005); Getty Museum Department of Photographs in Los Angeles (1996, 2006); Philadelphia Museum of Art (2007); National Audio-Visual Conservation Center in the Packard Campus of the Library of Congress in Culpeper, Virginia (2007); Harley-Davidson Museum and Archives in Milwaukee, Wisconsin (1999, 2008); Art Gallery of Ontario (2008); LDS Church History Library in Salt Lake City (2009); University of Chicago, Mansueto Library (2011); Toronto Metropolitan University (formerly Ryerson University) Image Centre, which includes the Black Star Print Collection (the print collection was originally located in New York) and the archives of Canadian photographer Edward Burtynsky (2012); Cleveland Museum of Art (2012); Franklin D. Roosevelt Presidential Library and Museum in Hyde Park, New York (2013); National Film Board of Canada, St. Laurent Montreal and Wampum Underground, Wampum, Pennsylvania (1995, 2013); Conde-Nast Photographic Archive in New York (2014); Caterpillar Tractor, Inc. in Mossville, Illinois (2015); UCLA Film & Television Archive (2015); The Metropolitan Museum of Art (2000, 2015); University of California at Berkeley, Bancroft Library (2009, 2016); San Francisco Museum of Modern Art (2016); Georgia Institute of Technology-Emory University Library Service Center (2016); Cornell University Library Annex (1978, 1979, 2004, 2017); Duke University Library Service Center (which also houses the Duke historic newspaper collection (2001) and the Rubenstein Library Freezer Program (2018)); Museum of Fine Arts, Houston (2018); Chicago History Museum (2018); Museum of Modern Art in New York (1984, 2019); Amon Carter Museum of American Art (1982, 2019); Tennessee State Library and Archives in Nashville (2021); Library and Archives Canada Preservation Centre in Gatineau, Quebec, Canada (1997, 2011, 2022); University of Iowa Library Annex (2018); Walt Disney-Lucasfilm-20th Century Fox Film Library (1970, 1997, 2012, 2019); Yale University (1998, 2021); Dartmouth College-Library Collections and Services Facility (2024); Pritzker Military Museum and Library in Kenosha, Wisconsin which provides both refrigerated and sub-zero freezer storage (2024); Smithsonian Museum Support Center in Suitland, Maryland (2015, 2025); Center for Creative Photography at the University of Arizona (2026); Collections Preservation and Research Complex at the University of Texas at Austin (2026); University of Wisconsin at Madison Library Collections Preservation Facility (2026); Royal BC Museum PARC Campus in Colwood, British Columbia (2026); City of Vancouver Archives (2001, 2026); University of Illinois at Urbana-Champaign Archives and Special Collections Building (2027).

Library and Archives Canada in Gatineau, Quebec

In terms of the refrigerated and sub-zero freezer facilities for long-term storage and preservation, Library and Archives Canada (LAC) now has three buildings:

Gatineau Preservation Complex (2 buildings linked together with a walkway): Gatineau Preservation Center (opened 1997):

48 vaults, each about 355 m³

Different T/RH based on materials stored in each vault, but most vaults are at 18C [65F] /40% RH with a few exceptions for paintings (45% RH), medals (35% RH), film (25% RH);

2 sub-zero freezer vaults for color photographs, negatives, and film, at -18C [0F] / 30% RH with 2 progressive acclimatization chambers (built in the antechamber leading to the vaults);

Storage building for special collections, including photographs and negatives, audiovisual, paintings, cartographic material, art on paper, 3D objects (sculptures, globes, chests, medals, awards, banners, etc.)

Major Addition:

Nitrate Film Preservation Facility, in Kanata, Ontario (opened 2011): 23 vaults, each about 45 m³

3 acclimatization vaults at 10C [50F] / 30% RH

20 vaults at 2C [36F] / 30% RH, including one vault for nitrate at advanced stages of deterioration (stages 4 and above) and one vault for disposition

Storage only for nitrate collections (film and photo negatives) with blow out panels and a blast wall.

Latest Addition:

Preservation Storage Facility (opened 2022):

6 vaults, each 17476 m³

5 vaults at 10C [50F] /40% RH (for textual materials in standardized containers) 1 vault at 6C [43F]

/ 30% RH (for film and microfilm)

1 acclimatization chamber

Fully automated item-level retrieval using sophisticated warehouse-scale robotic systems for storage for textual materials, films, and microfilms in standardized containers

Authors Information

Mr. Henry Wilhelm (Presenting)

Wilhelm Imaging Research, Inc., Grinnell, Iowa, USA

Henry Wilhelm is the Founder and Director of Research and Publications at Wilhelm Imaging Research, Inc. Through its website, the company publishes print permanence data for desktop and large-format inkjet printers, chromogenic (silver-halide) color papers, digital presses, UV-curable ink printers, dye sublimation ink printers, and other digital processes. WIR developed test methods have become the worldwide de facto standard for print permanence evaluation and are currently being used by Epson, HP, Canon, HP Indigo, and other manufacturers. Wilhelm Imaging Research also provides consulting services to museums, archives, and commercial collections on sub-zero cold storage for the very-long-term preservation of still photographs and motion pictures. In 1979, Henry Wilhelm was one of the founding members of the American Institute for Conservation of Historic and Artistic Works (AIC) Photographic Materials Group (PMG). Wilhelm has authored or co-authored more than 30 technical papers presented at conferences sponsored by the Society for Imaging Science and Technology (IS&T) and the Imaging Society of Japan (ISJ) in the United States, Europe, and Japan. With contributing author Carol Brower, Wilhelm wrote "The Permanence and Care of Color Photographs: Traditional and Digital Color Prints, Color Negatives, Slides, and Motion Pictures," published in 1993. The complete 761-page book is available in PDF/A form at no cost from <www.wilhelm-research.com>. Since the book was posted online in 2003, more than one-half million copies have been downloaded worldwide. In 2011, Wilhelm received an Honorary Doctor of Science degree from Grinnell College for his research on the long-term preservation of photographs and motion picture films.

Job Title: Director of Research and Publications

Ms. Tania Passafiume (Presenting)

Library and Archives Canada, Gatineau, Quebec, Canada

Tania Passafiume has been the Head Conservator of Photographic Materials at Library and Archives Canada (LAC) since 2005. She holds a Master's Degree in Art Conservation from Queen's University, specializing in photographs, works-on-paper, and book conservation. After graduating, she moved to Rochester, New York, where she completed the Certificate Program in Photographic Preservation and Archival Practice at the George Eastman House. She remained there for over three years, later serving as a Fellow in the inaugural cycle of the Andrew W. Mellon Advanced Residency Program in Photograph Conservation. Passafiume continued her Mellon-funded work at the Art Institute of Chicago, where she spent an additional three years as a Fellow in Photographic Conservation. Her experience also includes positions at Jana Conservation, the McMichael Canadian Art Collection, the National Archives of Canada, the City of Vancouver Archives, and the Canadian Centre for Architecture. Her research includes the publication *Silver Gelatin Paper Sample Sets* with the Canadian Conservation Institute, based on her thesis work at the George Eastman House, as well as extensive study of Hippolyte Bayard's photographic processes. In 2017, Passafiume led a major LAC collaboration with the Cultural Affairs Department of the City of Paris / Atelier de Restauration et de Conservation des Photographies de la Ville de Paris (ARCP) to develop the first English-French visual glossary of photo conservation terms. This enhanced eBook, *Lingua Franca: A Common Language for Conservators of Photographic Materials*, has since expanded into a multilingual project. A Spanish edition, produced with Fundación Comillas (CIESE-Comillas), was launched in 2021, and a Portuguese edition – developed with Luisa Casella, Instituto Moreira Salles, Clara Mosciaro, and the Department of Conservation and Restoration of NOVA FCT, Élia Roldão – was released in 2024. *Lingua Franca* is available for free on iTunes.

Job Title: Head Conservator of Photographic Materials, Library and Archives Canada

Ms. Penelope Bertrand (Presenting)

Library and Archives Canada, Gatineau, Quebec, Canada

Penelope Bertrand has been the Collection Manager for Private Archives in the Preservation and Digitization Branch of Library and Archives Canada since 2017. She holds a Diploma in Arts and Culture, a Bachelor of Arts with Honours in Anthropology and a minor in History, a Technical Diploma in Museum Studies, and a Master of Information Studies. Her initial training in museum studies sparked her interest in preventive conservation and collection management. As part of this program, she completed an internship at the Museum of Anthropology at the University of British Columbia, focusing on preventive conservation, documentation, and storage preparation for ethnographic and archaeological collections. Penelope pursued graduate studies in information science, where her research centered on collection management and preventive conservation in libraries and archives. During this program, she completed an internship with McGill University's Rare Books and Special Collections, strengthening her skills in provenance research, documentation, and the care of collections. Penelope expanded her professional scope at Bibliothèque et Archives nationales du Québec (BAnQ), where she worked with special collections and supported preservation and access services. She reorganized the cartographic, newspaper, and art-on-paper collections, introduced new storage procedures, and contributed to the long-term preservation and valorisation of Québec's heritage collection. Her work combined preventive conservation practices with collection reorganization to improve both preservation conditions and public access. Today, at Library and Archives Canada, Penelope leads preventive conservation initiatives and environmental monitoring programs for storage and exhibition spaces, provides institutional training on collection care, and develops strategies for risk management and long-term preservation. Her technical achievements include implementing an environmental data analysis program, creating a silica-gel humidity control model for exhibition cases, and updating national procedures for the storage of Canada's heritage collections. Her professional interests center on preventive conservation, environmental monitoring, and collaborative approaches to safeguarding heritage collections.

Job Title: Collections Manager for Private Archives, Preservation and Digitization Branch