2025 International Conference for Aviation Museum Professionals

May 12-14, 2025
Canada Aviation and Space Museum & Ingenium,
Ottawa, Canada

NATIONAL AVIATION MUSEUM OF KOREA

Ingenium

CANADA AVIATION AND SPACE MUSEUM
MUSÉE DE L'AVIATION ET DE L'ESPACE DU CANADA

CIMUSET
ICOM international committee for museums and collections of science and technology

2025
International Conference for
Aviation Museum Professionals

Program

Day 1

May 12 , 2025

Time	Program
08:00 – 08:30	Registration
08:30 – 09:00	**[Opening]** Greetings Introduction of the Network for Aviation Museums
09:00 – 10:30	**[Session 1] Storytelling in Curatorial Practice** / *presentation and workshop* **Adina Langer** (Kennesaw State University)
10:30 – 10:50	Coffee Break
10:50 – 12:15	**[Session 2] Caring for Aircraft** **Sterling Gilliam** (National Naval Aviation Museum) / *via Zoom* **Kate Good** (Intrepid Museum) **Andreas Hempfer** (Deutsches Museum) Questions and Discussion on Session 2
12:15 – 13:30	Lunch
12:15 – 15:00	**[Senior Leadership Meeting]** Lunch in the boardroom Agenda Discussion
13:30 – 14:45	**[Workshop]** Group 1. Tour of Cold War Exhibition Group 2. Moving Aircraft Workshop (weather dependent)
14:45 – 15:05	Coffee Break
15:05 – 16:15	**[Workshop]** Swap Group 1 / 2
17:00 – 19:00	**Welcome Dinner** hosted by Ingenium & CASM - CASM main floor

Day 2

May 13, 2025

Time	Program
09:00 – 10:30	**[Session 3] Engaging with Audiences** **Rosie Cardiff** (Science Museum London) **Arianne Richeson** (Ingenium / Canada Aviation and Space Museum) **Meiju Pax** (Finnish Aviation Museum) Questions and Discussion on Session 3
10:30 – 10:50	Coffee Break
10:50 – 12:30	**[Session 4] Experiential Learning in Aviation Museum** **Arthur Bednar** (Museum of Flight) **Michelle McMahon** (Wings Over the Rockies) **Terry Michael Slobodian** (Royal Aviation Museum of Western Canada) **Dongun Gwon** (National Aviation Museum of Korea) Questions and Discussion on Session 4
12:30 – 13:45	Lunch
13:45 – 15:00	**[Workshop]** Group 1. Reading Artifacts Group 2. Aerospace Experiences
15:00 – 15:20	Coffee Break
15:20 – 16:35	**[Workshop]** Swap Group 1 / 2
19:00 - 21:00	**Welcome Dinner** hosted by NAMOK - Korean Restaurant in Downtown Ottawa

Day 3

May 14, 2025

Time	Program
09:00 – 10:50	**[Session 5] Access, Hazard Management, Storage** **Matthew Bruce / Skye Marshall** (Ingenium) **Steve Nichol** (British Columbia Aviation Museum) **Sodam Lee** (National Aviation Museum of Korea) **Andor Vince** (Heritage Collections Care Consortium) / *via Zoom* Questions and Discussion on Session 5
10:50 – 11:10	Coffee Break
11:10 – 12:30	**[Session 6] Digital** **Erin Napier / Sean Kearney / Al Mickeloff** (Canadian Warplane Heritage Museum) **Lauren DiVito** (Ingenium) **Witali Gerber** (Bundeswehr Military History Museum, Berlin-Gatow Airfield) Questions and Discussion on Session 6
12:30 – 13:45	Lunch
13:45 – 14:45	**[Workshop]** Group 1. Tour of Ingenium Centre (collection storage facility) Group 2. Interactive conservation activities in the Conservation Lab
14:45 – 15:05	Coffee Break
15:05 – 16:05	**[Workshop]** Swap Group 1 / 2
16:05 - 17:05	**[Closing]** Reflections on the 2025 Conference Announcement of the Host Museum for the 2026 Conference

2025
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Aviation Museum Professionals

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Senior Leadership Meeting


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Opening

GREETINGS

Younjin Park
President and CEO
National Aviation Museum of Korea

The National Aviation Museum of Korea (NAMOK) was established on July 5, 2020, in commemoration of the 100th anniversary of the opening of the Korean Aviation School in California, USA, on July 5, 1920. As the nation's flagship museum dedicated to the theme of "aviation," NAMOK was founded after extensive research into leading museum practices across North America and Europe, and through the integration of valuable insights from numerous domestic experts. As a result, NAMOK has swiftly earned the love and support of the Korean public.

In September of last year, NAMOK signed a memorandum of understanding with ICOM-CIMUSET in Vienna, Austria, launching the Network for Aviation Museums – a four-year initiative to foster communication and collaboration among aviation museums worldwide. Building on this momentum and through a close partnership with the Canada Aviation and Space Museum (CASM), we are honored to host the first-ever 2025 International Conference for Aviation Museum Professionals here today.

Aviation is one of the most iconic and beloved themes in modern history. Across the globe, aviation museums and science centres share common ground while offering unique and diverse content. In this regard, aviation museums occupy a distinctive position, capable of

generating powerful synergies through international networks – in exhibitions, education, collection management and conservation, and curatorial research.

NAMOK has actively engaged in international collaborations, including a special exhibition on Otto Lilienthal with several German museums, collection development initiatives with the Royal Air Force Museum in the United Kingdom, and joint colloquiums with the Finnish Aviation Museum. These projects, often difficult to undertake solely within Korea, have been made possible through our expanding global partnerships.

This conference represents a long-awaited forum for focused and professional dialogue among experts in the aviation museum field. It is a unique opportunity for us to explore shared questions, challenges, and solutions together. Through this growing network, NAMOK is committed to continued communication and meaningful collaboration with all of you.

I would like to extend my heartfelt gratitude to Director Christopher Kitzan, Curator Erin Gregory, and all our colleagues at CASM and Ingenium for their generous support and contributions from the early planning stages of this conference. We sincerely hope that this meaningful first step will lead to lasting relationships, vigorous dialogue, and inspiring collaboration as we journey together toward 2028 and beyond. Thank you very much.

GREETINGS

Christopher Kitzan
Director General
Canada Aviation and Space Museum

It is my distinct pleasure to welcome you to the 2025 International Conference for Aviation Museum Professionals, held at the **Canada Aviation and Space Museum** in Ottawa, Ontario. The museum is one of three national institutions that make up Ingenium – Canada's museums of science and innovation.

Our museum is home to one of the world's finest collections of aviation and aerospace technology. We strive to not only preserve and display this incredible collection for the public but also to be relevant to an ever-changing society through the programs and events we offer, both physically and virtually. Surrounded by the pioneering spirit of flight and space exploration, we hope you will find inspiration in the discussions had and stories shared.

This year's conference brings together leaders and practitioners from many aviation museums in North America, Europe, and Asia, offering a unique opportunity to exchange ideas, build new collaborations, and explore the unique challenges and opportunities we face in this field.

Over the next several days, you will have the opportunity to engage with dynamic speakers, participate in insightful discussions, learn new skills in hands-on workshops, and explore

Ingenium’s state of the art collection storage facility. We also encourage you to take time to enjoy the museum's exceptional collection and experience the remarkable stories that have shaped Canada's contributions to aviation and space.

We are honored to host you and look forward to a productive and memorable event.


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2025 International Conference for Aviation Museum Professionals

DAY 1


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2025 International Conference for Aviation Museum Professionals

[Session 1]

Storytelling in Curatorial Practice

Adina Langer
Kennesaw State University, USA

2025 International Conference for Aviation Museum Professionals


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Session 1

The Many Sides of the B-29

A Storytelling Workshop for Aviation Museum Professionals

Adina Langer | Senior Curator,
Museum of History and Holocaust Education, Kennesaw State University, USA

1. Background

With twenty years of experience in exhibition curation, and having served recently as the editor of the practitioner anthology Storytelling in Museums, I am delighted to present a workshop focused on best practices for employing storytelling techniques to amplify and expand perspectives in aviation museum narratives.

I believe in the power of personal stories to create connections across disciplines. This is especially important in museums focused on science and engineering where complex technological concepts may excite some visitors while alienating others. Learning about the people who enabled innovation and technical advancement empowers visitors to see themselves in the worlds of possibility introduced through museum narratives.

As a child, I was entranced by science museums in the United States, especially the famous Smithsonian National Air and Space Museum in Washington, D.C. It was there that I first realized the potential for controversy in large-scale exhibitions of technologies that played a pivotal role in world history.

Having visited "The Enola Gay" at the National Air and Space Museum in 1995, I was nonplussed by the simple display of the airplane's fuselage and lack of contextual information. It was not until I was a graduate student in public history that I learned the full story of the controversy behind the display of the airplane that famously dropped the first atomic bomb on Hiroshima, ending World War II. Earlier plans for an exhibition including graphic imagery and artifacts melted in the explosion were scrapped after veterans groups

and members of Congress claimed that the exhibition focused too much on the destructive power of the bomb and portrayed the Japanese as victims rather than aggressors. Plans to cancel the exhibition were met with frustration from academics and museum professionals. In the end, a simple display commemorated the 50th anniversary of the end of the war but satisfied no one.

Enola Gay on Display, c. 1995,
Smithsonian Institution Archives,
Acc. 11–009, Image no. 95–4624.

After graduating from college, I joined the staff of the National 9/11 Memorial Museum in New York City. There, I began to hone techniques for interpreting difficult histories — topics that involve traumatic memories and/or evoke strong emotions — for wide audiences. These techniques have continued to serve me well in my current role at the Kennesaw State University Department of Museums, Archives, and Rare Books where I am responsible for exhibitions and programming at the Museum of History and Holocaust Education as well as community projects that tackle challenging topics ranging from immigration to the American civil rights struggles.

Over the years, I have come to appreciate the importance of recruiting diverse community narrators, recording testimony, and strategically incorporating varied perspectives into museum exhibitions in order to curate multi-vocal museum experiences that resonate with broad audiences. In this workshop, I will share techniques for bringing a storytelling sensibility to the work of an aviation museum through a relevant case study that hearkens back to my first experience with museum controversy: the B-29 Superfortress.

2. Seeing the Many Sides of the B-29

Kennesaw State University is located ten miles (16 kilometers) from what is now a Lockheed Martin manufacturing facility but had been a Bell Aircraft plant during World War II. Between 1942 and 1945, workers at "Bell Bomber" in Marietta, Georgia, produced 668 B-29 Superfortress airplanes which dropped bombs for the Allies primarily in the Pacific theater of war. Although the two B-29s which dropped atomic bombs on Japan were manufactured in Bellevue, Nebraska, the story of the B-29, and thus Bell Bomber, is forever intertwined with the history of the atomic bomb and the end of World War II.

As the closest university to the former Bell Bomber site, Kennesaw State University houses photographs and documents related to the operations of the plant in its University Archives and Special Collections. This, along with a robust Legacy Series oral history program created to document the experiences of World War II veterans, home front workers, and Holocaust survivors, provides a unique set of primary sources for workshop participants to consider as they work to imagine an exhibition focused on the legacies of the B-29.

During the workshop, participants will engage with subsets of this material in small groups. They will then present essential information to the larger group about the perspectives illuminated through the materials they examined. Together, the larger group will outline an interpretive plan incorporating these diverse perspectives into a coherent museum exhibition. My goal is for participants to come away from the experience understanding the following:

- There are many ways to think about a single topic for a museum exhibition.
- One person's celebrated achievement is another person's "difficult history."
- By approaching a topic from many angles, it is possible to create opportunities for visitors to empathize with people of the past and to reflect on the complexities of their own lived experiences.
- Since museum exhibitions are spaces for free-choice learning, it is possible for exhibits to hold multiple truths simultaneously.

3. B-29 Case Studies

Expanded versions of the following case studies will be distributed to participants for study during the workshop:

Boeing and Bell: Engineering and Manufacture

The Boeing Corporation's work on long-range bombers started in 1938, three years before the United States entered World War II. Boeing submitted the winning design for a four-engine bomber with a range over 2000 miles following a call for proposals in 1940.

The B-29 was the largest aircraft flown during World War II and featured innovative new technologies including a pressurized cabin, dual-wheeled tricycle-style landing gear, and an analog "computer" that controlled machine gun turrets.

Four plants manufactured the airplanes between 1942 and 1946: two Boeing factories, a Martin factory, and Bell Bomber in Marietta, Georgia. Having demonstrated success building smaller military aircraft with innovative engine design, Bell was selected to build a plant in Marietta that would build heavy bombers including the B-29s under license from Boeing and B-24 Liberators under license from Consolidated Aircraft.

Related Resources

https://www.boeing.com/content/dam/boeing/boeingdotcom/history/pdf/Boeing_Products.pdf
https://buffaloah.com/h/aero/bell/

Franklin Roosevelt, Lucius Clay and James V. Carmichael: Geography and Politics

Concerned about the safety of coastal areas during World War II, President Franklin D. Roosevelt and Secretary of War Henry L. Stimpson wanted to select inland sites for the manufacture of airplanes and other important war materiel. General Lucius D. Clay of Marietta, Georgia, was tapped by President Roosevelt in September 1940 to lead an emergency airport construction program to prepare the nation for war. Clay's success in this role led him to become Director of Materiel for the U.S. War Department and to recommend the selection of Marietta for the new Bell plant. By February 1945, 28,158 workers were employed at the facility.

According to the New Georgia Encyclopedia:

> "About nine in ten employees were southerners, with the vast majority coming from communities in north Georgia. Some 37 percent were women, 8 percent Black, and 6 percent physically disabled. Opportunities for advancement were limited for women and African Americans, and the job sites were segregated. Yet Bell's equal-opportunity record was no worse than other southern industries of that era, and its pay scale was substantially higher."

Less than a month after the bombing of Hiroshima and Nagaski, the Bell plant in Marietta closed its doors. It remained shuttered until the U.S. government awarded a factory contract to Lockheed in 1950 to build B-47 aircraft in the former Bell plant.

Related Resources:
https://www.georgiaencyclopedia.org/articles/government-politics/bell-bomber/
https://express.adobe.com/page/QITjWOMiIBTiV/
https://soar.kennesaw.edu/handle/11360/3782

Geraldine Anthony: Home Front Worker

Born in Bartow County, Georgia, in 1927, Geraldine Anthony worked as a janitor at Bell Aircraft in Marietta during World War II. Despite having been paid less than her white counterparts during the war, Anthony was able to save money to purchase her family home in Rome where she lived until her death in 2020.

Related Resources:
https://soar.kennesaw.edu/handle/11360/2415
https://mediaspace.kennesaw.edu/tag/tagid/geraldine%20anthony

Jessie Moss: Home Front Worker

Born in Forsyth County, Georgia, in 1918, Jessie Moss worked on a team building fuselages for B-29 bombers at Bell Bomber during World War II. When her husband returned from fighting in the Pacific, Moss paid for the construction of their first home with money saved from her job at Bell.

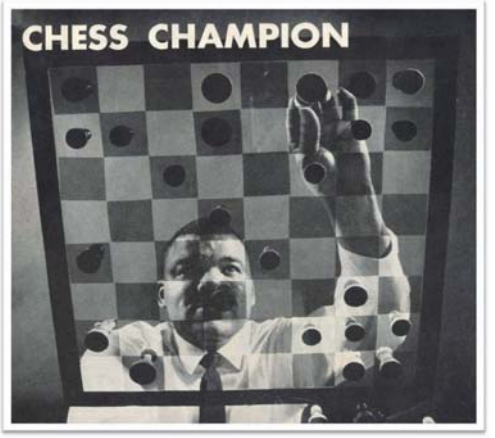
Related Resources:
https://soar.kennesaw.edu/handle/11360/2227
https://mediaspace.kennesaw.edu/tag/tagid/jessie%20moss

Melvin Price: B-29 Radio Operator

Melvin (Mel) Price was born in Dunkirk, New York, on January 23, 1926. He enlisted in the U.S. Army Air Corps after graduating high school and was trained as a radio operator assigned to a B-29 crew. Between 1944 and 1946, Price was based on Tinian Island where he witnessed the activities of the 509th Squadron, which would later drop atomic on Hiroshima and Nagasaki. Price flew firebombing and POW missions over Japan until he was honorably discharged.

Related Resources:
https://georgiajourneys.kennesaw.edu/tours/show/41
https://soar.kennesaw.edu/handle/11360/6969

W.A. Scott III: Veteran and Liberator



William A. Scott III moved with his family to Atlanta in 1928 at the age of five. Drafted into the U.S. Army, Scott served as a reconnaissance sergeant, photographer, and part-time historian in the intelligence section of the 183rd Engineer Combat Battalion. In April 1945, he was one of the first Allied soldiers to enter and photograph survivors of Buchenwald concentration camp. His unit was on a boat headed for the Pacific Theater, when he learned that the dropping of the atomic bombs from B-29 bombers had ended the war. Instead of heading to Japan, Scott spent the remainder of his military service on Enewetak Atoll honing his skills at chess.

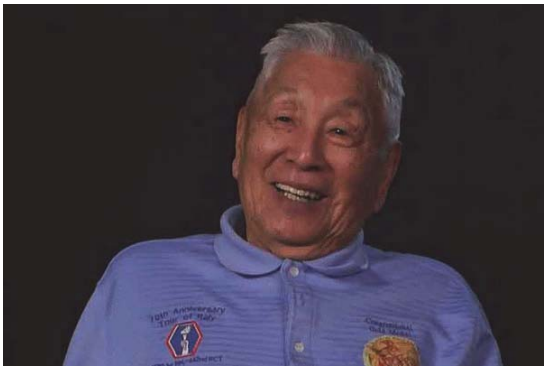
Related Resources:

https://georgiajourneys.kennesaw.edu/tours/show/22

https://soar.kennesaw.edu/handle/11360/3446

https://mediaspace.kennesaw.edu/tag/tagid/m.%20alexis%20scott

Jimmy Doi: Veteran and Incarceration Survivor



Born in Oxnard, California in 1925, Jimmy Doi was the son of Japanese parents who immigrated to the U.S.in the early 20th century but returned to Japan before the start of World War II. Doi spent two years in the Gila River War Relocation Center in Arizona, before he was drafted into the U.S. Army as a member of the 442nd Regimental Combat Team. When his tour of duty was up, he reenlisted so that he could return to Japan to see his parents. Although they lived only four miles from Hiroshima, they survived the atomic bomb attack. Sadly, Doi lost other relatives in Hiroshima, including cousins who were in school there, and his father ultimately died from lung cancer likely related to the radiation from the bombs. After the war, Doi moved to Georgia to work in the poultry industry.

Related Resources:

https://mediaspace.kennesaw.edu/tag/tagid/jimmy%20doi

https://soar.kennesaw.edu/handle/11360/2228

https://georgiajourneys.kennesaw.edu/tours/show/7

Eugene Kimling: Veteran and Aeronautical Engineer

Born in New York City in 1929, Eugene Kimling grew up in a German immigrant family. While visiting Germany in September 1939, he and his family were trapped by the Nazi regime due to the outbreak of World War II. Kimling was forced to join the Deutsche Jungvolk and then the Hitler Youth. After the war, he became an interpreter for the British and American occupational authorities and then enlisted in the U.S Army, serving in Asaka, Japan. After he was discharged from the Army in 1948, Kimling studied aeronautical engineering in California under the G.I. Bill. He ultimately settled with his family in Marietta, Georgia, where he worked at the Lockheed plant that had been Bell Bomber during the war.

Related Resources:

https://georgiajourneys.kennesaw.edu/tours/show/23

https://mediaspace.kennesaw.edu/tag/tagid/joanna%20kimling%20stubbs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[Session 2]

Caring for Aircraft

Sterling Gilliam
National Naval Aviation Museum, USA

Kate Good
Intrepid Museum, USA

Andreas Hempfer
Deutsches Museum, Germany

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Session 2

The Changing Preservation Landscape at the National Naval Aviation Museum

Sterling Gilliam | Director, National Naval Aviation Museum, USA

If one were to look at photographs of the National Naval Aviation Museum (NNAM) in the years following its opening in June 1963, the only macro-artifacts visible would be three airplanes on outdoor display in front of a small, antiquated building that was NNAM's first home. Additional airframes were acquired in anticipation of the construction of a new museum building that came to fruition in 1974. Subsequent expansions through 2011 increased the museum footprint to two museum buildings encompassing almost 400,000 square feet located on a 60-acre campus. As such, our collection has grown from those original three display aircraft to 179 aircraft located here in Pensacola and over 900 aircraft on loan across the United States and six international partner nations. NNAM is now the third largest aviation museum in the world, and the same challenges that existed in preserving those first three aircraft more than a half century ago endure today.

Early National Naval Aviation Museum

1. Shift in Collections Strategy

The difference between then and now, one that is fitting given the museum's military subject matter, is in strategy. In our formative years, macro-artifact acquisition rested on what could be called a "hope" strategy — acquisition of historic aircraft with the hope that they could be maintained long enough to be restored and placed on indoor display. Today, it is a multi-pronged approach that involves a network of stakeholders all with an interest in preserving Naval Aviation's enduring history and heritage that began in 1911.

While it would be unfair to say that the museum's founders were not mindful of provenance when it came to aircraft acquisition — one of the early aircraft acquired was the last A-1 Skyraider to fly an attack mission during the Vietnam War — in many instances they accepted the first offer they received for a particular aircraft and did so without regard for the ability to care for it in the long-term, particularly in the case of the larger aircraft for which there was little hope for indoor display. As the museum buildings have filled up with aircraft, many with notable provenance like the only surviving aircraft to have flown at the Battle of Midway and three aircraft with connections to U.S. presidents, including a "Marine One" helicopter, the necessity of balancing provenance and life-cycle considerations is more important than ever given limited resourcing. This impacts aircraft acquired in the past and planning for future acquisitions so the museum can meet its mission to "select, collect, preserve, and display historic artifacts relating to the history of Naval Aviation."

2. A New Look at Loans

NNAM manages loaned aircraft around the world, whether they are "gate guards" located at military installations or placed in the exhibit galleries of museums. Most of these aircraft went directly from fleet service to the borrowing entity, their final flights being to the respective institutions. In the case of NNAM's multi-year underwater recovery efforts in Lake Michigan, where many naval aircraft crashed during World War II carrier qualification, these wartime wrecks also went from the water to the borrower.

In recent years, as the elements have begun to take their toll on the museum's collection of outdoor aircraft, museum leadership was forced to make a life-cycle management decision — find a home for them or risk losing them. Thus began a concerted effort to reduce the exterior footprint, selecting aircraft for retention based on provenance and potential maintenance and restoration resources and actively seeking to find other entities desiring to care for others. The result has brought many success stories. Fundraising efforts to restore the wreckage of a rare SB2C Helldiver recovered from Lake Otay in California had not generated the necessary resources. However, the USS Midway Museum in San Diego sought an example of this aircraft, which was one of the early types to operate from the carrier, for display. The airplane is now on a restoration loan, which will net for the Navy the restoration of the only example of the SB2C in its collection and fill a display gap for a partner museum with great visibility. A similar scenario exists for an Arado Ar 196 seaplane that once flew from the German battle cruiser Prinz Eugen. Seized by the Navy after World War II, it was displayed for many years at Naval Air Station Willow Grove, Pennsylvania, before being transferred to NNAM. It is now on loan to the Aeronauticum in Germany, where it is undergoing extensive restoration and tells the story of World War II German aviation industry, including the tragic chapter of the slave labor that supported it.

Instead of being placed on loan, other aircraft have been transferred to government entities. An R5C (C-46) Commando, which was used on a limited basis in Naval Aviation but saw extensive service with the U.S. Air Force, is now part of the collection of the Air Mobility Command Museum at Dover AFB in Delaware. Sadly, some aircraft cannot be saved, the deterioration so great that they are unsafe to retain. In these instances, the staff removes an historic component to retain as a heritage asset and NNAM engages a Navy contract scrapping company to break the aircraft apart.

3. Last is First

The museum is also placing greater emphasis on provenance and life-cycle management in current and future acquisitions as we build the collection for the 21st century. We have identified specific F/A-18E Super Hornet strike fighters that participated in notable combat actions for eventual assignment to the museum even though they have decades remaining in their service lives. For aircraft types approaching retirement, we have embraced the strategy of getting the last one of a specific type, ensuring the active component of the Navy provides the maintenance on it until the very last. And when the time comes for the last aircraft of a particular type-model-series to be retired, we carefully evaluate our ability to care for it in the long term. If we cannot, we look for a borrower who can accept it on loan, thus preserving a heritage asset for the Navy and meeting our mission. A prime example of this is the recent retirement of the EP-3E Aries II that landed on Hainan Island after a mid-air collision with a People's Republic of China fighter on April 1, 2001. We decided to place it on loan to the Pima Air and Space Museum, where even on outdoor display its preservation level would be higher than in the Florida panhandle.

4. Preservation Strategies

The recent completion and display of a rare "Birdcage" F4U-1 Corsair, so named because of its cockpit canopy design, marked the probable end of an era. Since the early 1990s, when the museum began raising World War II aircraft from underwater environments, full-scale restoration of these vintage warbirds was a core element of our operations. The F4U-1 marked the last of these aircraft and even before its completion, what has been an aircraft restoration operation was experiencing a shift to a more conservation/preservation function. This is in part the result of a shrinking industrial capacity on site, a once robust corps of volunteers consisting of skilled artisans who had worked on vintage aircraft while on active duty, greatly diminished and widespread hiring of skilled labor by region's expanding commercial aviation industry.

Final preps for suspension of NNAM's Birdcage F4U-1

As stated above, major restoration projects have been shifted to the limited number of entities capable of vintage aircraft restoration. The core museum staff now focuses on corrosion control, minor parts repair/fabrication and painting. With the limited appropriated funding the museum receives consumed in large part by operating a facility of tremendous size and scope, NNAM relies on the museum's non-profit 501(c)(3) support organization, the Naval Aviation Museum Foundation, to support large scale projects. With that organization focusing on potential new infrastructure in the next decade, the museum has embarked on a course of action seeking funding to contract one major aircraft preservation per year, selecting a small number of aircraft on outdoor display that have significant provenance. For those airframes not on the preservation schedule, the museum staff maintains a regular schedule of washing and performance of minor maintenance, an unending battle against the elements.

The aircraft on indoor display are not subject to the heat, humidity and salt air that affect those outdoors, but a longstanding hallmark of the museum's exhibit philosophy does present conservation challenges. NNAM prides itself on placing few barriers to limit the ability of the public to get up close and touch the aircraft on display. To this end, they

occasionally suffer minor damage to fabric control surfaces and worn areas that require repainting or polishing. An exception to this is aircraft on loan from the Smithsonian National Air and Space Museum, which include the Skylab II command module and the NC-4 flying boat, which in May 1919 became the first aircraft to fly across the Atlantic Ocean. These have barricades around them per loan agreement.

5. Conclusion

Aviation museums are unique among cultural institutions in the sheer size of the macro-artifacts they collect, which ironically in their operational days were designed to be expendable. With aviation remaining one of the most dynamic human endeavors, preservations of its history and heritage will remain an ongoing mission requiring constant reevaluation and shifts in planning to meet resourcing and environmental challenges. The fact that there is an ever-shrinking industrial base that can properly and professionally restore vintage aircraft exacerbates these challenges. Let us hope all of us are up to the task.

NNAM's entrance today

Session 2

Overcoming Obstacles: Preserving Outdoor Aircraft at the Intrepid Museum

Kate Good | Associate Curator of Aerospace, Intrepid Museum, USA

1. Introduction to the Intrepid Museum

The Intrepid Museum holds a special place in New York City's cultural landscape. Founded in 1982 with the acquisition of the aircraft carrier USS *Intrepid*, the Museum educates and entertains visitors of all ages from all around the world. Its dynamic exhibitions exemplify the intersection of history and innovation to reveal the stories of the people who made history, and the technology that made possible some of the most extraordinary and historic accomplishments of the 20th century.

The U.S.S. Intrepid, the museum's largest artifact.
Photo Credit: Intrepid Museum

2. The Intrepid Museum's Artifact Collection

The Museum has collected artifacts and archives for its historic collections since its founding in 1982. The majority of our collections focus on Intrepid during its service from 1943 to 1974. However, we also collect items related to our other major artifacts: the submarine Growler, the Concorde, the space shuttle Enterprise and the aircraft collection. Our collections staff maintains a climate-controlled collections storage room on board Intrepid, and catalogs over 22,000 records in our collections management database. We also hold a collection of over 250 oral history interviews with former crew members, including some who flew or worked with aircraft during their service. While some of our 29 aircraft are owned by the Museum, the majority are on loan to us from the National Naval Aviation Museum, National Museum of the United States Air Force, and the National Museum of the Marine Corps.

An overhead view of the Flight Deck from the ship's Island.
Photo credit: Intrepid Museum

3. Beginning of the Restoration Program

The old restoration tent on the Flight Deck being taken apart.
Photo credit: Eric Boehm

A recent picture of the new Aircraft Restoration Hangar, completed in 2016.
Photo credit: Kate Good

Since the founding of the Intrepid Museum, we have recognized that all our objects are artifacts with a living history, not simply static. As such, we are fully dedicated to the preservation and conservation of our entire collection and what it means for future generations to have access to visible history. The museum takes great lengths restoring, maintaining, and caring for all the Museum's aircraft, paying special attention to the outdoor collection's needs. The aircraft restorations and treatments are completed on site by our three-person team of Restoration Specialists, with support from a dedicated team of volunteers.

When the Museum established an official restoration program in 2005, there was no on-site facility for aircraft restoration work. With limited funding, the initial solution was a large weather-resistant tent with rollable sides. The tent was capable of housing one aircraft at a time, with the projects completed by one full-time staff member and a cadre of volunteers. Over time, the team expanded to three full-time staff, allowing for more consistent maintenance of the aircraft. However, although it was certainly better than no structure and provided some shelter, the tent was still vulnerable to the elements and proved impractical and difficult to manage for the teams working to preserve the artifacts. With careful planning and some creative problem solving to reorganize some of the flight deck, in 2016, we were able to construct a restoration building and replace the tent. Located on the flight deck with

most of the Museum's aircraft, the Intrepid's Aircraft Restoration Hangar (ARH) is now the center of "where the magic happens." Hundreds of thousands of visitors each year get to watch the transformation and care of our aircraft up close, especially from spring to fall when the main roll door is open, showcasing the entire workspace.

4. Aircraft Preservation Challenges

Caring for twenty-nine aircraft, including a British Airways Concorde and the space shuttle *Enterprise*, can be daunting, and it takes a lot of teamwork and coordination to keep the artifacts in their best condition. The Intrepid Museum's location in New York City and having a majority of our aircraft outdoors present a wide variety of preservation challenges. Like many museums with outdoor displays, our aircraft are exposed to the elements. However, in recent years, climate change has taken its toll, requiring us to adopt new strategies to keep up with maintenance, especially when it comes to corrosion. Extreme heat and cold, major storms, debris, and pollution all contribute to the wear and tear.

High flooding from Hurricane Sandy outside the Welcome Center of the Museum.
Thankfully, no aircraft on the flight deck were harmed in the storm.
Photo credit: Intrepid Museum

A few issues specific to the Intrepid Museum have to do with its riverside location in New York City. Situated in the Hudson River tidal estuary that flows into the Atlantic Ocean, every day the aircraft collection on the flight deck is exposed to salt air. That salt air means we need to constantly look out for increased instances of corrosion and do our best to mitigate it. Aircraft walkaround inspections are a normal part of day-to-day operations for the restoration team to identify weak spots on the airframe that may need an inhibitor for corrosion. A task that greatly helps with mitigating damage from the elements: regular washing and waxing. Every year, sometimes twice a year for airframes prone to gathering debris and rust, the exteriors of every aircraft on the flight deck are hand cleaned and waxed.

5. Repelling the Elements

Each aircraft comes into the ARH for refurbishment/restoration every seven to ten years. The aircraft rotate in and out based on the immediate maintenance needs of the airframe, length and cost of the project, and, with our small team, staff bandwidth. Frequently, during the routine maintenance, staff discover hidden problems such as birds' nest infestations or water retention caused by a worn-out fastener. When an aircraft comes in, the restoration team thoroughly inspects it, writes a restoration plan, and begins working on the identified problems. We recently implemented a process that brings our Aircraft Restoration, Collections, and Curatorial teams together to gain better understanding of the scope of work that is completed in the ARH, as well as streamlining the documentation of projects for the Museum's collections records. Having so many aircraft in our collection that are loans, we also liaise closely with each lender to get approval for any major work that needs to occur to an airframe and include it in the documentation.

A light refurbishment usually takes around six months to complete. If the aircraft needs to undergo a full restoration or large repairs that require detailed fabrication of a part, that time can take anywhere from six months to two years. The only two aircraft on the flight deck that we cannot fit in the restoration hangar: the Lockheed A-12 and the E-1B Tracer. Our team works on these aircraft in their current positions on the flight deck.

The F9F-8 Cougar when it originally arrived at the Museum. After being left in a field and treated effectively like playground equipment, the Cougar was in extreme disrepair and many pieces (or lack thereof). The full restoration began in 2009.
Photo credit: Eric Boehm

The completed restoration of the F9F-8 Cougar in 2011.
Photo credit: Eric Boehm

Visible exterior corrosion, sun damage, and worn-out surface paint on the tail of the F-8K Crusader before coming into the ARH in 2024. Photo credit: Intrepid Museum

The most recent aircraft brought into the hangar was our F-8K Crusader. The airframe required metal work and reinforcement in a few places, including replacing some of the internal honeycomb structure and fabricating new skin panels for the underside of both wings at the trailing edge. Among other repairs, the team also replaced the nose wheel strut, which had a crack in it and was a safety hazard for the artifact and staff; we stabilized the aircraft until we were able to find the exact strut and parts needed. Once in the hangar, we acquired a brand-new strut and installed it during the restoration process. Corrosion, fastener replacements, and additional sealing was also completed.

Finally, after a fresh full repaint, the Crusader was ready to return to its place on the flight deck. The full restoration took about a year but was put on hold for six months to restore the Museum's newest aircraft, an FG-1D Corsair. Now, for the next several years, the aircraft restoration team will maintain the Crusader in the same way as all the other aircraft on the flight deck, with light touchups and repairs as needed. The goal of the new paint and completed repairs is to protect and seal the airframe until its next turn in the seven-to-ten-year cycle.

The finished refurbishment of the F-8K Crusader. The airframe was repainted in the same Vietnam War livery, which honors Intrepid's own aviator Anthony Nargi. The aircraft returned to its place on the Flight Deck in April 2025.
Photo credit: Peter Torraca

6. Education and Visitor Experiences

The Museum actively works to focus on its place as an aviation museum with multiple education and outreach initiatives. Through its after school, professional development, and STEM programs, we engage with more than 100,000 students each year. Our exhibits and programs are designed to provide a meaningful visitor experience for all, with a special focus on diversity and inclusivity. One of the major programs that our aircraft team works with every year is called All Access Maker Camp. The program is one of the most inclusive in an aviation museum for children with physical, cognitive, and sensory disabilities, including autism. Students interact with the aircraft team and Museum educators in the ARH and on the Flight Deck. They are introduced to the aircraft, with special guided access to experience touch tours and enter some of the collection, including the HH-52 Seaguard, T-34 Mentor, and UH-1 Huey. Students learn how we take care of our aircraft and make sure that they are

maintained properly and safely. Additionally, students gather in the ARH to learn about the aircraft restoration process and the tools we use to complete the work. Each child takes home a little hands-on metalwork project they create with the help of the aircraft team. We pride ourselves on bringing such unique experiences and educational programming to a wide variety of visitors, adults and children alike.

The museum has an annual program called All Access Maker Camp,
which includes a day where small groups of kids have the opportunity to interact with certain aircraft
on the Flight Deck and participate in a hands-on workshop with the restoration team.
This past year, the project was fabricating sheet metal airplanes using drills, clecos, and squeeze rivets.
Photo credit: Intrepid Museum

During Kids' Week, the Museum welcomes thousands of families and children to come meet STEAM professionals and participate in interactive workshops.
Each day is a different theme in STEAM, from NASA day to aviation engineering to learning about nature conservation.
Photo credit: Intrepid Museum

7. Conclusion

A core value of the Intrepid Museum's mission is to bring aviation history and its relationship to modern technology alive to hundreds of thousands of visitors every year through education programs, hands-on experiences, and new exhibitions. We rely on the knowledge, engagement, and hard work of our restoration team and volunteers to help with that goal. Without the many hands that steward our aircraft, we would not be able to keep up the caliber of maintenance we strive to keep for the future preservation of the collection. The Museum strives to stay at the forefront of conservation and preservation methodology, frequently adapting to new procedures and best practices. Whether it's normal wear and tear from everyday environmental hazards or sudden unpredictable events, the Museum continues, and will always continue, to safeguard the aircraft collection for future generations.

The newest addition to the Museum's aircraft collection, an FG-1D Corsair.
From October 2024 to March 2025, the Corsair was restored by the team and is now housed in a brand-new exhibition in Hangar 1 of the ship.
Photo credit: Intrepid Museum

The completed FG-1D Corsair in the new exhibition space.
The airframe is painted in the livery of Intrepid World War II ace-in-a-day A lfred Lerch.
Photo credit: Intrepid Museum


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Session 2

From Warplanes to Witnesses:

Uncovering Historical Traces on WWII Aviation Artifacts with Modern Conservation Science and Non-Destructive Testing at the Deutsches Museum

Andreas Hempfer | Curator for Aviation until 1945, Deutsches Museum, Germany

1. Introduction: Dealing with heavily restored objects

In 2015, the Deutsches Museum embarked on an ambitious project to update and redesign its permanent aviation exhibition, focusing particularly on some of its most iconic aviation artifacts from World War I and II. Among these, the Messerschmitt Bf 109 E-3, Me 163 B, V2 rocket, and the Fokker D.VII fighter stand out due to their historical significance. This project marks a major shift from the museum's earlier restoration practices, which often lacked scientific supervision up until the 1990s. As a result, many aircraft lost significant traces of their individual service histories during previous restoration efforts, or these traces were obscured. With the goal of uncovering unknown details and answering long-standing questions about the objects' service histories, the museum's own research institute[1] and curators worked closely with external partners, including the Fraunhofer Institute[2] and several universities, to apply modern conservation science and non-destructive testing (NDT) techniques. The museum also offers scholar programs, where external scientists can reside at the museum for research projects.[3] The resulting interdisciplinary collaborations have proven to be invaluable support for the museum's limited resources.

1) https://www.deutsches-museum.de/forschung/forschungsinstitut, April 11, 2025.
2) https://www.fraunhofer.de/, April 11, 2025.
3) https://www.deutsches-museum.de/en/research/research-institute/scholar-in-residence, April 11, 2025.

2. Thermography and Non-Destructive Testing of Messerschmitt Fighters

The Messerschmitt Bf 109E-3 and Me 163B, two aircraft prominently displayed in the Deutsches Museum, have undergone various restorations since they were acquired in the 1960s. Over the years, both were repainted and modified extensively, often at the expense of historical accuracy. The question arose: what original traces from their time in active service still exist beneath the surface?

The analysis of paint and binder layers—using resin-embedded, sliced, and microscopically examined samples—provided the foundation.[4] It revealed multiple overpainted layers that may hold further information.[5] Collaboration with the Technical University of Munich's (TUM) Chair for Non-Destructive Testing[6] aimed to use established thermographic techniques to uncover suspected hidden numbers or symbols. Lock-in and active thermography are widely used in industries such as manufacturing, construction, and quality control.[7] Its ability to inspect large areas in a non-contact, non-destructive manner makes it an ideal method for museums dealing with large exhibits like aircraft. Thermographic testing is particularly useful in revealing hidden details in thin layers of materials, making it a suitable tool for examining aircraft with multiple layers of paint and filler. The method works by applying heat to a surface and measuring/visualizing the way the heat moves through the material. This allows researchers to identify inconsistencies, such as hidden markings, alterations, or structural features, which would be invisible to the naked eye.

For the Messerschmitt Bf 109, the tail was selected as the primary area of investigation, looking for factory numbers or other symbols from its service history in the Spanish Civil War to later museum paint. The thermographic testing revealed several surprising findings. Notably, the research team discovered 101 overpainted victory markings on the rudder, invisible to the naked eye. The Bundeswehr, which named a fighter squadron after World War II flying ace Werner Mölders in 1973, added these markings when the Bf 109 was loaned out for the occasion.[8] This discovery was particularly interesting as it highlighted how

4) This method is standard in the conservation of paintings and other art.

5) Jacopo La Nasa; Catharina Blaensdorf; Marisa Pamplona; Eleonora Dolcher; Ilaria Bonaducellaria Bonaduce: Historical aircraft paints: Analytical pyrolysis for the identification of paint binders used on two Messerschmitt Bf 109 planes. In: Journal of Analytical and Applied Pyrolysis, Vol. 163, May 2022.

6) https://www.mae.ed.tum.de/en/zfp/home/, April 11, 2025.

7) https://www.iisb.fraunhofer.de/en/research_areas/packaging_reliability/lock-in_thermography.html, April 11, 2025.

objects from the Second World War were repainted to reflect contemporary socio-political attitudes. These results also formed the basis for the decision to preserve the current paint scheme, although it is historically inaccurate.

Left: Measurement setup for lock-in thermography with heat lamps and infrared camera on the tail of the Bf 109. **Right:** swastika and victory markings made visible (frequency: 0.01 Hz). © TUM, Julia Frisch.

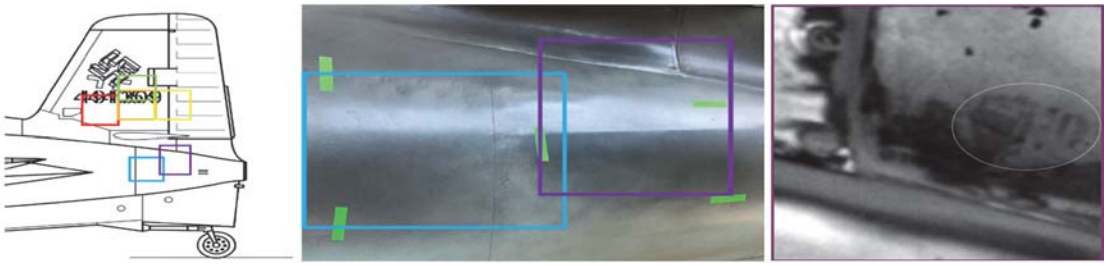
The analysis revealed structural details that had been covered up by previous restoration work, such as rows of rivets, repairs and patches that had been concealed with filler. Also uncovered were parts of the insignia from the aircraft's symbols added in 1960 in Seville prior to the donation of the Plane to the Museum.

"Tiger Head" emblem applied to the aircraft before donation to the Museum in Seville, 1960. (lock-in frequency: 0.1 Hz). © Deutsches Museum / TUM, Julia Frisch.

For the Me 163, the left side of the tail was chosen for analysis. Thermographic results revealed features that were not visible in regular photographs, such as distinctive z-pattern rivets used to place many rivets in a small area without compromising structural stability of the plane. An interesting finding was a metal patch, which was initially suspected to be a repair but later confirmed to be a handflap mounted with screws. Flash thermography also identified excess layers of filler material applied for aesthetic purposes or during repairs,

8) Werner Mölders († 1941) close ties to the Nazi regime were not widely known until much later, and the Bundeswehr changed the tradition name of Jagdgeschwader 74 in 2005.

revealing different types of rivet rows and filler patches. Of particular interest, It is the number “319” that can be identified after the first character in Fig.3. It is not yet clear whether this corresponds to the end of the factory number of the complete plane or whether it is a part number of the sheet metal.



Left: mapping of the tail using historical photos. **Middle**: testing area. **Right:** The white circle marks a number “319” in the top right corner of the purple square. © Deutsches Museum /TUM, Julia Frisch.

The flash thermography results for both the Bf 109 and the Me 163 showed how non-destructive testing methods can help reveal hidden details and historical features that were previously undetectable without damaging the paint. The combination of thermography with other methods, such as microscopic paint and material sample analysis, provided a comprehensive view of the aircraft's layered history.[9)]

3. XXL CT-Scan of the Me 163

Another important partner of the museum is the Fraunhofer Development Center for X-ray Technology (EZRT) in Fürth, near Nuremberg.[10)] As a testing facility for future large scale CT scanners, Fraunhofer aimed to showcase its capabilities by scanning famous objects with cultural significance. Until 2016, XXL (X-ray) CT scans of a T-rex skull[11)] and a historic car[12)] were successful. The next project in 2018 was the scan of the Messerschmitt Me 163. To prepare for the CT scanning process, the aircraft's fuselage and wings were separated and

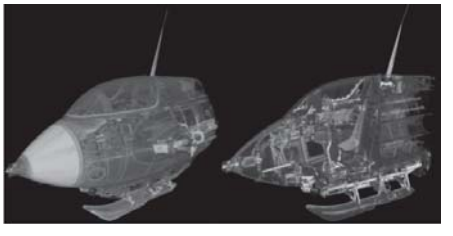
9) Julia Frisch; Catharina Blänsdorf; Philipp Jatzlau; Andreas Hempfer; Christian Große: Lock-in- und Blitzthermographie zur Untersuchung von Lackschichten an den historischen Flugzeugen Bf 109 und Me 163. DGZfP, 2019.; Julia Frisch, Catharina Blänsdorf, Andreas Hempfer, Marisa Pamplona-Bartsch, Christian Grosse: Active thermography to look beneath the surface of a historic German aircraft. 13th ECNDT in Lisbon, 2023.

10) https://www.iis.fraunhofer.de/en/ff/zfp.html, April 11, 2025.

11) https://www.iis.fraunhofer.de/de/ff/zfp/forschungsthemen/kulturgut/Trex.html, April 11, 2025.

12) https://www.iis.fraunhofer.de/de/ff/zfp/forschungsthemen/kulturgut/BMW_Wendler.html, April 11, 2025.; https://blog.deutsches-museum.de/2025/04/04/der-bmw-328-wendler, April 11, 2025.

mounted onto custom-built steel frames.[13] The CT scanning was conducted using one of the world's largest computed tomography systems, developed by Fraunhofer EZRT. Unlike medical CT scanners where the imaging device rotates around the subject, this system rotates the subject itself on a large turntable, allowing for comprehensive imaging of sizable objects like the Me 163. The scanning process involved capturing thousands of individual slices, which were then transformed into a detailed three-dimensional model of the aircraft's interior. This meticulous process spanned several weeks, given the complexity and size of the Me 163. Large scale CT-scans are likely to become more widespread and thereby more accessible to museums in the future. The evaluation of the extensive CT dataset is ongoing. It has so far made it possible to differentiate between original components from those replaced during later restorations. The original version of the plane was also proven to be "Me 163 B-0/R2", and a range of factory numbers was narrowed down. Additionally, the scan provided a comprehensive assessment of the condition inside the fuel tanks, informing future conservation strategies. Even when it comes to exhibition media, the detailed and segmented 3D model based on CT data allows for a more effective explanation of the serious dangers the Me 163 posed to its own pilots—such as through an animation showing the layout of the fuel tanks surrounding the cockpit. Future plans see more interactive media stations as well as virtual and augmented reality applications of the CT Dataset, making it accessible for other Museums with Me 163s on display.[14]



XXL CT images of the Me 163 by the EZRT at Fraunhofer IIS.

13) https://blog.deutsches-museum.de/2019/03/06/size-does-matter-ct-scan-einer-messerschmitt-me-163-komet, April 11, 2025.
14) Gruber, Roland: Reims, Nils; Hempfer, Andreas: An annotated instance segmentation XXL-CT dataset from a historic airplane. Fraunhofer IIS, 2023.; https://www.iis.fraunhofer.de/de/pr/2019/20190321_EZRT_XXL-CT_Messerschmitt.html; April 11, 2025.

4. Aggregat 4 or “V2” Rocket: What to preserve?

In 2015, during renovations, the “Vergeltungswaffe 2” (“Vengeance Weapon”) V2 rocket was temporarily wrapped and left in place due to its size. When the renovation was completed in 2022, it was discovered that the rocket had suffered significant damage from water leakage and corrosion. The damage was particularly evident in the paint layers, which had begun to detach from the surface. The museum now faces difficult ethical decisions regarding the rocket’s restoration. Can the current U.S. paint scheme[15] be preserved? Or is there still an original German World War II paint layer beneath it, as suggested by some areas of the rocket? Given that the Nazi regime used murderous forced labor in the production of V2s, preserving German layers would enhance its historical significance. These questions have sparked intense debate within the museum. A master's student from the State Academy of Fine Arts in Stuttgart has been tasked with assessing and mapping the rocket's condition as a semester project. Using the established thermographic testing, the team also searched for hidden markings on the basis of the student’s mapping, but no significant discoveries were made so far.[16] Another student is currently analyzing paint samples, looking for remnants of German WW2 layers. As part of future student projects, possible conservation methods will be applied in summer 2025.[17]

Left: The complete V2 rocket in the staircase.
Right: Areas of extensive corrosion and paint damage.
© Deutsches Museum, Hubert Czech.

15) This V2 came as a gift from the US in 1955 from White Sands, on the initiative of Wernher von Braun.
16) https://www.ed.tum.de/en/ed/news-single-view-start/article/das-letzte-geheimnis-der-v2/, April 11, 2925.
17) https://www.deutsches-museum.de/en/museum/current-news?tx_news_pi1%5Baction%5D=detail&tx_news_pi1%5Bcontroller%5D=News&tx_news_pi1%5Bnews%5D=449&cHash=4edc7fe3ab76fba32d731a8989eddc1f, April 11, 2025; https://blog.restauratoren.de/das-letzte-geheimnis-der-v2/, April 11, 2025.

5. Fokker D.VII: A gift for Göring?

The Fokker D.VII was Initially believed to be a German-built aircraft from 1918. During crude restoration work in 1980, it was discovered that it served with the Dutch Marine Luchtvaart Dienst until 1937. A complex project emerged, asking the question of whether the plane is illegal Nazi war booty and if it should it be returned to the Netherlands.

The Dutch roundel and number remnants were unfortunately removed shortly after this photo was taken in 1980. It is still unclear whether the white ID number shows “D-28” or “D-20”. © Deutsches Museum.

In 2020, a student from the State Academy of Fine Arts (ABK) Stuttgart employed advanced imaging techniques—such as infrared reflectography, thermography, and microscopy, with the support of Siemens and TU Munich, to delve deeper into the aircraft's color layers.[18] These methods revealed previously unknown identification plates beneath removable cockpit panels, inscribed with "D 28". Other documents strongly suggests that “D-20” was painted on the fuselage. The research team, expanded in 2023 with Dutch experts from the Nationaal Militair Museum in Soesterberg, found out that the plane was likely intended as a gift for Hermann Göring. But was it D-28 or D-20? New evidence shows that D-28 had been intended for a Dutch aviation museum in 1937 and was captured by German forces in 1940. If that is the case, a restitution is likely. The D-20, on the other hand, was supposedly scrapped and therefore presumably legal war booty. As a temporary solution, the Dutch-German research team agreed to loan the plane for five years to the Netherlands, where research and analysis will continue, while telling the planes complex Dutch-German history.[19]

18) Mitscke, Dennis: Master-Thesis, Deutsch oder „Dutch“? - Untersuchungen an der textilen Bespannung und dem Anstrich der Fokker D.VII aus dem Deutschen Museum, München. Abk Stuttgart, unpublished, 2020.

19) https://blog.deutsches-museum.de/2025/03/20/eine-fokker-dvii-fuer-hermann-goering, April 11, 2025; https://www.deutsches-museum.de/museum/presse/meldung/heimkehr-auf-zeit, April 11, 2025.

6. Conclusion

The analysis methods described have been pivotal in uncovering the provenance, authenticity, and condition of some of the most significant aviation artifacts in the Deutsches Museum's collection. They also form a crucial foundation for making informed decisions on ethical restoration practices. The museum not only employs these methods but also actively shares them with the public via dedicated media stations in the new exhibitions, highlighting the work of researchers and fostering collaboration opportunities with external partners. All projects discussed have garnered media attention. University programs like restoration or others with closer ties to the industry like NDT are eager to demonstrate the diverse applications of their techniques.

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DAY 2


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2025 International Conference for Aviation Museum Professionals

[Session 3]

Engaging with Audiences

Rosie Cardiff
Science Museum London, UK

Arianne Richeson
Ingenium / CASM, Canada

Meiju Pax
Finnish Aviation Museum, Finland

2025 International Conference for Aviation Museum Professionals


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Session 3

Understanding and engaging online audiences at the Science Museum Group

Rosie Cardiff | Head of Digital and Web, Science Museum London, UK

The Science Museum Group's mission is to inspire futures through the creative exploration of science, technical innovation and industry, and how they made and sustain modern society. The Science Museum Group (SMG) comprises:

- The Science Museum, London
- The Science and Industry Museum, Manchester
- The National Railway Museum, York
- Locomotion, Shildon
- The National Science and Media Museum, Bradford
- The Science and Innovation Park, Wroughton

Together, these museums receive over four million visitors a year. The Science Museum Group cares for an unparalleled collection of over seven million items related to science, technology, engineering and medicine, including:

- 140,000 medical items, including the long-term loan of the Wellcome Collection
- 38,000 items relating to railway locomotives, technology and railway life
- 26,000 scientific instruments
- 17,000 items of photographic, cinematographic and televisual technology
- 7,000 artworks

Highlights include, Charles Babbage's drawings, Dorothy Hodgkin's model of penicillin, Helen Sharman's spacesuit, Tim Peake's spacecraft, Amy Johnson's Gipsy Moth aircraft, and famous locomotives from Stephenson's Rocket to Flying Scotsman.

The Science Museum Group aims to engage audiences more deeply with the ideas, stories and people embodied in our collection. In 2017, we relaunched our online collection website, publishing over 282,000 objects and archival records online. Following a digitisation programme, this has now grown to around 500,000 objects and 50,000 archival documents published online, 250,000 with an accompanying image. Consequently, visits to the Collection Online website have increased significantly, and it now receives approximately 1.6 million visits per year.

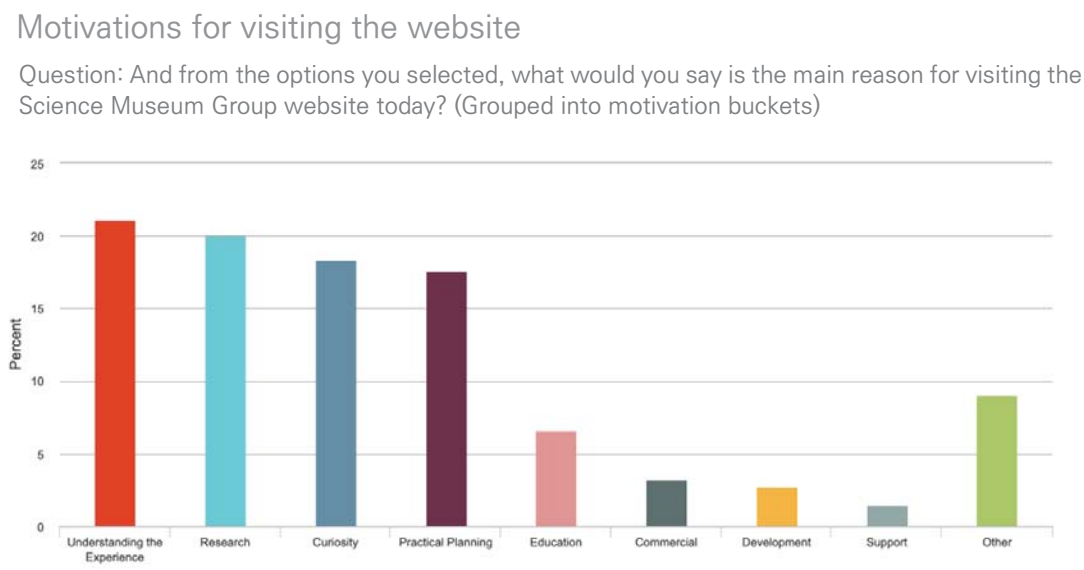
A key strand of our digital strategy since 2015 has been to build upon the online collection to engage a global audience. The SMG Digital Strategy 2015–17 outlined our ambition to develop narrative content that would 'tell the stories of how the modern world was shaped by the areas covered by the collection through narrative–based content'. The updated Digital Strategy 2018–21 highlighted the need to increase audience reach and to 'engage audiences in the people–centred stories that the objects tell'.

This led to the development of a content strategy based on online storytelling to bring our collections to life. Each museum website has an 'Objects and Stories' section, which is the home of compelling collections–rich content. 'Stories' are visually engaging long reads that showcase curatorial knowledge and add context to the objects from the collection.

This content strategy was underpinned by extensive research into our digital audiences. Between 2020 and 2022, the Science Museum Group took part in the Insight for Change project, coordinated by digital experience experts, Frankly Green & Webb. The Insight for Change project arose from the challenges faced by the cultural sector during the COVID–19 pandemic and brought together a group of cultural organisations in the UK and the USA. A better understanding of our online audiences allowed us to be more strategic in our approach to digital content and delivery, particularly during museum closures. The research consisted of an online survey that was available on all the museum websites as well as via the online collection. A separate survey was also promoted on the different museum social media channels. The surveys ran twice. During the first survey in late 2020, some of the museums were closed due to the pandemic. The second time the survey ran was in 2022 when all the museums had fully reopened.

The research showed that most of the survey respondents were local – generally living near one of the museums in the group, and 67% of respondents had visited one of the museums before. In addition, 92% of our social media audience live in England. Our online audience is also highly educated with 72% or our web audience and 85% or our social media audience having completed a degree or higher level of education. This presented a challenge, as SMG aimed to use its digital channels to diversify its audience and reach a broader demographic. In particular, one of SMG's strategic aims is to reach people with low science capital, enabling more people to engage with and participate in science, technology, engineering and maths (STEM) and to bring greater diversity to the type of people who participate in and contribute to science and innovation. However, the research showed that our digital channels, especially social media, were mainly reaching people who already had a high engagement with STEM and the museums themselves.

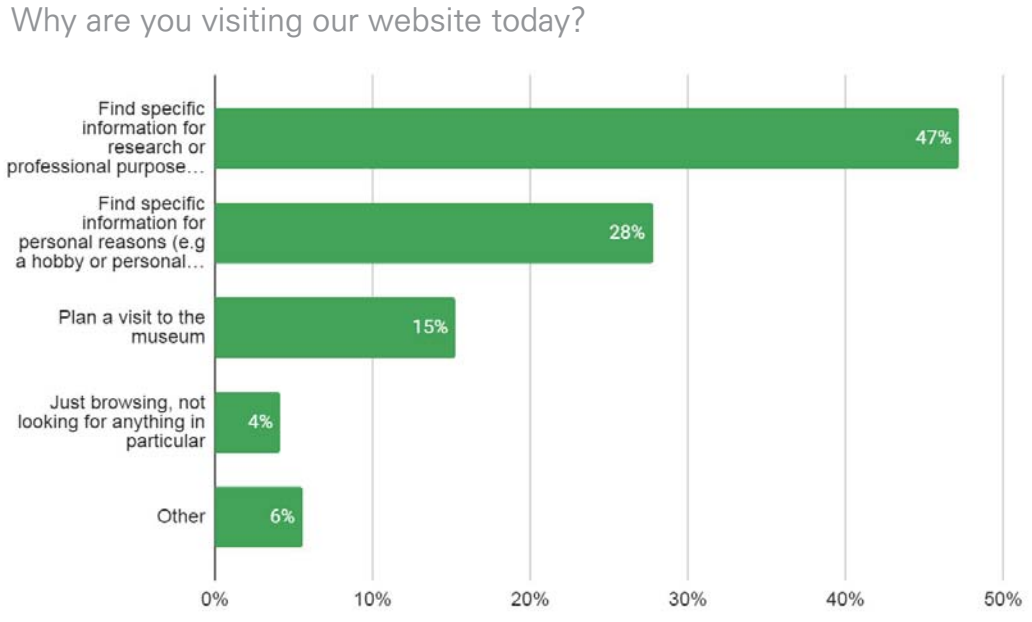
The Insight for Change research also investigated what motivated people to visit SMG websites. This showed that 20% of our website visitors were motivated by research – detailed investigation of a subject or object in the collection. This included formal and informal research. A further 18% of our website visitors were motivated by curiosity. Participants in this group explored topics and objects in a more casual, less in–depth manner than researchers.



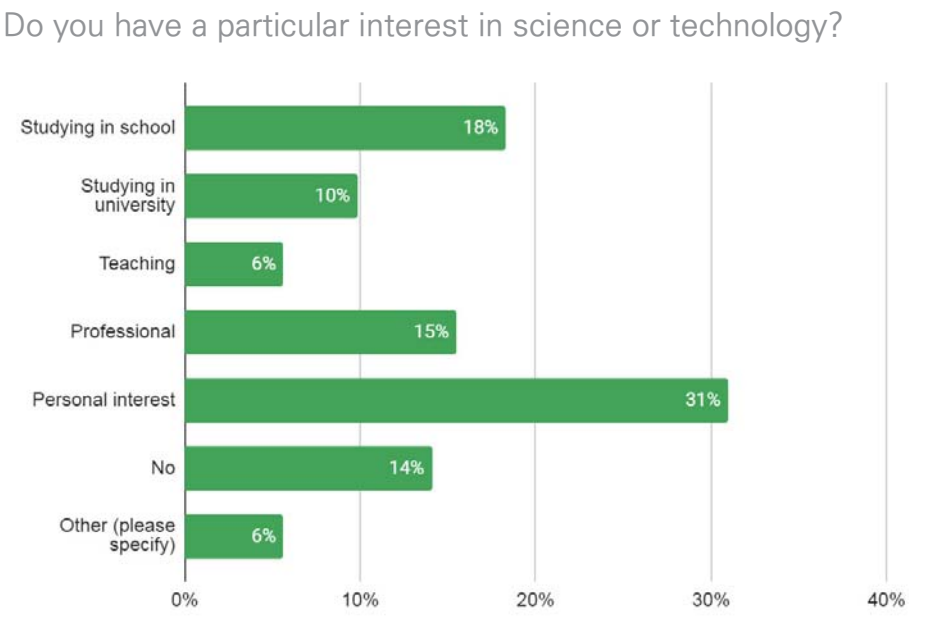
Breakdown of motivations for visiting the SMG websites

Within the group motivated by curiosity, nearly 70% were checking a fact or answering a question. This presented an opportunity to reach people who were not specifically looking for SMG content but were searching for topics based on their own interests. We hoped to target this enquiry–led audience through the online stories.

In addition to the Insight for Change project, we conducted our own online survey to investigate why people were specifically visiting the Objects and Stories section of the website. The results showed that 47% of visitors were finding information for research or professional purposes and 28% of visitors were looking for specific information for personal reasons such as a hobby or interest. The survey also showed that 80% of the visitors to the Objects and Stories section had a connection with science and technology. This ranged from studying STEM subjects at school to people with a professional interest but again there was a large group (31%) with a personal interest in the subject.



Summary of motivations for visiting Objects and Stories

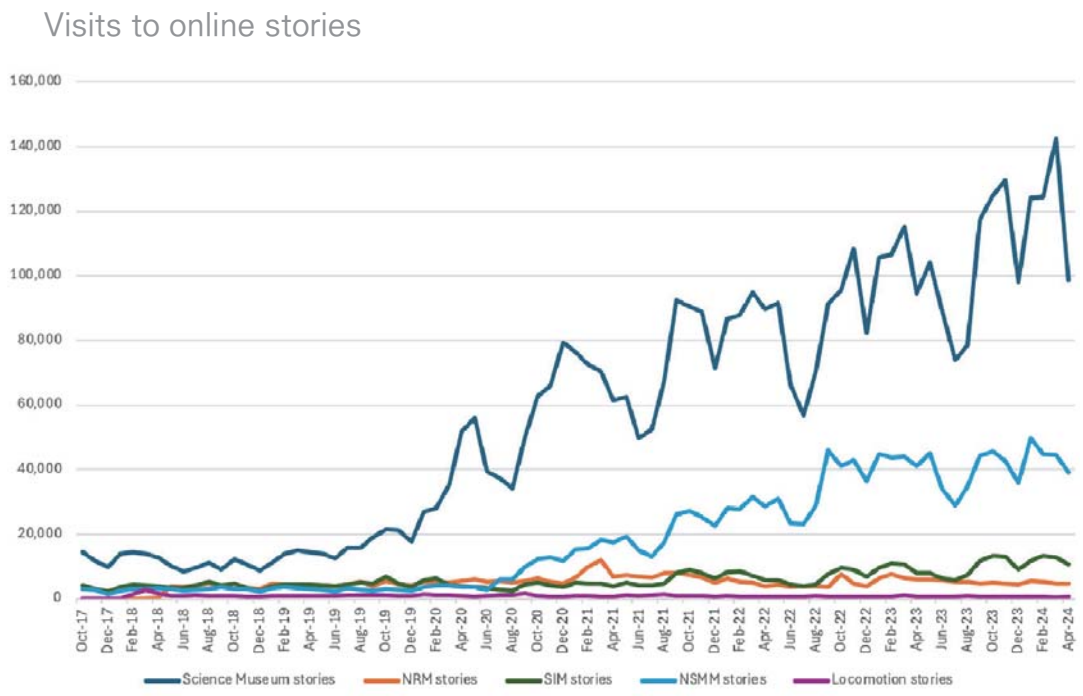


Summary of online audience interest in science and technology

More recently, in 2024 we conducted a survey on the online collection website to understand the motivations for people visiting this area of the website. Many respondents were looking for information or images for personal hobbies or interests (28%) or to find information about a particular object (26%). In addition, the desire for further information on objects, such as historical context and stories, received the highest interest when presented with a list of potential new features.

This research has shown that rather than having a passive audience who come to our website to browse stories, our audience is driven by a question on a topic or theme. They are bringing their own starting point and looking to us — as a trusted source — to provide an answer or open a gateway to more information.

Since embarking on our content strategy around online storytelling, SMG has published over 200 stories on subjects as diverse as 'how was penicillin developed' to 'the technology used to broadcast the moon landings'. The online stories have driven considerable traffic to our websites with some of the most popular stories receiving over 100,000 views per year. Around 78% of visits to the online stories are from outside the UK, indicating our success in reaching a more global audience.



Growth in visits to online stories for each museum

Building on the success of the online stories, in 2022, SMG updated its Digital Strategy 2022–24 to focus on reach. The strategy states that 'SMG will make a step change in the scale of its mission delivery by addressing a global digital audience through a new content strategy that is grounded in the principles of science capital and focused on video content for adults and children.' This new editorial content strategy would be audience centred, repeatable and optimised for discovery via search. The new video content would bring SMG's collection and STEM subjects to life as well as being targeted at well-defined audience needs.

In 2023 the Science Museum Group launched the Delivering Digital Reach project with the ambition to deliver this new, video-led digital content strategy based around standalone, episodic videos published on YouTube. The project aimed to grow our audience on YouTube by two million views over a two-year pilot and establish the capabilities and approaches for sustained growth.

The project has four key objectives:

- Be the catalyst for transformational increase in reach and digital delivery of SMG's mission by piloting a new, video-led digital content strategy that addresses audience needs and delivers SMG's mission to remote audiences.
- Evaluate short-form narrative video formats and linked online stories, establishing the most effective content formats, and methods for optimising discovery.
- Develop curators' skills to engage remote audiences with SMG's topics and themes on YouTube and through online stories.
- Establish capability and processes for ongoing growth in digital reach and impact beyond the pilot project.

The project set out to deliver 60 videos and 20 online stories over two years with the target of growing our annual YouTube views from 2.7 million in 2023 to 4.7 million in 2025 as well as increasing subscribers from 76,000 to 146,000. The project would establish a test-and-learn methodology for content format development and investigate new approaches to search optimisation, targeted marketing and algorithmic recommendation.

The project is now in its second year and has delivered:

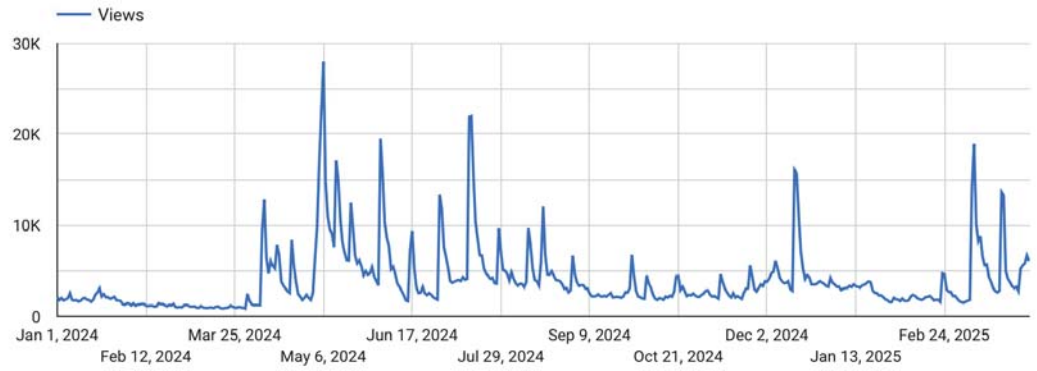
- 22 videos on the National Railway Museum YouTube channel
- 9 videos on the Science Museum YouTube channel
- 18 accompanying online stories across our museum websites

The new video-focused approach has had more success on the National Railway Museum YouTube channel where we have a global audience of passionate specialists who are enthusiastic about railway content. The audience is predominantly male (89.3%), with 52% being over the age of 45 and based primarily in the USA and UK. They are an incredibly active, knowledgeable and engaged audience.

Since releasing regular content on the National Railway Museum YouTube channel from April 2024, we have seen a steady increase in views and subscribers, with the channel recently reaching 50 thousand subscribers.

Views	Total Watch Time ...	Average Watch Time	Average View Percen...	New Subscribers
1,814,714	176958:32:39	00:05:51	39%	15,653

1 - 1 / 1



Number of views on the National Railway Museum YouTube channel

The National Railway Museum audience has a strong connection with the subject matter and is very engaged with the channel, the curators and the collection. Viewers frequently comment on the videos and provide input on what they would like to see on the channel. Initially the project team produced videos around topics that the audience was familiar with, focusing on large railway vehicles, but more recently they have diversified into videos around the material culture of the railways. We plan to continue experimenting with different formats and responding to audience suggestions. The channel is now monetised, generating revenue through YouTube ads and promoting related products in the online shop. We plan to explore further opportunities for monetisation as part of the project.

Achieving similar growth and engagement on the Science Museum YouTube channel has proved more challenging. This is partly due to the varied nature of the collection with videos covering diverse topics from memento mori objects to electric cars. This variety and breadth make it difficult for the YouTube algorithm to identify the correct target audience for these videos, leading to sporadic bursts of activity but not sustained growth. In response to this, we plan to create a series of videos dedicated to a specific topic (e.g. space exploration or medical history) to see if we can target an audience with a deeper connection to the subject matter. We are also planning to experiment with different formats such as shorts and animation.

The successes of online stories and the National Railway Museum's YouTube channel demonstrate the power of connecting with passionate, global communities. While challenges persist, particularly in reaching diverse audiences and achieving consistent growth on broader topics, the commitment to experimentation and audience engagement remains strong. As the Science Museum Group moves forward, it will continue to leverage its unique collections and curatorial expertise to ensure that the stories of science and innovation resonate with people around the world.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Session 3

From Hangars to Hashtags

Arianne Richeson | Officer of Marketing and Communications, Ingenium / CASM, Canada

Today, I'll be talking about how, at the Canada Aviation and Space Museum we engage with our audience—particularly online—and what we have learned about building meaningful digital connections. In this presentation, I will discuss:

- Strategies we use to captivate and grow our digital communities
- How user-generated content and interactive campaigns help foster deeper engagement
- And some lessons we've learned along the way

1. The Digital Landscape of Aviation Enthusiasts

To begin, I'd like to give a brief overview of the Canada Aviation and Space Museum and its audiences. As Canada's national museum of aerospace history, this institution is home to one of the most extensive collections in the world, with stories that span early flight, military aviation, bush flying, and space exploration.

Our audiences are passionately engaged with our collections. Many have a personal connection to the subject matter. They themselves, or family members may have flown as civilians or in the military, sometimes in the very aircraft that are on display in the museum. Many in our audience are professional or amateur historians- with a knowledge of aviation and space history that rivals some academics. This is a community that is highly informed and invested in the subject matter. This presents both opportunities and challenges.

On one hand, we have an audience eager to connect and celebrate our subject matter. Yet we must be thoughtful in our content—because this is a community that will quickly spot inaccuracies, and they care about how this topic is represented.

We also have the added challenge that we are not only developing content for the "avgeeks" as they are lovingly self-described, but also for people who know next to nothing about the subject matter. We must consider how to engage our most passionate devotees without alienating potential new visitors.

In addition, the museum has been seeking to evolve the stories it tells, to represent a diversity of perspectives. This too, adds another layer of opportunity and complexity.

As a national museum in Canada, we must also respect the need for bilingualism and accessibility. In negotiating all these objectives and expectations we have utilized several key strategies for engagement.

2. User-Generated Content (UGC): Building Community Through Shared Experiences

One successful strategy has been encouraging visitors to share their own photos and experiences of the museum. These images tend to be more authentic and highlight diverse visitor experiences.

They are featured within the museum, as well as in promotional materials. These images often outperform professional photos in terms of engagement, demonstrating the power of personal connection.

During the development of our recent exhibition, The Cold War, we launched a call to the public for photographs capturing everyday life on European RCAF bases during the Cold War. We asked for images that showcased family and community moments—school photos, sports and scouting activities, and candid shots of home life. The team's goal was to complement the broader historical narrative with personal perspectives that resonated on a human level.

We received a range of images. Some of these photos became a part of the exhibition and we used many of these community-submitted images in our promotional efforts.

3. Immersive Experiences: Bringing the Museum to Life

Another way we have deepened engagement with our audience is through immersive storytelling—content that makes followers feel like they're stepping behind the scenes, or even into the cockpit.

Behind-the-scenes access is one of the most effective ways to foster this connection. Whether we share footage of our conservation assistant dusting aircraft wings, or of the items in our library and archives, this kind of content invites people into spaces they wouldn't otherwise see.

We have also shared the incredible work of our conservation team. We receive strong engagement on posts of conservation staff or volunteers working on an aircraft. These are slow detailed processes, but through videos, we can bring them to life in seconds.

One of our biggest successes came during what we affectionately called the Buffalo Shuffle —months of aircraft movements, captured in time-lapse as we repositioned aircraft. These videos offered a sense of movement not often seen by visitors.

Aircraft POV videos are another tool to bring our audience into the action. From the perspective of a plane being moved into the museum, to the rapid disassembly of the Stearman Speedmail, these views give followers a sense of being there with us.

Perhaps most popular are short videos that take viewers inside the aircraft. These are not professionally filmed —they're often quick clips or photo montages—but they consistently spark the most interest and conversation. People recognize the aircraft they once flew in, trained on, or saw in service, and they love sharing their memories.

And on a different note, we recently experimented by strapping a GoPro camera to young person and capturing her POV as she explored the museum. It was a playful way to show the space through a child's eyes. Sometimes, fresh perspective means just lowering the camera angle.

These posts do more than just entertain—they build curiosity, and a sense of access that transforms followers from observers into participants.

4. Going live on social media: Connecting Audiences with Experts

Instagram and Facebook live have helped us to connect directly with our audiences by offering real-time engagement with some of our incredible colleagues and with guests beyond the museum walls.

At the museum, we're fortunate to have a team of knowledgeable professionals who are eager to share their expertise. We have hosted Q&A sessions with our science advisor, who has spoken about topics ranging from the arrival of a new Mars rover to the significance of the spring equinox.

Our curators have also gone live to highlight hidden gems from the collection, share the stories behind iconic artifacts, and even lead live virtual tours of exhibitions.

These platforms have also allowed us to speak with guests with new perspectives. We have talked to a pilot who runs a flight school for people with disabilities as well as the first Deaf person to achieve orbital spaceflight.

5. Sparking Engagement Through Interactive Content

Some of our most successful online interactions come from inviting our audiences to actively participate—rather than simply observe.

One of our most consistently popular posts is where we invite people to 'guess the aircraft'. We share a close-up photo of an aircraft and challenge followers to guess its identity. It's low-effort but high-return. It taps into the expertise of our aviation-savvy audience, while also educating newcomers.

We also align our content with key milestones. For example, on the anniversary of the Avro Arrow's rollout, we might share rare photos, archival footage, or a curator's perspective. These posts connect to both Canadian identity and international enthusiasm.

And speaking of the Avro Arrow, nothing generates more engagement than a little controversy. Mentioning a contentious issue can be a great way to fan the flames of enthusiasm. Then it's just a matter of ensuring those flames don't get out of control!

Together, these strategies help transform our social platforms into spaces of dialogue, knowledge exchange, and collective enthusiasm for aviation history and innovation.

6. Hosting an Instagram Meet-Up: Inviting Fresh Perspectives

To promote our Cold War exhibition, we hosted an Instagram meet-up, inviting local content creators and photographers for exclusive access to our museum. This low-effort, high-impact initiative resulted in a wealth of visually stunning content that was shared organically with each participant's (sometimes substantial) following.

This approach provided several key benefits: extended reach into new, engaged audiences, fresh takes on our exhibition from a variety of visual styles, authentic promotion from trusted voices in the local community.

By offering a behind-the-scenes opportunity, we generated buzz around the exhibition, and also strengthened relationships with local creators—turning them into ambassadors for the museum.

7. Case Studies: When Engagement Gets Complicated

As rewarding as online audience engagement can be, it doesn't come without its challenges. I want to share three case studies that illustrate both the complexities and the potential of this work.

The Signature Campaign That Wasn't

Many of the aircraft in our collection feature signatures from the final crews who flew them—a unique, human touch that seemed like the perfect storytelling opportunity.

We had the idea to invite the public to reach out if they—or a family member—had signed one of our aircraft. The plan was to confirm the signature, share a photo of it online, and tell a small story behind the name.

It seemed like a great way to personalize the collection and connect directly with our audience. But despite our best intentions, the idea never made it off the runway.

Why? Some of our staff were understandably concerned that promoting signatures might unintentionally encourage others to write on aircraft, compromising conservation protocols. Even more unexpectedly, questions arose about privacy—specifically, whether publishing a name and signature online could open the door to identity theft or other risks.

These were valid concerns—ones I hadn't anticipated. And they ultimately led us to shelve the idea.

This case study is a reminder that even good ideas must be weighed carefully against ethics, security, and institutional policy. It's a balancing act—between creative engagement and responsible stewardship.

Paper Planes and Portal Jumps

While not all campaigns succeed, some soar higher than we imagined—and often, it's the playful, staff-driven content that really takes off.

We've had success with a series of reels that tapped into social media trends, and used the right touch of whimsy to capture attention.

Reel 1: The Paper Airplane Journey
A paper airplane glides through the museum, looping around the front desk, passing key exhibits, and flying by collection highlights. It was lighthearted, simple to film, and staff had fun helping to choreograph its path.

Reel 2: Reserve Hangar Jump Cuts
We built on the trend of transition videos—our guides appeared to "jump" through the museum and land in the Reserve Hangar, showcasing our behind-the-scenes tour offerings.

What made these successful? Staff enthusiasm—they brought personality and creativity to the process, and whimsy—audiences responded to the lighthearted tone and the unexpected approach to museum storytelling.

The result: These videos were some of our most viewed and most shared content, proving that fun, informal content created with internal champions can make a big impact.

Highlighting Hidden Histories

Our museum—like many—has traditionally centered its narratives around well-known figures and milestones in aviation history. But over time, we've been working to tell more inclusive stories.

Our recent exhibition, The Cold War offered an in-depth look at the Cold War but also included stories not often told—including those of Rainbow Veterans: individuals who were purged from the Canadian military during the Cold War because of their LGBTQ+ identity.

We featured several social media posts of these powerful and painful stories, highlighting the resilience and courage of those affected. These posts were widely shared, and we hope, struck a chord with people who may not have previously seen themselves reflected in our museum's narratives.

These cases reflect the range of possibilities—and pitfalls—that come with creative audience engagement. Whether an idea needs to be rethought or becomes a success, we learn from each experiment.

8. Conclusion: Building Meaningful Connections in the Digital Space

At the heart of everything discussed today is one core idea: audience engagement is about building relationships. Whether we're showcasing behind-the-scenes conservation work, sharing personal stories, going live with our curators, or celebrating user-generated content —our goal to create moments of connection, curiosity, and community.

The Canada Aviation and Space Museum exist to preserve and share Canada's aviation and aerospace heritage—but that story doesn't live only in our hangars. It lives in the memories and experiences of our visitors—on-site and online.

Digital platforms give us an opportunity to bring our collection to life in new ways, invite dialogue, and reach audiences far beyond our physical walls.


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Session 3

Lifting Aviation Museum Exhibits to New Heights with Customer Data and Participatory Workshops

Meiju Pax | Exhibition Producer, Finnish Aviation Museum, Finland

How to collect relevant customer data for exhibit development and design? Can customer data help in designing aviation museum exhibitions? How can information collected in participatory workshops improve the exhibits?

In this article I will go through a case study of how we collaborated with our customers at the pre-planning phase of the New Aviation Museum project. At first, I will briefly introduce the Finnish Aviation Museum and the big changes it is facing. After that I will tell what we focused on when collecting ideas regarding the new exhibitions and followed by, how we are utilizing these ideas and information in pre-planning a new exhibition. Finally, I suggest a recipe how one can create own experiments on the possibilities of participatory workshops in the exhibit development.

1. The Finnish Aviation Museum briefly

The Finnish Aviation Museum is located in Aviapolis Area, the city of Vantaa, near the Helsinki-Vantaa Airport. The Association of Aviation Museum was established in 1969, and it opened its first exhibition in Helsinki-Vantaa airport in 1972. Nowadays the Foundation of Aviation Museum is responsible for running the museum. The first part of the current museum building was opened in 1981but no longer meets the contemporary criteria to store our collections and exhibitions: almost all the museum's 82 aircrafts are presented in the unheated exhibition halls, so there is no room to make modern exhibitions. The museum reached over 50 000 annual visitors last year (2024).

2. The Big Change – New Aviation Museum

The Finnish Aviation Museum is currently undergoing a tremendous change – it is constructing a new museum building to the block next door, moving its collections and creating a new permanent exhibition. The project started officially in the Spring 2024, but the idea of a new museum has been growing since the early 2000´s. Due date for the new museum is late 2027 – early 2028.

The Finnish Aviation Museum´s strategic mission is to expand understanding of aviation. We want to display the versatility and the significance of aviation in and for Finland. To do that, we are not able to showcase our entire aircraft collection in the new museum – we want the new museum to be more accessible and story-based, not just "open storage exhibition".

One of the museums core values is communality. How to keep our stakeholders and audiences with us in this change? The museum conducted surveys and workshops during Autumn 2024 and Winter 2025 to gather opinions and preferences, from both visitors and non-visitors, heavy users, and visitors who are not yet interested in aviation. What are the expectations and wishes for the new museum and its exhibits? This article focuses on the information collected regarding the exhibitions.

3. Multiple ways to collect data and ideas

The museum´s customer service team created an online survey. The online survey link was shared in museum´s different social media sites, official websites and newsletter. QR-code was provided to the museum visitors to participate. The survey received 305 responses in total, and it was open for four months. The customer service team also went to various shopping centres, libraries, and the Helsinki-Vantaa Airport to reach the non-visitors. A total of 615 people were interviewed during these surveys, of which 53,3% had never visited the Finnish Aviation Museum before.

The customer service team also arranged workshops for local residents and corporate clients, who rent the the museum´s meeting premises. The museum visitors could share their ideas by writing to a piece of paper what one would like to experience, see and learn in the new museum, and put the papers on a box in the museum´s entrance hall.

Hilla Leikas in Helsinki–Vantaa Airport. Photo: Zulayho Farhodova.

The online surveys were partly traditional customer surveys including questions like "what´s the main reason to go to museums" and "with whom you commonly visit the museums". Thoughts about the new museum were also asked. There was a one question focusing specially on the exhibitions.

The data from the surveys shows that visitors desire interactive exhibits, simulators, possibilities to experience the old planes, opportunities to learn about the history and future – often together with their loved ones. On the other hand, heavy users also wanted to see even more aircrafts and get new aircrafts to museum´s collections.

So, the customer data tells us that many visitors want to also experience something else than just the aircrafts. That led us to re–think how we tell stories, whose stories we tell and what are the meaningful storylines in the aviation history?

Another outcome was information about different visitor groups and what kind of things they wish for their whole visit to an aviation museum. The work with the visitor identities of the new museum is currently on–going by the customer service, audience development and communication teams.

4. Participatory workshops for volunteers

The museum was originally founded by group of volunteers. Today, the volunteers participate in different functions of the museum as guides and simulator instructors, participating in aircraft restoration and archival work as well as assisting in the Museum's events and operating the Museum´s hot air balloon. The relationship between volunteers and the museum is close and we want it to remain so during this change.

The volunteers are also all already interested in, committed to the topic of aviation, or at least have knowledge about some areas of aviation. Through them it is therefore possible to get deeper insight to the content than in the online survey or workshops with other groups.

To find out more about the volunteers' thoughts regarding the content of exhibitions we arranged four participatory workshops. To increase the accessibility made online form with same topics as in the workshops. There were even scheduled call times with the exhibition producer to discuss the same topics. Surprisingly, no one made a call. There were 37 participants in the workshops and 27 left their thoughts via online survey.

In the new museums concept, it was defined that new museum will broaden the understanding of aviation and highlight the significance of aviation. That´s why the focus on the workshops was to find out, what the volunteers think is the most important thing to understand of Finnish aviation history.

There was also already a strong will to highlight the people of aviation in the new exhibition, so we also asked whose stories the volunteers would like to hear. And of course – as the aircrafts are at the core of aviation museums – we asked what aircrafts they would like to see. The participants were instructed to focus on their own point of view – what they would love to see. There were individual tasks and tasks to do with a pair, and then discussion with the whole group.

We had created a baseline of what the new exhibition would focus on, and from it we formulated the structure for the workshops. We focused on asking what to tell, not how to present or represent. There was also time for open discussion, during which there popped out a lot of ideas answering the question how to, as we expected it would.

The material that we got was useful. It confirmed some of the topics that had already been discussed to be important. For example, why do the early Finnish Air Force aircraft have a swastika as their emblem, the history of Finnish Aviation Museum or the lesser-known professions in aviation such as test-pilots and mechanics. The safety culture of aviation was also one large topic.

Through the workshops we also hoped to communicate to our volunteers that our new exhibition would be based on stories rather than just aircraft. There were emotions linked to that, some aviation enthusiasts just want to see the aircraft and might think that everything else could be found in books. The power of hearing other´s thoughts was also remarkable: there were moments that some participants understood that it would not be a financially sustainable way for the museum to continue only showcasing the aircraft. There were also interesting discussions among the mostly elderly participants on what kind of things would interest children and young people.

5. Utilizing the thoughts and ideas

From online surveys we got hundreds of views of what we should display in the new museum and what to experience in the exhibition. Simulators, interactive exhibits, experiencing the exhibition together with friends and family, various ways of representing the content were often wished for. It created a checklist for the exhibition development.

- Interactive exhibits: Do we have interactive exhibits, and how many? Are they designed to be experienced alone, together with a pair and/or in small groups?
- Touch, feel, hear: What can the visitor experience with different senses?
- Simulating the feeling of flying (In how many ways can we achieve this?)
- Aircraft: Can visitors take amazing pictures? Can they see inside? Can they even go inside? Can they understand, what does it stand for in the aviation history?
- Other objects, photos and videos among aircrafts: Are they balanced and related to each other, telling the same storyline or another point of view in the same story?
- Easily readable texts: Can the visitor get the big picture? Can the visitor get more detailed information if wanted?
- Testing your skills: How many different professionals there are represented to relate?

- Accessibility: Is all this accessible for different visitors with different ages, backgrounds and abilities?

From the content workshops and "paper and pen"–box we got material:

- list of people, whose stories the enthusiast would like to hear
- list of aircraft the enthusiasts would like to see
- list of aircraft the people who had visited the museum would like to see
- list of aircraft that are not (yet!) in the museum´s collection
- list of topics and stories that would be important to tell from the aviation history of Finland
- list of topics and questions that the people who had visited the museum would like to understand

For further planning all the insights were put in one document guiding the exhibition planning and presented to the whole project team. The knowledge gathered is now one ingredient when constructing the new exhibition. One thing that is still on to–do list is to find out the most relevant way and interesting topic to invite the enthusiasts developing something further together with the museum experts.

6. Conclusions?

The data gathered confirmed that there are differences between the hopes of various visitor groups. For example, new visitors desire more interactive and experimental exhibits, enthusiasts a bit more traditional aviation museum, but both are willing to learn about history. We believe it is possible to serve both in the future.

We collected a lot of material: data for the visitor identities, checklist for visitor experience and lists for creating content. The surveys and workshops also raised awareness about the new aviation museum: over 1000 individuals were engaged.

Next we continue developing the exhibition with the design team. In a few years, the results will be proudly presented in the New Aviation Museum. We are more than happy to invite you all to visit and experience the results with your own hands and heart!

Could customer data and participatory workshops be a tool to transform your museum to new hights?

7. A suggestion for your own experiments to engaging audiences

Find out your core. What are your plans for the exhibitions? What type of input or material could be beneficial to your project?

Define the audiences, whose answers you need to hear. Where and how you can find these audiences?

Define the input you require. Quantitative data or more in-depth qualitive analysis?

Allocate resources for the project.

Plan the action.

Act!

Analyze the data and incorporate it into your design process.

Learn from the process. What could be done differently next time?

Is there a way you could invite the audiences to develop something further together?


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[Session 4]

Experiential Learning in Aviation Museum

Arthur Bednar
Museum of Flight, USA

Michelle McMahon
Wings Over the Rockies, USA

Terry Michael Slobodian
Royal Aviation Museum of Western Canada, Canada

Dongun Gwon
National Aviation Museum of Korea, Korea

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Session 4

Building Pathways and Career Connections: The Museum of Flight's Education Continuum

Arthur Bednar | Senior Program Manager, Museum of Flight, USA

The Museum of Flight is the largest independent, non-profit air and space museum in the world. With over 175 aircraft and spacecraft, tens of thousands of artifacts, millions of rare photographs, dozens of exhibits and experiences and a world-class library, the Museum and its people bring the incredible history of aerospace to life. Its vision is to inspire all through the limitless possibilities of flight, sparked by a singular experience or a lifetime connection. Currently, we are embarking on an ambitious transformation plan, known as Vision 2050. Integral to this vision, the Museum's education goal is to change the lives of school-aged learners, their communities, and the workforce to which they will contribute through our educational programs and experiences. To do this, we are building academic pathways and career connections using a three-phase process – inspiration, exploration and preparation[1]. This is The Museum of Flight's education continuum.

1. Inspiration Starts Here

Museums and science centers have always played a pivotal role in education. They are positioned to allow people to see and learn about the world around them through unique and hands-on experiences. For example – my local childhood museum, The Museum of Science and History in Jacksonville, Florida, introduced me to topics and ideas that shaped my future. That opportunity to inspire a person and spark their curiosity is the foundation for The Museum of Flight's education continuum.

1) An individual' s path through the three phases needs not be linear nor consecutive. Each phase is designed to allow students to enter, or exit based on their interests, goals and academic trajectory.

To visualize the continuum, it is helpful to tell the story through the experience of a hypothetical individual. We'll call her Mona. Mona is one of 17,000 different students that will attend a school field trip at the Museum annually. Her fifth-grade class is part of a hands-on workshop in the Aviation Learning Center, one of the Museum's flagship educational program spaces. For two hours, Mona receives a glimpse into the day in the life of a pilot. She begins with interactive lesson on flight dynamics, collaboratively working through hands-on experiments with a classmate. From there, she and her classmate complete a preflight check on our Cirrus SR-20 and a flight plan for a pre-determined route through the region. Then, Mona takes what she learned and pilots a Cirrus SR-20 in our simulator bay. Finally, Mona spends her remaining time at the Museum on a self-guided Museum Exploration with her class. While touring the Museum, she visits the Alaska Airlines Aerospace Education Center and learns about a variety of exciting opportunities, including Aerospace Camp Experience (ACE). Mona cannot wait to tell her parents about her day!

Aviation Learning Center students performing a preflight check of a Cirrus SR-20 aircraft

The Museum's Aerospace Camp Experience (ACE) is an award-winning, weeklong summer day camp for kindergarten through 9th grade youth. Each week, campers explore aerospace topics through hands-on experiments, exclusive tours of the Museum, and learn from special guests like pilots, engineers, scientists, and astronauts. Mona, now a rising sixth grader, is signed up for a camp called "Lean, Green, Flying Machines!".

Over the course of the week, Mona – and 19 other 6th and 7th grade campers – will investigate how sustainable aircraft design, engineering, and manufacturing innovations are changing the way humans fly. She learns how truss-braced wing design may create a

solution to sustainable commercial flight and competes in a design challenge to refine and build her own truss-braced X-Plane. She leaves the week having made friends and shared experiences with children her age. After completing a week at ACE, she was enrolled in the Museum's Connections program.[2)]

ACE campers flying in The Museum of Flight's simulator bay

Connections is an educational membership program for students ages 5-18. Through this program, Mona will receive unlimited access to the Museum at no cost and a monthly newsletter highlighting events and educational opportunities until she is 19. This is where she learns about her next exciting experience.

2. Explore More

Programming within the exploration phase provides greater depth in both learning and career connections. The goals are to help students foster interests, build community and expose students to a greater variety of possibilities within aerospace. Mona, now a middle school student, loves space. Through Connections Mona learned about two programs for middle school students like her, Amelia's Aero Club and Michael P. Anderson Memorial Aerospace (MPA) Program. These out-of-school programs run consecutively through the academic year. Amelia's Aero Club is exclusively for middle school girls and centers around personal growth, building community, and exposing students to high-demand aerospace careers. The Michael P. Anderson Memorial Aerospace Program centers around and celebrates the contributions of the Black, Indigenous and People of Color (BIPOC) community to aviation and space. Each program incorporates hands-on aerospace themed workshops designed to strengthen skills and confidence in STEM-related topics. Additionally, students receive

2) All participants that complete a week of ACE and other select Museum educational programming are invited to enroll in Connections.

mentorship from professionals working within aerospace fields, thus providing them with information related to a variety of aerospace jobs and career pathways.

2025 MPA Mentors

MPA students visiting an Alaska Airlines Boeing 737 training simulator

While with her MPA cohort, Mona engaged in a Challenger Learning Center program. This two-and-a-half-hour simulation-based space mission allows the students to become the NASA scientists and engineers with a single purpose – work together to have a successful mission. Mona's specific role with the mission is to build and test a rover that will search for signs of water on Mars. This experience helps her build collaboration and communication skills while also engaging in hands-on engineering tasks. Additionally, Mona's mentor with MPA is a systems engineer at Blue Origin. She tells Mona about her personal experiences and her pathway to becoming an engineer. The opportunity for students to meet and learn from professionals, ones that share similar backgrounds to the students, allows students to see themselves in these career pathways. Mona is hooked and excited to learn more. Through the course of middle school, she stays engaged with AAC and MPA. As she approaches high school, she knows she wants to pursue something related to aerospace engineering.

3. Be Prepared

The preparation phase occurs during the students' high school years. At this time students should be actively investigating post-secondary and career opportunities. The Museum of Flight is uniquely positioned to offer a variety of programs that provide preparatory skills in aerospace sciences and credits for both high school and college. Mona, now a high school sophomore, has found a strong interest in both space and engineering. Knowing that many astronauts are also pilots, she signed up for Private Pilot Ground School (PPGS) between her sophomore and junior year of high school. PPGS is a three-week summer course that provides the opportunity for Washington State rising 9th-12th grade students to explore the fundamentals of being a professional pilot while creating a base of aeronautical knowledge needed to successfully pass the Federal Aviation Administration (FAA) private pilot written exam. Upon completion, Mona received 0.5 high school credits in Career and Technical Education. Additionally, she had opportunities to learn from local aerospace professionals and explore local aerospace companies.

Private Pilot Ground School students attending a "behind the scenes" tour of Seattle-Tacoma International Airport

Entering her junior year of high school, Mona applies and is accepted into the Washington Aerospace Scholars (WAS). This two-phase program is an online course and summer experience designed for students pursuing STEM pathways through the exploration of flight, aerospace design and space travel. Phase one, running November through March, is a fully asynchronous, online course consisting of 8 lessons and a final project.

Each lesson is a blend of online reading, essays, aerospace-based math problems, virtual group discussions, and hands-on labs. Completion of phase one qualifies access into phase two, a six-day summer residency at The Museum of Flight. During phase two students will

get an inside look at the aerospace industry in Washington State through behind-the-scenes aerospace company tours, presentations from science and engineering experts and the opportunity to network informally with professionals. Additionally, WAS students connect with like-minded peers from across the state of Washington and participate in engineering challenges, museum tours and team building activities. An estimated 75% of WAS students pursue STEM degrees in college.[3)]

WAS "green team" presenting at the end of summer residency

Mona successfully completed WAS and received 5 college credit hours through the University of Washington's Department of Aeronautics and Astronautics. She now has a head start having gone through the rigor of a college level course and learned about many scholarship opportunities for her post-secondary studies.

Furthermore, she is now part of an expansive alumni network of people studying STEM related fields in college and professionals working in aerospace industries throughout the United States. She finishes high school and is accepted to college with the goal of receiving a Bachelor of Science in Aerospace Engineering. Nothing can stop Mona now!

3) Washington Aerospace Scholars typically remain in contact for six years via regular surveys and updates. To date, of the over 1,770 alumni who have updated the WAS program on their post-high school pathway, 75% percent report that they pursue STEM degrees; 48% percent specifically in engineering.

4. Intentionality and Access

Intentionality and access are important to the success the education continuum. Through each stage of Mona's (or any student's) journey, the Museum's education team is intentional in presenting future opportunities and resources. This requires a large group of Museum staff and volunteers working towards the same goal – to change the lives of school-aged learners, their communities, and the workforce to which they will contribute – through our educational programs and experiences. During the inspiration phase, opportunities are shared visually and verbally with teachers, caregivers, and school district leadership. This continues during the exploration phase with the addition of in-person presentations and mentorships with aerospace professionals and unique experiences at aerospace facilities. These efforts compound in the preparation phase by adding scholarship and internship opportunities as well as career preparation. Furthermore, it is critical to provide financial access for anyone in need. Every educational program The Museum of Flight offers is at no cost to the student or has easy to apply for financial aid. Reducing barriers to access educational programming and creating a sense of belonging and engagement with the local community is paramount to all work at The Museum of Flight.

As The Museum of Flight embarks on the plan for transformation, Vision 2050, that will direct the focus and work for the coming decades, these are the foundations for goals around intensifying impact in the local community and removing barriers for access. By intentionally creating experiences that act as pathways for students like Mona, the education continuum allows for efforts in connecting youth to opportunities at the Museum and in their community long-term. Museums are a key part of a community's learning ecosystem and by approaching programming in a connected way this role can be amplified and impact students, families, and the broader community more deeply. The past ten years of The Museum of Flight's investment in the education continuum provides one example of the possibilities that exist for museums.


2025
International Conference for
Aviation
Museum
Professionals

Session 4

Wings Over the Rockies Educational Programming

Michelle McMahon | Director of Education, Wings Over the Rockies, USA

Wings Over the Rockies is a diverse community organization dedicated to unlocking our visitors' dreams of flight through exhibitions, events and educational programming at two locations: Wings Over the Rockies Air & Space Museum and Exploration of Flight. Each year these two locations welcome approximately 160,000 visitors representing all 50 U.S. states and 34 countries.

Transferred from the United States Air Force to a group of volunteers in 1994, Wings Over the Rockies Air & Space Museum is located in Hangar 1 of the former Lowry Air Force Base in Denver, Colorado. Today the museum boasts more than 100,000 square feet of exhibit space dedicated to displaying iconic aircraft, space vehicles, artifacts, military uniforms and much more.

Located about 19 miles south of the museum, Exploration of Flight is a 15–acre campus set on one of the busiest general aviation airports in the nation. Through aviation –focused events, programming and exhibits, Exploration of Flight offers an immersive, education experience for those fascinated by flight, and a unique perspective for those already in the industry.

At both locations, Wings features a variety of programming designed to fulfill the Wings' mission "to educate, inspire and excite all people about aviation and space endeavors of the past, present and future."

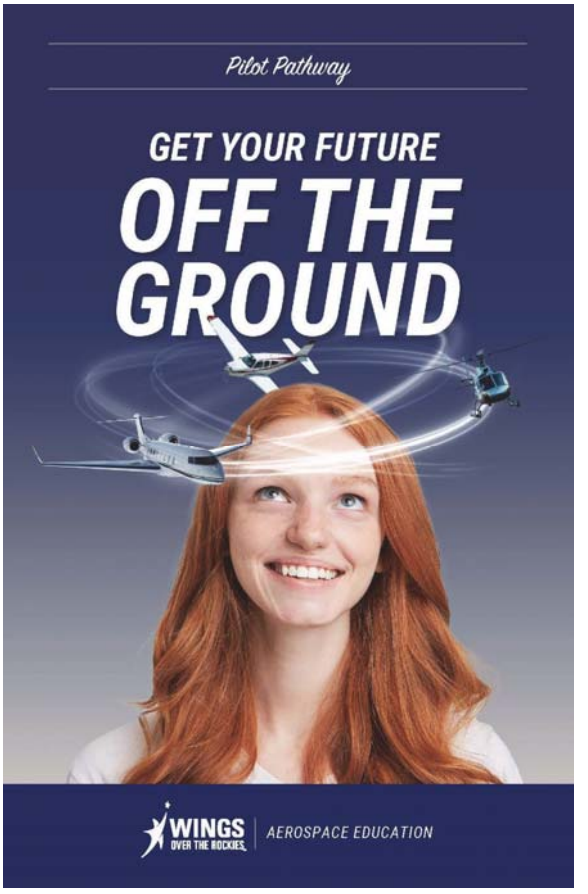
Through a shared dedication to five core values: passion, integrity, teamwork, curiosity and honor, the staff seeks to fulfill a vision to inspire innovation and action for the next generation of aviation and space explorers.

One of the central components to this approach is to offer a variety of pathways to meet the aerospace educational needs of a vast audience in the Denver, Colorado metropolitan area. The Denver area is home to offices for United Airlines, Lockheed–Martin, Blue Origin, Lunar Outpost, United Launch Alliance (ULA), Sierra Nevada Corporation, Astroscale U.S. Inc., BAE Systems, Boom Supersonic, and numerous military air bases and smaller aerospace support companies. In order to help support this large aerospace community, Wings Over the Rockies is dedicated to providing opportunities to help develop the next generation who will fill pivotal roles in the industry.

Wings Over the Rockies currently offers four pathways: Pilot Pathway, Drone Pilot Pathway, Teacher Flight Pathway and Aerospace Exploration Pathway.

Each pathway has an instructor/s who is specialized in their craft. Instructors can be professionals on Wing's staff, volunteers or contract employees. Class size is kept at a 20:1 ratio or less to ensure the ability of the instructor to specifically meet the needs of each student. Each pathway leads students from a beginning level to a more advanced level of knowledge which can culminate with an FAA certification. All pathways are paid for via tuition for the class/program. Students who cannot afford to pay the entire price have their tuition subsidized by a foundation grant.

Here is a brief synopsis of the Wings Aerospace Pathways:



Pilot Pathway
Ages 8–19

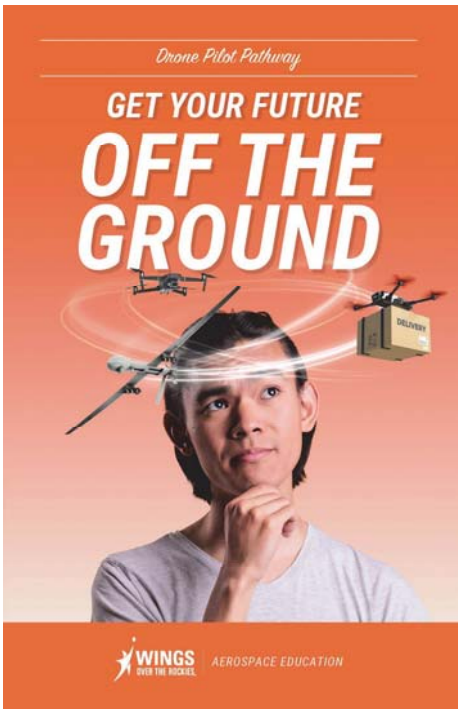
This is a four–stage pathway to get young people on track to pursue a career as a commercial or military pilot.

Young Eagles Flight (Free, in conjunction with Experimental Aircraft Association)

Introduction of Pilot Pathway ($40 for students 8–12) – Basic Introduction into flight controls, navigation, radio communication and the four forces of flight.

Private Pilot Ground School – Offered through the Aerospace Exploration program and area flight schools, this series of classes is designed for students actively seeking to attain their ground school certification.

Flight Training Scholarships (Up to $12,000 awarded to @25 students annually). In conjunction with a foundation that works with the museum, every February, area students are invited to apply for a competitive flight scholarship. This year, 159 students applied to the process and 28 were selected to receive a full or partial scholarship to be used for flight training.



This pathway is a three-week intensive summer class for teens and a 6 – 8 week, twice a week class for adults. It includes the following:

Introduction to Drones, Drone Flight Training, FAA Part 107 Preparation and Making a Living as a Drone Pilot. The goal is to get students competently flying a variety of drones, and getting them prepared to pass the FAA test and have the requisite safety knowledge and flight skills to begin an entry level drone pilot job.

Drone Pilot Pathway
Ages 15–Adult ($250 for teens, $350 for adults)

This pathway encourages teachers to become engaged with aerospace and take their excitement and knowledge back to their classrooms. It includes a complimentary 30-minute flight for teachers, free Professional Development for Teachers and a visit by the Wings Education department to their classroom or school to teach about something related to aerospace (rockets, plane construction, four forces of flight, constellations, etc, based on grade level and teacher choice).

Teacher Flight Pathway
Adult (Free)

Aerospace Exploration
Age 11–18, Middle School Grades 6–8,
High School Grades 9–12

The hallmark pathway for the museum is a unique, full–day enrichment program that complements but does not take place of a regular education program. The courses are designed to prepare students for a future career in:

- Aerospace Science
- Aerospace Engineering
- General Aviation
- Unmanned Aircraft Systems

Students come from a variety of education opportunities including online, hybrid, expeditionary, or public schools. These schools give students permission to attend the Aerospace Exploration program.

Classes cover a variety of exciting aerospace topics including 3D modeling, rocketry, drone mechanics, FPV Drones, Electricity basics, Python and block coding, Drone Soccer, Human Factors in Space, Space Farming Aerospace Cinematography, flight simulators, restorations technology and more!

For middle school, the idea is to give students introductory skills that help them become well–rounded in aerospace.

The focus of the high school program in particular is for students to attain proficiency in one of the aforementioned categories. At the high school level, students have the opportunity to participate in an aircraft build class. In this class, students work under the guidance of a certified A & P mechanic as well as museum volunteers, to build an experimental aircraft. Three years ago, the program completed it's first aircraft, a Vans RV–12is. During the 2024–2025 school year, students began working on a RANS –21 aircraft. The builds take approximately three years to complete. When completed, they are FAA certified and then

sold. The proceeds from the aircraft sale are then reinvested into the program. The entire process gives students, regardless of their professional interests, experience they cannot get at most high school programs. In an era where many aerospace companies like to see workshop experience in their new hires, Wings Aerospace Exploration delivers!

Students in both levels of the program are able to learn from guest speakers, as well as participate in field trips to area aerospace–related businesses.

Whether it's an FAA Ground School certificate (Part 121 Certification), a Unmanned Aircraft System FAA Part 107 drone pilot certificate, or college credit from Spartan College of Aeronautics and Technology, students are well positioned upon graduation for further study in university or technical colleges or move directly into the workforce as an airline appearance/ramp agent, Part 107 pilot or other entry level aerospace position.

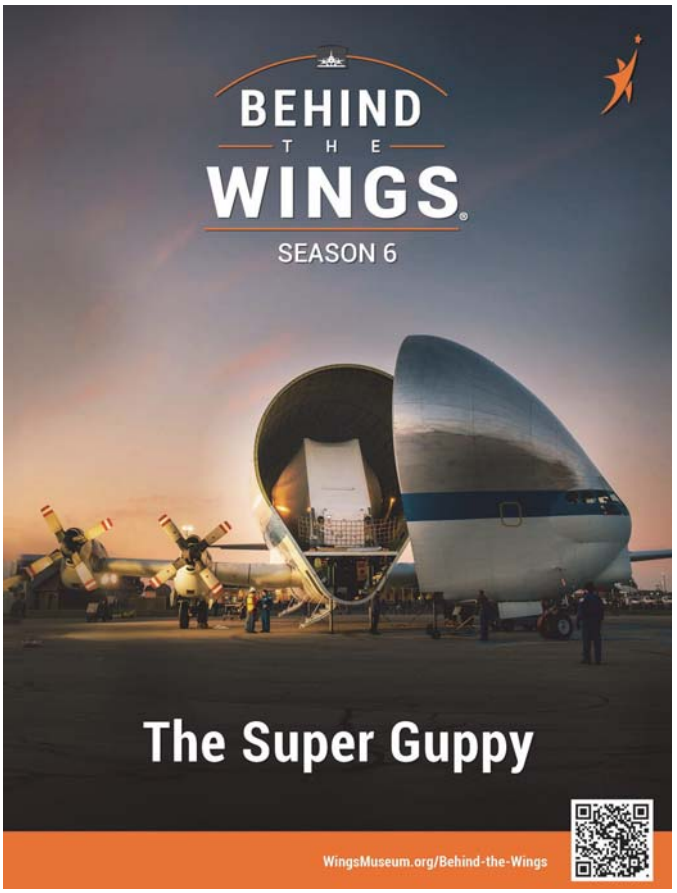
Instructors for the program are a mix between formally trained educators and industry professionals and museum specialists and volunteers.

Other Important Education Programming

Summer Camp

Every summer, Wings Over the Rockies hosts 10 weeks of summer camp at both of it's locations. Each week there is a different focus for the camps. For 2025, some of the camps include: Fabulous Flying Machines, Rockets & Drones, Fighters & Bombers, Aerotech, Aspiring Aviators, RoboDrone Adventures and more.

Camps are staffed with a seasonal group of high school and college students and led by Wings' own education staff as well as temporary teachers. Annually there are approximately 500 campers at Wings during the summer season. Students pay $399 for the week of aerospace programming.



Behind the Wings

Behind the Wings is an incredible podcast and Public Broadcasting Service program featuring legendary aircraft and the pilots, engineers and people who make it all happen. It is an award-winning, in-house written and produced series that serves as a foundation for learning about aerospace world-wide.

In addition, numerous special events are held throughout the year to encourage new visitors to engage with the museum and its programming. These include Hauntings in the Hangar, Santa in the Hangar, Sensory-Friendly days, STEAM days, Aviation Career Symposiums, Breakfast Fly-ins, showcase events and more.

Each event and education opportunity is designed to fulfill the mission of Wings Over the Rockies and helps attendees to learn and grow in their aerospace knowledge. It's a great place to launch into a variety of careers, while learning about and developing an appreciation for the past and present in aerospace!

Session 4

Experiential Learning in Aviation Museums

Terry Michael Slobodian | President & CEO, Royal Aviation Museum of Western Canada, Canada

1. Introduction

Experiential learning and STEM (Science, Technology, Engineering, and Mathematics) education represent transformative approaches to engaging learners in meaningful and practical ways. The Royal Aviation Museum of Western Canada (RAMWC) exemplifies the power of these methods, using aviation as a dynamic lens to explore complex concepts. By immersing individuals in hands-on activities and real-world applications, the museum fosters curiosity, critical thinking, and problem-solving skills. This manuscript will explore

how experiential learning and STEM education converge at RAMWC, highlighting programs, benefits, challenges, and opportunities that demonstrate their potential to inspire and empower learners of all ages.

2. Background

RAMWC located in Winnipeg, Manitoba, Canada is one of the premier aviation museums in North America. With its vast collection of vintage aircraft, historical artefacts, and innovative exhibits, the museum is a testament to Canada's aviation heritage and its contributions to technological progress. The collection includes remarkable aircraft such as the Avrocar, an experimental flying saucer, and the de Havilland Beaver, a workhorse of Canadian aviation. These artefacts provide a compelling narrative of technological advancements and human ingenuity.

Beyond its historical significance, the museum serves as an ideal setting to bridge the gap between education and inspiration. The museum's state-of-the-art facilities, interactive exhibits, and carefully curated programs transform it from a static repository into a vibrant learning environment. This approach reflects the museum's belief that history is not just to be observed but experienced.

The museum's commitment to STEM education has been recognized on a provincial level—earning the prestigious title of Manitoba's Outstanding Science Organization awarded by the Science Teachers Association of Manitoba. This accolade underscores the museum's dedication to delivering impactful and innovative programs that inspire learners of all ages.

Aviation, as a field, inherently embodies STEM. The principles of aerodynamics, engineering, meteorology, and navigation converge to enable the marvels of flight. Visitors gain a unique perspective on these disciplines as they explore the museum's exhibits. This unique intersection makes our museum an exceptional space for experiential learning, where abstract concepts take on tangible, real-world relevance.

Our museum has also earned its reputation as a key community partner. Schools, families, and industry regularly collaborate with us, recognizing our space as one where education takes flight—both literally and figuratively. These partnerships allow us to continually innovate and refine our programs, ensuring they remain relevant and impactful for a diverse audience.

3. The Concept of Experiential Learning

Experiential learning goes beyond traditional teaching methods—it is an immersive approach that encourages learners to actively engage with their surroundings, apply critical thinking, and draw insights from their experiences. This learning-by-doing philosophy emphasizes direct interaction with the subject matter, transforming abstract concepts into tangible, memorable experiences.

Rather than solely relying on lectures or textbooks, experiential learning involves activities like designing, building, experimenting, or simulating. These hands-on exercises enable learners to test theories, solve problems, and explore creative solutions in real-world or simulated scenarios. For example, sitting in the cockpit of our Beechcraft Musketeer, students learn the principles of aerodynamics allowing learners to see firsthand how lift, drag, and thrust interact in flight. Similarly, activities like assembling components or engaging with interactive simulations can make complex ideas more relatable and accessible.

The true power of experiential learning lies in its ability to foster curiosity, critical thinking, and a deeper connection to the subject matter. By immersing learners in the process, this approach not only enhances knowledge retention but also cultivates problem-solving and creativity, ensuring that learning feels like an exciting adventure rather than a passive task.

4. The Role of STEM Education

STEM education is vital in equipping learners with the tools to navigate and address the complexities of our modern world. It emphasizes interdisciplinary thinking and real-world applications, preparing students to become innovators and leaders in fields as diverse as technology, healthcare, and sustainability.

Our aircraft and exhibits are fully integrated with STEM programming, ensuring that learners can connect aviation principles to STEM concepts in dynamic and interactive ways. When schools visit the museum, students participate in one or two of our engaging STEM courses, followed by guided tours of the exhibits led by our highly trained and experienced tour guides, who are also subject matter experts. This combination of hands-on learning and expert guidance creates a comprehensive educational experience.

Students inside the Vickers Viscount

Our exhibits further demonstrate the integration of STEM in aviation. The evolution of jet engines, showcased through interactive displays, allows visitors to explore how advancements in engineering and materials science revolutionized air travel.

STEM education is most impactful when learners see its relevance. By rooting STEM concepts in aviation—a field synonymous with exploration and innovation—we ensure that learners view these principles as exciting and applicable to real-world challenges.

5. Connecting Experiential Learning with STEM

The integration of experiential learning and STEM education is an effective strategy for sparking curiosity and fostering innovation. By encouraging hands-on activities, this approach allows learners to explore complex STEM concepts in engaging and practical ways.

Through interactive activities, experiential learning transforms STEM education into a dynamic process, ensuring learners develop problem-solving, analytical, and creative thinking skills.

6. Programs and Activities at the Royal Aviation Museum

RAMWC offers a diverse array of programs that combine experiential learning with STEM education, creating memorable and impactful experiences for visitors.

For example, our fully operational wind tunnel is used to demonstrate airflow and the forces of lift and drag, offering visitors and students an immersive and interactive learning experience. This tool features prominently in our "Science of Flight" program, where Grade 6 students investigate the four forces of flight, Bernoulli's Principle, and the mechanics of lighter- and heavier-than-air aircraft. Students also sit in the pilot's seat of a Royal Canadian Air Force Beechcraft Musketeer training plane, experiencing firsthand how its controls operate.

Our **14 STEM curricula-based programs** span Kindergarten to Grade 12 and are taught by a team of three certified teachers who collectively have more than **50 years of experience**. Approximately **10,000 students annually** participate in these programs, with 50% of them in Grade 6. These include:

- **Toys In Space** (Grades 4-6) What if astronauts wanted to play soccer on the International Space Station? In this engaging lesson, students learn about the physics of popular toys on Earth that allow them to operate as intended. Then, by testing various toys and applying scientific concepts after observing their motion, these junior scientists will investigate and predict to answer the question: Will these toys work in microgravity? Our museum's Black Brant rocket, viewed as part of our school tour, provides a Canadian connection for space exploration.

- **Ship the Chip** (Grades 6-9): Students work in teams to design cost-effective packaging to transport a fragile potato chip while exploring how flight revolutionized transportation using artefacts such as the Air Canada Vickers Viscount airliner.

- **Invisible Forces** (Grades 6–10): Students investigate Newton's Laws and test gravity assist devices while touring exhibits like the double-winged Vickers Vedette replica.

- **Orion Touchdown** (Grades 6–12): Students design protective spacecraft capsules and study the museum's Black Brant Sounding Rocket.

- **Save the Suit** (Grades 7–12): Students design spacesuits inspired by "The Martian" film and learn about protective gear such as the CF-104 Starfighter ejection seat.

Beyond individual programs, the museum also engages educators through professional development workshops. These sessions equip teachers with tools to bring aviation-themed experiential learning into their classrooms, extending the museum's impact.

RAMWC's educational initiatives aim to inspire curiosity and connect learners to aviation and STEM concepts. Among these, **Discovery Days** stand out as immersive events that introduce students to careers and opportunities in the aviation and aerospace fields. During a recent two-day event, high school students from Grades 9 to 12 engaged in hands-on workshops, STEM-related challenges, and talks by industry professionals. Notable guest speakers included LukePenner, Canada's top-ranked aerobatic pilot, and Kimberly Ballantyne, the first female Indigenous pilot from Opaskwayak Cree Nation. These vibrant and educational experiences feature demonstrations, career pathway discussions led by industry partners, and interactive activities that spark imagination and innovation among young learners.

7. Collaborative Initiatives with Educational Institutions

RAMWC Wind Tunnel

The Royal Aviation Museum collaborates with the University of Manitoba's Faculty of Engineering and the Manitoba Institute of Trades and Technology (MITT) to foster innovation and engagement in STEM education. These partnerships have yielded tangible results: two teams of engineering students designed interactive exhibits focused on propulsion and fuels as part of their "Capstone Projects."

These exhibits align with the museum's learning outcomes for STEM programming, providing visitors with hands-on opportunities to explore complex scientific concepts. Currently, MITT students are fabricating these exhibits based on the proposed designs, demonstrating the seamless integration of academia with practical applications. These collaborations not only enhance the museum's offerings but also provide students with valuable experience and the satisfaction of contributing to a community-centered educational initiative.

U of M Interactive Propulsion Exhibit

8. Benefits to Learners and the Community

The benefits of our programs are multifaceted, impacting learners, educators, and the broader community alike. For students, experiential learning fosters a deeper engagement with STEM principles, enhancing understanding and retention. It also develops critical soft skills, such as collaboration, adaptability, and resilience—traits essential for thriving in the 21st century.

Educators, too, benefit from our initiatives. Teachers gain access to innovative resources and lesson plans, while parents witness their children's growth and enthusiasm for learning. These programs also strengthen connections between schools and the museum, creating a supportive ecosystem for education.

The museum's contributions extend to workforce development. By inspiring interest in STEM careers, we help cultivate a talent pool equipped to address societal challenges. Aviation, in particular, offers pathways to careers in engineering, technology, and environmental innovation—all fields critical for the future.

Accessibility is a cornerstone of our mission. RAMWC offers free admission to Indigenous Peoples, reflecting its commitment to the Truth and Reconciliation Commission's Calls to Action. Visitors with disabilities are also supported through complimentary admission for up to two companions. Additionally, our Access for All fund provides financial resources for schools in underserved areas to participate in our programs, ensuring that no child is left behind in the journey to be educated and inspired.

9. Challenges and Future Opportunities

Implementing experiential learning and STEM programs presents certain challenges. Limited funding and resources can restrict the scale of initiatives, while ensuring accessibility for underserved communities requires innovative approaches. Despite these hurdles, RAMWC remains steadfast in its commitment to expanding its reach and impact.

One of our proudest achievements is delivering programs virtually to remote communities in the far north of Manitoba, including places like Churchill, located more than 1,200 miles away. In partnership with the Frontier School Division, we bridge distances to bring interactive STEM education into classrooms, fostering curiosity and innovation in areas that may otherwise lack access to such resources.

Looking ahead, future opportunities include developing mobile exhibits to connect with rural schools, enhancing augmented reality experiences to complement physical displays, and building partnerships with industry leaders to sponsor programs. Additionally, we aim to collaborate with schools and universities to create curricula integrating aviation–themed STEM education, amplifying our reach and inspiring a broader audience.

Through these initiatives, the RAMWC is dedicated to ensuring that learning and discovery transcend physical boundaries, creating meaningful connections with learners across Manitoba and beyond.

10. Conclusion

In conclusion, RAMWC exemplifies the transformative power of experiential learning and STEM education. By connecting learners to aviation's history and innovations, we ignite curiosity, creativity, and a passion for discovery.

Our programs highlight the profound impact that hands-on learning can have, equipping individuals with the skills and confidence to navigate the complexities of our modern world. The museum is more than a space for exploration—it is a catalyst for change, empowering communities and shaping future generations.

As we look ahead, we will continue championing these initiatives. Together with our partners, donors and stakeholders, we can ensure that experiential learning and STEM education remain central to our mission, inspiring generations to dream, innovate, and reach for the skies.


2025
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Session 4

Expanding the Aviation Experience through Education:

Sharing case studies of education programmes at the National Aviation Museum of Korea

Dongun Gwon | Senior Curator, National Aviation Museum of Korea, Korea

1. Characteristics and Direction of Education at the NAMOK

The National Aviation Museum of Korea (NAMOK) is the country's first national museum dedicated to aviation, established in 2020. Aligned with its vision—"A place where the highest dreams come closest"—the museum is committed to discovering, preserving, researching, and exhibiting Korea's aviation culture and industrial heritage.

This conference brings together aviation museums from across the world, including institutions from the United States and Canada. While we all share the common theme of aviation, each museum may pursue different directions in education and exhibition programming. These differences often reflect how integrated aviation is into the everyday lives of people in each country.

In North America, including the U.S. and Canada, vast territories and low population density have encouraged the growth of private and recreational flying. Aviation is not limited to a specific professional field but has become a part of everyday cultural life that is widely accessible to the general public. In contrast, Korea's geographic constraints and high proportion of restricted airspace due to military control mean that aviation is not as easily encountered in daily life. As a result, the public's perception of aviation often centers around commercial air transport, with fewer opportunities for personal engagement or direct experience.

To bridge this gap, the National Aviation Museum of Korea sees aviation not as something simply to observe, but as a culture to experience and participate in. Our educational mission is to make aviation more accessible and interactive for everyone.

2. Overview of Educational Programs at the NAMOK

The National Aviation Museum of Korea develops and operates a variety of educational programs to help the public engage more closely with aviation culture. To broaden access to aviation education, the museum aims to both expand the range of target audiences and create more opportunities for participation. This includes developing outreach programs that bring aviation education directly to communities.

To meet this goal, the museum offers on-site programs that are available year-round, has designed specialized aviation education for people with disabilities, and implements mobile programs that reach audiences beyond the museum walls. Most recently, the museum has introduced new school-based programs, further expanding the scope and reach of its educational efforts.

〈Permanent Education Programs〉

Program		Training for	Videos
The aviation exploration programs	Building paper airplanes	No restrictions	
	Balloon helicopters	No restrictions	
	3D Puzzles	6 years old or older	
The drone programs	Remote-controlled drone	5 years old or older	
	Sensor drone	7 years old or older	
The UAM programs	The aviation future in your hands	6 years old or older	
The early childhood programs	Aviation culture activities for infants and young children	24-48 months old	
	Infant and Toddler Aviation Book activities	24-48 months old	

The museum's educational programs fall into four main categories, based on target audiences and modes of delivery. First is Lifelong Aviation Education, which offers aviation-related learning opportunities for people of all ages. Second is Future Aviation Education, which explores the future of aviation in relation to emerging technologies and changes in daily life. Third is Inclusive Education for People with Disabilities, which provides customized programs tailored to various types of disabilities. Finally, School Partnership Programs offer aviation education tailored for student groups through collaborations with

schools. This presentation will provide an overview of these four key educational areas at the National Aviation Museum of Korea.

Lifelong Aviation Education and Future Aviation Education

The National Aviation Museum of Korea offers Lifelong Aviation Education and Future Aviation Education to raise public interest in aviation and help people of all ages engage with aviation culture in their daily lives. In Korea, experiences with aviation are largely limited to commercial air travel. Given this restricted context, the museum has developed a variety of programs to reframe aviation not simply as something to observe, but as a hands-on and participatory cultural experience.

Lifelong Aviation Education includes permanent education programs, exhibition-linked learning, and career exploration programs related to aviation. Among these, the permanent education programs are the museum's flagship offerings, available year-round for visitors of all ages. These programs are tailored to various age groups and skill levels, and are conducted in the "Aviation Learning Playground" on the second floor and the "Flying Fun Playground" on the third floor of the museum.

The aviation exploration programs feature hands-on activities like building paper airplanes, balloon helicopters, and 3D puzzles, designed to help participants understand basic flight principles in a fun and accessible way. The drone programs introduce the principles of flight through drone control and sensor-based activities. The UAM (Urban Air Mobility) programs allow participants to design futuristic aircraft using tablet PCs, then launch their models in an augmented reality (AR) environment—encouraging imaginative thinking about future air mobility. The early childhood programs are aimed at children aged 24 to 48 months and their caregivers, incorporating sensory play and picture book-based activities to introduce aviation culture in a playful, age-appropriate manner. These programs are currently being enhanced in both content and space as part of the museum's ongoing development.

To expand public understanding and interest in future aviation, the museum also offers Future Aviation Education. These programs go beyond introducing new technologies—they aim to explore how aviation intersects with other fields, expanding the scope of aviation education through interdisciplinary approaches.

A key example is the convergence education program, primarily offered during school breaks. This program integrates topics such as the principles of flight, aviation history, drones, and emerging aviation technologies. While the permanent education programs cover foundational topics, the convergence program offers a deeper, more comprehensive learning experience.

The museum also operates an outreach initiative called Museum on the Move, which brings aviation education to communities through partnerships with local organizations and aviation institutions. By participating in public exhibitions, regional festivals, and collaborative projects, the museum increases access to aviation education in areas with limited resources. It is also working with institutions such as the Korea Aerospace Administration and the Aviation Meteorological Office to co-develop specialized educational content and establish a sustainable and professional foundation for aviation education.

Inclusive Education Programs for People with Disabilities

The National Aviation Museum of Korea offers a range of inclusive education programs tailored to different types of disabilities, with a focus on accessibility, continuity, and long-term development. These programs are currently organized into three main categories: on-site school programs for special education schools, exhibition-linked programs for individuals with visual or hearing impairments, and arts-integrated programs that interpret aviation themes through artistic activities.

The special education school outreach program was designed through collaborative workshops with teachers to effectively convey aviation—an unfamiliar subject to many students—with developmental disabilities. The museum runs long-term programs consisting of 20 or more sessions, emphasizing consistency, emotional comfort, and relationship-building between instructors and students. Since 2024, this program has expanded to include schools for students with visual and hearing impairments.

The exhibition-linked programs for people with sensory disabilities are centered on developing customized content. For individuals with visual impairments, the museum has created large-print and Braille learning materials, as well as tactile teaching aids using airplane and airport models. For those with hearing impairments, the program includes captioned videos and aviation-related sign language resources. These materials enhance

understanding of the exhibitions and are also utilized in school visit programs for visually and hearing-impaired students.

The arts-integrated program transforms aviation themes into inclusive artistic experiences such as theater. The first initiative was based on the 2023 special exhibition about Kwon Ki-ok, Korea's first female aviator and independence activist. In 2024, the program expanded with a new production centered on Otto Lilienthal and his glider experiments. These performances are designed to be barrier-free and inclusive for all audiences, regardless of ability. They feature sign language interpretation, captions, audio descriptions, and pre- and post-performance tactile activities.

In addition to the current programs, the museum is developing new formats to enhance accessibility and self-directed learning. To address the limitations of in-person school visits, the museum is preparing distributed teaching kits that include teaching guides and materials, enabling teachers to lead aviation education sessions independently. This model maintains educational quality while allowing greater flexibility and variety based on teacher capabilities and student needs.

The museum is also developing on-site, exhibition-linked programs for visitors with developmental disabilities, in response to the increasing number of such visitors. Building on experience with sensory-friendly tools for those with visual and hearing impairments, the museum is creating customized teaching aids to support learning in the permanent exhibitions. These resources are designed for use by companions or group leaders, and additional guidance will be available for visitors who attend without support persons.

〈The arts-integrated program(Barrier-free theatre)〉

videos

School Partnership Programs

The school-linked education program was newly launched in 2024 in response to the Korean government's policy to expand after-school learning opportunities for elementary students. Under this initiative, the National Aviation Museum of Korea developed and implemented an outreach program that brings aviation education directly into schools.

This effort was aligned with the government's new "Neulbom School" system, which aims to provide additional after-school learning for lower-grade elementary students. The museum saw this as an opportunity for aviation education to enter the public school system and actively joined the program. According to the policy timeline, the program began in 2024 with first-grade students (typically six years old), and will expand to second grade in 2025, eventually covering all elementary grades by 2026.

To meet the needs of this younger audience, the program was designed as a short-term, intensive course delivered over two consecutive sessions, rather than a long-term curriculum. The educational content includes activities such as making and flying paper airplanes to understand the principles of flight, and role-playing scenarios at an airport to explore aviation-related occupations and culture. These hands-on, engaging activities were intended to spark curiosity and make aviation concepts accessible to young learners.

In addition to developing the content, the museum also established a training program for professional instructors to ensure stable and high-quality program delivery. After a competitive selection process involving document screening and interviews, selected trainees participated in a course that combined aviation theory instruction with teaching practicums. To further build their capabilities, trainees were also invited to submit their own education proposals in a planning contest.

Upon completing the training, these instructors began visiting schools to deliver the newly developed lessons. So far, the program has reached approximately 400 students.

As the program scales up to include all elementary grades by 2026, the museum is preparing a long-term curriculum consisting of more than 20 sessions, tailored to each developmental stage. In parallel, it is developing advanced training for certified instructors, ensuring they are equipped to deliver expanded content across a broader age range.

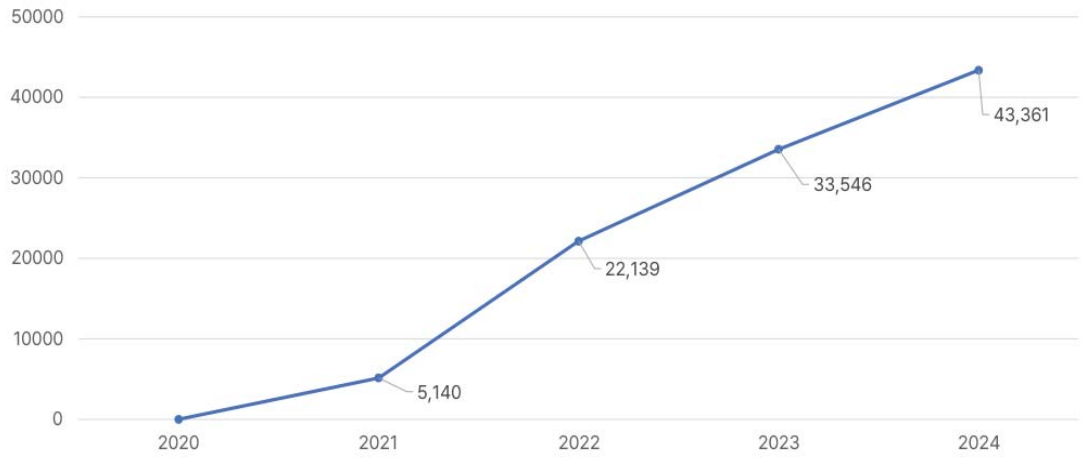
〈Current Status of National Aviation Museum Education Programs〉

Program			Place
Lifelong Aviation Education	Permanent Education Programs	The aviation exploration programs	On-site
		The drone programs	On-site
		The UAM programs	On-site
		The early childhood programs	On-site
	Exhibition-Linked Programs	Permanent exhibition linkage	On-site
		Special exhibition linkage	On-site
	Career Exploration Programs	Lecture by active aviation practitioners	On-site
		Aviation field trip education	Off-site
	Instrument Training	Children's day educational program	On-site
		Aviation day educational program	On-site
Future Aviation Education	Aviation Convergence Education	Beginner-level convergence education program	On-site
		Intermediate-level convergence education program	On-site
	Museum on the Move	Aviation-related organization collaboration education	Off-site
Inclusive Education Programs for People with Disabilities	The Special Education School Outreach Program	Cooperative education for special schools for developmental disabilities	Off-site
		Cooperative education for special schools for the visually impaired	Off-site
		Cooperative education for special schools for the hearing impaired	Off-site
	Visiting Disability Education	Museum visit education for disabled People	On-site
		Distribution of content for visitors with disabilities	On-site
	The arts-integrated Program	Barrier-free theatre	On-site
School Partnership programs	Professional Training	Aviation Instructor training and management	On-site
	School Visit Education	Aviation principles training	Off-site
		Aviation culture education	Off-site
		Online aviation training	On-site

3. Future Directions of Education at the NAMOK

The National Aviation Museum of Korea has seen a steady increase in educational participants each year, reflecting growing public interest and evolving social needs. Its educational programs are no longer limited to simply conveying information—they are part of a broader effort to make aviation, a traditionally specialized field, more accessible as a cultural experience for all.

〈Education attendance growth over the past 4 years〉



In this context, programs such as customized education for people with disabilities and school-linked education serve as important examples of how the museum fulfills its public mission and social responsibility. These initiatives demonstrate the museum's commitment to addressing challenges related to accessibility and inclusivity in museum education.

Looking ahead, the National Aviation Museum will continue to expand its scope and content in response to diverse educational needs. It aims to evolve as an inclusive lifelong learning institution for aviation, open and accessible to everyone.

2025 International Conference for Aviation Museum Professionals

DAY 3


2025
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2025 International Conference for Aviation Museum Professionals

[Session 5]

Access, Hazard Management, Storage

Matthew Bruce / Skye Marshall
Ingenium, Canada

Steve Nichol
British Columbia Aviation Museum, Canada

Sodam Lee
National Aviation Museum of Korea, Korea

Andor Vince
Heritage Collections Care Consortium, New Zealand

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Session 5

Safe Access: The Collections Risk Management Program at Ingenium

Matthew Bruce / Skye Marshall | Conservator, Ingenium, Canada

1. Disclaimer

Practice Care. This presentation addresses trauma, death, vicarious trauma and mental health, and aviation related disasters/ traumatic events.

2. Introduction

Although hazard management had always been a part of Ingenium's collections practices, in 2018 a comprehensive Collections Risk Management Program (or CRMP) was implemented. The new CRMP put staff and visitor safety at the forefront of our conservation and collections practices, prioritizing hazard management with the goal of making our collections spaces more physically accessible to the Canadian public.

Canadian workers have three fundamental rights when it comes to health and safety. All workers have the right to know about health and safety hazards in their workplace, the right to participate in health and safety matters, and the right to refuse unsafe work.

Ingenium has developed safe work practices for more than 28 hazards present in the national collection. These practices include training, standardized labelling, risk assessment and safe work practices (RASPs), and standardized mitigation strategies. RASPs are internal documents that serve as a starting point to inform of the risks and safe work practices for each hazard.

Collection/artifact labels that describe an object's hazards are based on GHS, or the Globally Harmonized System of Classification and Labelling of Chemicals. Within our database, collections objects which have been identified as hazardous are specifically identified. This

action results in a visual icon in the catalogue record to indicate that there is a hazard present.

Through the CRMP process, ingenium staff have identified almost 10,000 hazardous artifacts. The program trained over 70 personnel on hazardous material management and created an effective culture change that encourages open discussion and learning about hazardous object management.

Ingenium's Trauma Informed Collections Access Project (TiCAP) was formed in answer to questions about managing psychological hazards in the collection. Beginning in 2020, the project works to implement trauma informed practices to better support staff and researchers working with the Ingenium collections.

Details and processes regarding hazard mitigation are in line with Ingeniums' local regulations. Please consult your own local legislation before undertaking hazard remediation in your collections.

3. Hazards in Aviation Collections

There are many more hazards in aviation museum collections than just the obvious ones associated with operational aircraft. Spinning propellers and flammable fuels may be primary concerns at an airport, but for objects on static display they are much lower on the list. Many of the systems and substances designed to make aviation safer for passengers and operators come with their own risks, and unexpected hazards are often found only when an object is receiving a detailed treatment or inspection. To properly respond to these hazardous collection needs, constant training/re-training is required for a variety of licenses and certifications, including respirator use, WHMIS GHS, and firearms licensing.

At Ingenium, we keep an up-to-date database of collection risks and safe working practices when dealing with aviation collections. We also have policies and guidelines in place when new hazards arise.

4. Tires

While in service, an aircraft's tires are maintained and changed regularly. However, in a museum setting tires degrade over time. They become hardened, cracked and more prone to leaks. High pressure tires certainly present a risk of explosion (for example, the main tires on the CF–101 Voodoo are supposed to be inflated to 295 psi), but even with tires inflated to only 20–30 psi, rapid – or gradual – failure can have serious consequences. For example, the airplane's wings will move significantly and can hit something (or someone) next to it. While a deflated tire may only represent a change in height of only a few centimeters, that movement is multiplied many times at the wingtip. Furthermore, as one wing drops, the other one is raised. Consideration must always be given to how and where aircraft are stored, displayed and maintained in relation to other objects.

Management: Proper training on regular wheel inspections and tire maintenance is critical for good long–term collections care. Instead of using compressed air, nitrogen gas is preferred because it is drier, less likely to cause oxidation or corrosion, and more thermally and dimensionally stable over time. Tire pressures are set to the aircraft's specification to prevent flat–spotting and sidewall cracking unless there are immediate concerns about the stability of the tire. When possible, custom–made axle stands are installed to help reduce the weight loads on tires and to prevent a dramatic drop in the event of a tire failure. We keep tires that are appropriate for the aircraft installed whenever possible but will consider substitutions when there are no other alternatives. After all, some types and sizes of tires are simply no longer available.

5. Explosives

While easily recognized explosives such as bombs and ammunition can be found in some aviation museum collections, other concealed explosives are also worth considering. Explosively activated fire suppression systems in modern aircraft are designed to be activated either by the crew or by automated systems. Despite their small size, explosive squibs can be accidentally activated, resulting in the release of toxic fire extinguisher chemicals. Squibs that have been removed are still an explosion risk while being handled and must have their electrical contacts isolated. Some of these devices are so sensitive that

static discharge from a person's clothing could activate them.

Another example of hidden explosive hazards is in the ejection systems of military aircraft. They usually consist of multiple components designed not only to eject the seat itself (main rocket), but to blow off the canopy, to sever cables and wires connected to the seat, and to launch the parachute stowed inside.

Management: When arranging for the acquisition of an aircraft, try to have these systems neutralized and clearly marked "inert" ahead of time (especially if it is being transferred by the military). If that is not possible, all aircraft systems must be examined by qualified personnel. In the case of squibs and ejection seat systems, there are established procedures that must be followed before they can be safely removed. Once identified, they should be removed and discharged in a controlled manner, then tagged and reinstalled when possible. Ammunition and ordinance should be sent for proper disposal unless it can be safely neutralized or has been documented and marked as "inert" upon arrival.

6. Fire Extinguishers

Extinguishers have been a part of aviation since the earliest years, and the means and methods of using them have evolved over time. Although they are designed for use in an emergency, many of them ironically consist of chemicals that are hazardous to human life and the environment and should not be used in enclosed spaces. Types of fire extinguisher chemicals that we have encountered include carbon tetrachloride, chlorobromomethane, methyl bromide, halon, dry chemical (ABC), and CO2. They can be contained in hand operated bottles, or in specialized reservoirs incorporated into an aircraft's engine nacelles and fuselage. As previously mentioned, the presence of squibs in these systems can lead to an accidental release of chemicals.

Management: aircraft should be thoroughly inspected for extinguishers. Once found, they should be removed, sent to an appropriate facility to be emptied, and reinstalled or placed in storage with a tag stating that they are inert. There are established procedures for removing dangerous systems that use Halon and Methyl Bromide bottles, and not many facilities are equipped to service or drain them. When sent for remediation, fire extinguishers must be

packed and transported as hazardous goods.

7. Batteries

Batteries come in a multitude of sizes and compositions, from small button cells up to very large main batteries. They can be alkaline, Ni–Cd, NiMH, Lithium Ion, Lithium manganese, lead acid, etc. They can be anywhere, including main battery compartments, inside avionics, in flashlights and emergency kits, and in Emergency Locator Transmitters (ELT's) to name a few. The main risk is that they will degrade over time and potentially burst, causing the release of toxic, corrosive or flammable compounds.

Management: Batteries should be removed whenever possible. If they are rare or uncommon they can be kept, but in a dedicated storage area set up for that purpose that is properly monitored. They need to be stored in containers that can safely contain any leaked electrolytes. Consider disposal when batteries are very common. When possible, it is recommended to drain and neutralize the batteries, or to keep the outer case for reference purposes instead of the intact battery. In certain cases, decisions are made to leave a battery in place but disconnected from any wires. An example of this is with some ELT's, which can have their batteries glued inside the case. In some models, removal of the cells would cause extensive damage. Instead, regular inspections should be done to monitor the condition of the cells.

8. Psychological Hazards

A psychological hazard, also referred to as a psychosocial hazard or an emotional hazard, is a situation, condition, or thing that may affect a person's mental health. This may result in physical effects by overwhelming individual coping mechanisms, thus impacting the person's ability to function in a healthy and safe environment.

A psychological hazard can look different to different people, depending on their personal histories, identities, and mental health. While we can't aim to remove all psychological hazards from a collection, we can mitigate those most likely to cause psychological harm.

Anecdotally, it is known that exhibits that make us feel emotions, whether positive or negative, can stay with us. TICAP in no way looks to limit or remove emotional responses and reactions. However, one of the goals of the project is to limit, or mitigate, psychological harm. Psychological harm is harm that causes mental or emotional trauma or that causes behavioural changes or physical symptoms. This harm may include suffering, damage, impairment, or dysfunction.

9. Vicarious Trauma in Museums

Also referred to as secondhand trauma, vicarious trauma can occur following exposure to images, narratives, or objects related to trauma and traumatic events. Instances where this can occur are limitless, but most often involves the suffering of another living being. This type of trauma is most often associated with first responders, medical staff, and counselors. Current research shows that vicarious trauma occurs in a much wider variety of settings, including museums. Sources of possible vicarious trauma in the Ingenium aviation collection include but are not limited to evidentiary collections from disasters and crash sites, conflict related collections from military equipment and weaponry, and objects with colonial histories, such as survey markers or bush planes.

The risk of vicarious trauma increases with the frequency of traumatic experiences. Symptoms can present emotionally, psychologically, and behaviorally. This can include feelings of hopelessness, panic symptoms, frequent headaches, increased isolation, and difficulty sleeping.

10. Trauma Informed Collections Practices

The Trauma Informed Collections Access Project began in 2020 to address the need to develop trauma informed practices. The project is supported by a working group with staff across Ingenium's collections and research team. It includes conservators, curators, cataloguers, and library, archives and information management staff.

Custom collection/artifact labels featuring a heart icon and the phrase "practice care / prenez soins" are used similarly to hazard labels to highlight the presence of a psychological risk. These labels provide context to the risk, allowing staff to choose whether they are prepared to engage with the object. Staff are encouraged to work alongside colleagues when working on these collections objects, to take frequent breaks from psychologically taxing tasks, and to take time to process their emotions once they are done. Further recommendations address the placement of collections objects in storage, and staff training and support.


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Session 5

Case Study of BCAM: How small museums can manage a very large projects

Steve Nichol | President, British Columbia Aviation Museum, Canada

1. Physical Access To the Museum

Road access into BCAM is currently limited to a single lane paved road to a small paved parking lot (25 cars) and an unpaved gravel parking lot (20 cars being expanded to 50 cars) It is located on leased federal land of the Victoria International Airport and as such must comply with all federal guidelines (airfield security, environmental laws etc). Security fences control access to the museum and are the same ones that provide security to the airfield. This is patrolled by Paladin Security who do continuous patrols and check that all gates are locked day and night around the museum and the circumference of the airport.

Volunteers are vetted and have had criminal background checks. They have received orientation, security and AED training. Once certified, they have access to a number of gate keys to allow for overflow parking to the south and west of the hangars. Each morning volunteer tour guides open the museum and do a security audit. Each evening, they do the reverse when closing the museum.

A salmon bearing creek and ditch run adjacent to BCAM has restricted expansion of the road access to the museum. This will become a service road once the Victoria International Airport builds their new access road along the south border of the museum property and should greatly relieve the pressure on the access road. BCAM will then be allowed to build a public access entrance to a much-expanded parking lot (〉 200 spots).

During working hours, all access outside to the museum hangars is controlled by our tour guides as unescorted visitors could potentially walk right onto active airfield property and onto an infrequently used but still active runway. For this reason, we control the flow of visitors into and around the museum.

Airside access to the museum is via a gravel road we built with surplus airport millings last summer. This was built to allow the Martin Mars to be towed to its display position while on its massive bespoke transporter. It is now available to visiting aircraft to visit the museum but it is not a recognized taxiway. Therefore, they must be towed to our west facing apron for display.

Controlled access is carried out in our 4 open aircraft, the Martin Mars, the Vickers Viscount, the Canadair CT–133 Silver Star and the Convair 580. Entry to all these aircraft is with a tour guide only. Additionally, visitors must have a tour guide to enter the Restoration Hall and only on days when restoration is not taking place.

2. Access to artifacts

Once through the doors and past the cashier, visitors are offered free tours. Without a tour guide visitors are free to explore our static interpretive displays, our seven continuous video displays and aircraft by themselves. However, they must have a tour guide present to enter

the Martin Mars, the Convair 580, the CT-133 and the Restoration Hall. During workdays no visitors may enter the Restoration Hall for safety reasons but may observe from behind a barrier.

Researchers and members of the public are able to have access to the entire selection of displays with the above stated restrictions. Our resource centre and library are open to the public where we have volunteers ready to assist. These volunteers normally are doing their own tasks of cataloguing new donations and their own research. We have over 36,00 photographs on computer file, 9400 aviation publications and over 700 DVDs. Our archives also have many pilot logbooks, maintenance technical documents and unpublished memoirs. Memoirs are like gold to the library as they provide first-hand accounts of events often overlooked in official histories. These rich resources are highly valued by our library staff. Visitors are welcome to browse and read books in-situ but they must be a museum member to sign books out. Our current space limitation does not allow us to have a dedicated reading room, which we see a major shortfall. Unfortunately, online access is not available at this time.

Our artifacts department is located in the mezzanine over the Restoration Hall and allows researchers and visitors in by appointment. It includes items from the First World War to the present day.

Our education program is expanding and we currently have programs from kindergarden to grade 12. The BC provincial curriculum has aviation modules for grades 1-2, grades 6-7 and grades 11-12. We are expanding our outreach to schools and will be hiring a programming intern this summer. As yet, we have only had limited tours, mostly from private schools. Our plan is to target a percentage of the 42,000 public-school students enrolled in the Capital Regional District.

Many of our displays are interactive. We have 3 desktop simulators and a hi-tech motion simulator on loan from VRX, a local simulator manufacturer. In addition, we have a children's "touch and learn" area with many options to explore flight related themes. Children are free to handle these displays.

The museum is wheelchair accessible although we have no capacity to take physically handicapped people into our open aircraft displays. There are no elevators in the museum. We have wheelchairs and walkers available for those who need them and a number of rest areas in the museum.

3. Hazard Management – Aircraft

Our current hazard management can best be illustrated by examining how we manage the Martin Mars, the CF–104 Starfighter and the Restoration Hall.

The Starfighter was considered Controlled Goods until earlier this year by the US State Department. It was taken off the Controlled Goods List and the need to have a Controller Goods Officer was rescinded. This was a relief to the museum as the aircraft had been fully demilitarized. The structure had been made unflyable over 30 years ago. The Starfighter has a unique hazard in that the leading edge of the wings are extremely sharp. They present an injury hazard so protective covers have been attached to the leading edge of the wings. Tour guides are well trained to inform our visitors of the danger, and it has become one of the most interesting features of the aircraft. Visitors are invited to carefully feel the leading edge.

The Martin Mars presented some unique challenges due to its enormous size. POL (petrol, oil and lubricants) were drained from the aircraft and taken away professionally. Batteries were removed and taken away. Bespoke modular stairs have been erected around the aircraft to allow safe access in and out of the aircraft. Inside much work has been done. Barriers have been placed beside the built–in water tanks to stop fore and aft visitor access. The 22 water tanks are still in position to satisfy a Heritage Canada B status requirement and they can't be modified at this time. Interior LED lighting has been put throughout the aircraft. The floors have been reinforced with painted plywood sheets to cater to the increased numbers of visitors and this is being watched closely. If damage or stress is observed on the floor structure, repairs or a change of operation will be necessary. Plexiglas has been installed to prevent visitors from crawling into the interior of the wings while still allowing a good view. Environmental control inside the Hawaii Mars comesfrom of heaters, fans and dehumidifiers.

The Hawaii Mars has a low- speed high lift wing. It is enormous with a 200' foot wingspan. Outside the aircraft wing spoilers have been added to the top of the wing to prevent lift and the aircraft is tied down with eight 5000 lb buried cement blocks. Considering that the aircraft could scoop 60,000 lbs of water in 27 seconds, our mitigation efforts are deemed sufficient. This was proven last year when strong winter winds did not move the Mars. The aircraft is placed on deep concrete pads, topped with steel plates The aircraft actually sits on oleos extending down from the beaching gear which will stop any movement if any of the four main tires deflate.

We had been advised that if one of the tires deflated on either side, the remaining one would not be able to support it and the aircraft would collapse.

As mentioned earlier, access is controlled to the Restoration Hall. This is because of the hazardous workspace it represents. All Restoration Hall volunteers are qualified to work with the heavy machinery that they are operating. New volunteers are carefully vetted and receive training where required. WorkSafe BC protocols are enforced by the Restoration Hall Manager. A first aid locker for these volunteers is located within the hall. Tour guides are trained to take visitors through the Restoration Hall on non-working days.

On discovery that there was asbestos in our Pac Aero Westwind 4, a Hazmat team was called in to remove it. Further discover of bags of asbestos in the sea containers housing our Lancaster parts came as an unpleasant surprise. Fortunately, they were well sealed and also removed by the Hazmat team and properly disposed.

Our hazard management relies on the above-mentioned Work Safe BC protocols and on the large number of motivated volunteers that we have. They tour, maintain security and keep visitors safe. Our Museum Safety Officer oversees this aspect of our operation.

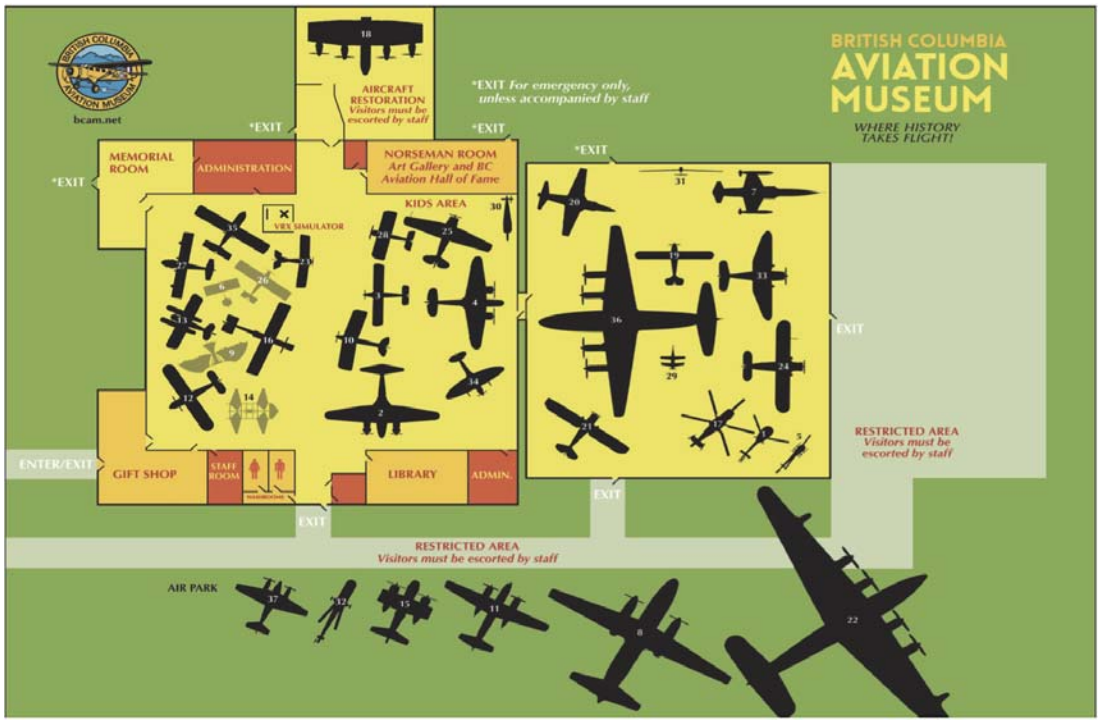
4. Hazard Management Archives and Artifacts

Artifacts are stored in a mezzanine above the Restoration Hall and are not climate controlled. Acid–free archival materials are used when in contact with our artifacts but not for all of them. This will change as the artifacts are continuously updated. Historic uniforms are stored within protective covers. The artifacts and archives are both protected from floods but not fires, as there is no sprinkler system in their places. That will be available in our new hangar facility. The roof is rated for a heavy snow load even though heavy snowfalls do not occur regularly in Victoria. Collection safety is always a concern at BCAM.

5. Storage

We are chronically short of storage space inside and outside the museum. Currently the BC Aviation Museum has 35,000 sq ft of space divided amongst our 2 main hangars, our annexes and our Restoration Hall. We display most of our 38 aircraft inside our two hangars. We store many of our artifacts in bespoke display cases as best we can and inside small storage areas (in the artifacts and archive departments and the Restoration Hall). Some of our archives are stored in a management office. Outside we have 3 temporary shelters for equipment (tugs and maintenance gear). We also have one 20' and three 40' shipping containers. One of the large containers is lighted and is fully stocked with inventoried Piasecki H–21 parts. The 20' container is also used for the Piasecki restoration. None of them have climate control.

The other 2 shipping containers are full of Lancaster parts outside of the main hangar. We are storing our Lancaster empennage outside under a tarp and the outer wings are stored in the open. This is far from ideal. There is chronic shortage of storage space available on the Victoria Airport grounds. There is no more room at BCAM and no offsite storage is possible.



In 2024, to meet the urgent need for space we created an outdoor airpark. This was not ideal due to the wet climate during the winter months on Canada's west coast but was still the best solution. However, it was essential as we did not have any more hangar space. Currently our Air Park holds 6 aircraft; the Martin Mars water bomber, a Convair 580 fire bomber, a Douglas A–26 fire bomber, a former Royal Canadian Navy Grumman Tracker and Sikorsky H–55 and a Pac Aero Westwind 4 (former aircraft used by the BC Minister of Highways).

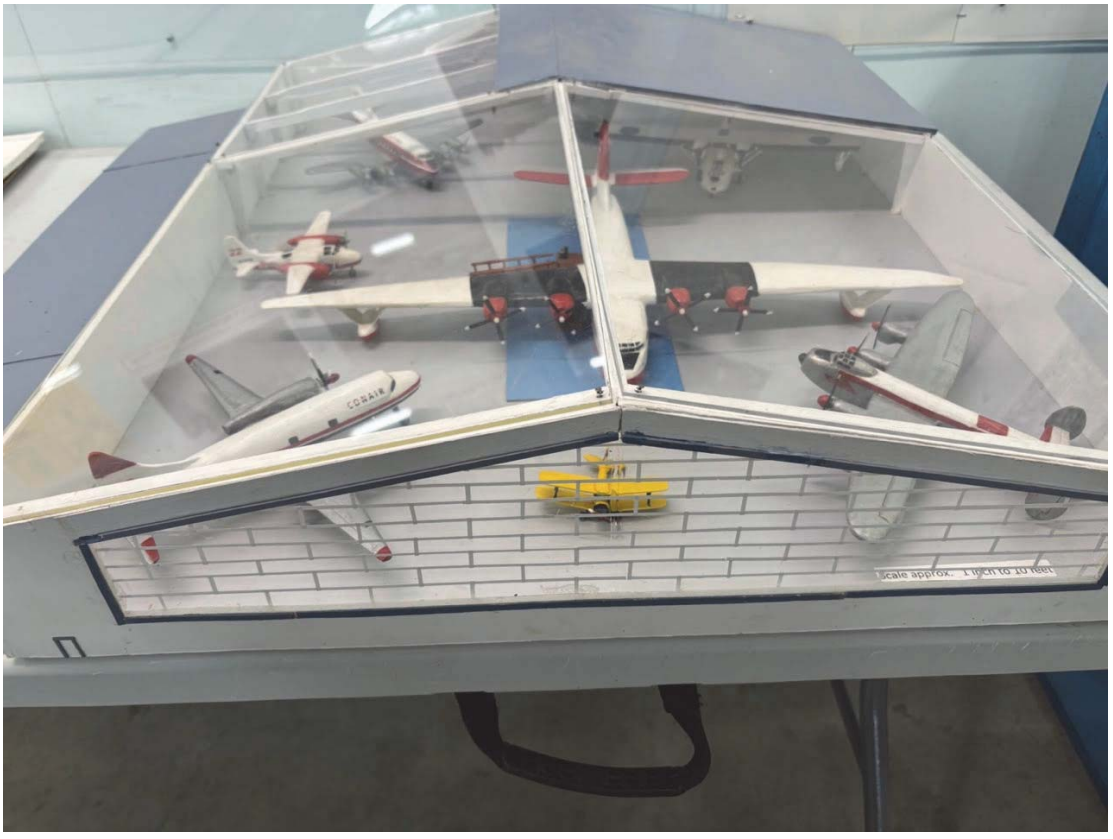
On the other side of the Main hangar, we have 2 Piasecki H–21 "Flying Banana" helicopters, one of which is undergoing restoration under a tarp and the other will be put up for sale. We are not allowed to put up any more temporary buildings by the Victoria Airport Authourity.

BCAM receives a large number of donations each month and that further adds to our storage problem. We have instituted a new protocol for artifacts; all donations must be arranged by prior appointment and with a list of potential donations. We have found that the families of veterans often want us to set up legacy displays for their deceased family member. This is no longer possible due to the space reasons already mentioned. We are in the process of deaccessioning many personal items that have been donated.

The library / archives department, however, still accepts all book and manuscript donations even though they are very crammed in their current space. Books are quickly assessed and as to their value to BCAM and many are then sold at our periodic book sales or on eBay. We have looked at a portable office with a weatherproof tunnel connecting with the library. This would allow proper climate control for these valuable records.

Future plans include a possible 3000 sq ft extension on the front of our main hangar to allow for more office and archive space. This is currently going through our project review process. Much bigger plans are being worked on for a new 72,000 sq ft hangar. This latter project is

just starting, and we are looking at a 5–7 year period for completion. This will be the museum's largest challenge in its existence with a requirement to raise $25 – 35 million dollars.The model below is of the proposed new hangar facility. This facility will greatly relieve our space and storage issues as the original hangars will be become the annexes to the new hangar. The new facility would allow for proper temperature and humidity control for our archives and artifacts departments.



Session 5

Case Study of the National Aviation Museum of Korea: Condition Survey of Aviation Heritage

Sodam Lee | Conservator, National Aviation Museum of Korea, Korea

Aviation heritage includes tangible and intangible elements related to the aviation industry developed since the 20th century, encompassing aircraft, parts, equipment, records, and technologies. As industrial heritage, it presents significant preservation challenges due to evolving technology and complex materials, necessitating systematic and quantitative condition surveys. The National Aviation Museum of Korea (NAMOK), opened in 2020, initially adopted a classification system developed in 2016 based on functional categories. However, it lacked adequate consideration for conservation needs and material properties. To address this, NAMOK launched a new preservation management project in 2023, followed by an extensive condition survey in 2024. This paper analyses methodologies, identifies limitations, and proposes improvements for enhanced preservation.

1. Establishing the Initial Framework (2023)

In 2023, the National Aviation Museum of Korea (NAMOK) conducted a condition survey of 200 artefacts to establish a systematic conservation management framework tailored to modern aviation heritage. Due to having only one in-house conservator, collaboration with external specialists was necessary. Thus, the National Gongju University Industry-Academia Cooperation Foundation was appointed as the lead organisation, coordinating a multidisciplinary team including Hanseo University's Cultural Property Conservation Science Research Center and cultural heritage conservation and policy research firms such as Modern Heritage, Hericon, Anchor Lab, and the Institute for Future Policy and Institutions.

Survey targets comprised 200 artefacts across 112 distinct categories, including aircraft parts, airline memorabilia, air force equipment, manuals, posters, uniforms, audiovisual

materials, and sound recordings, representing diverse periods, materials, and functions. Selection criteria included (1) material representativeness, (2) structural vulnerability, and (3) exhibition or research potential

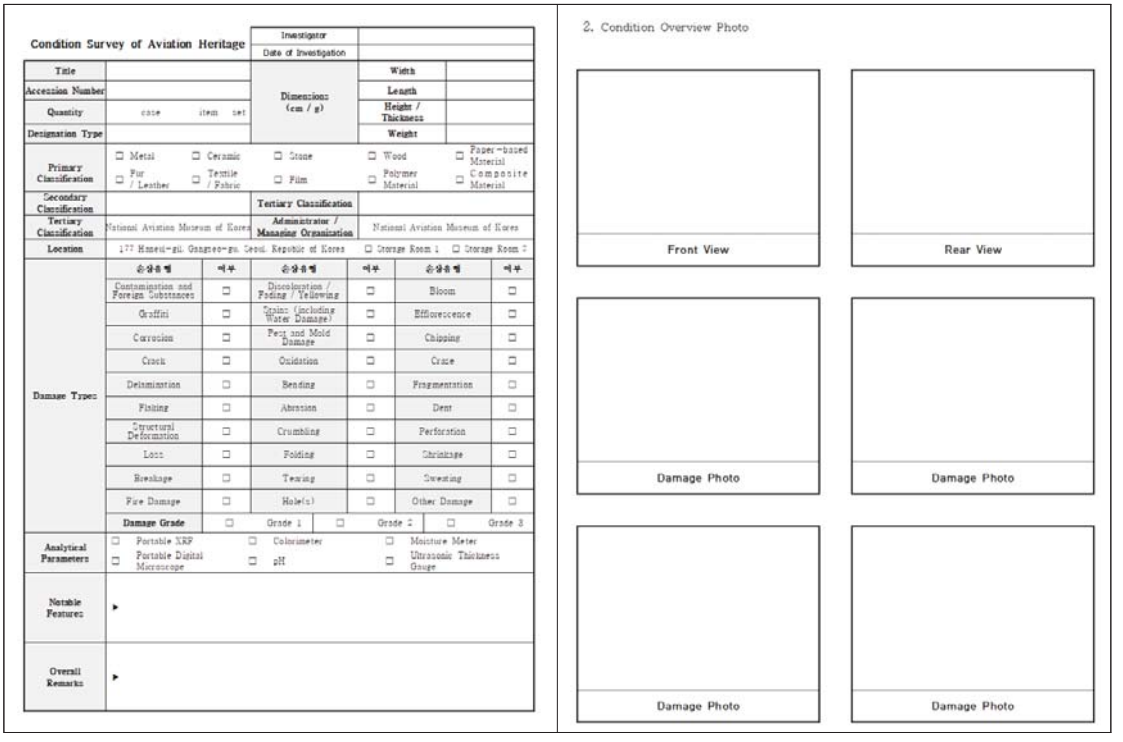
〈Overview of Surveyed Items〉

Item	Quantity	Example
Total number of investigations	112 cases 200 points	aircraft parts, airline collectibles, air force equipment, manuals, posters, etc.
Separate by material		metal, ceramics, glass, wood, paper, fur/leather, textiles/fabrics, and film, PlasticFRP, mixed materials
Separate by purpose		aircraft, doubles, photography & video, bibliography, household goods, paintings, memorabilia, other

Survey teams were divided based on material characteristics into inorganic materials (metals, ceramics, glass, films, plastics) and organic materials (paper, wood, fur, leather, textiles). Each team conducted condition assessments, non-destructive analyses, damage classification, and standardized reporting. Considering the complex composite nature of aviation heritage, various non-destructive analytical tools were employed, including portable XRF, digital microscopes, ultrasonic thickness gauges, colorimeters, and PCB inspection equipment.

Through this survey, NAMOK developed a standardized condition survey form enabling structural and scientific assessments of artefact conditions. The form includes fields such as basic information, material and functional classification, damage types and severity, analytical results, conservation priority, and comprehensive inspector evaluations, ensuring consistency in future extensive surveys.

Notably, about 20 distinct damage types were defined, reflecting aviation heritage's unique material characteristics and deterioration patterns. Representative damage types included corrosion, discoloration, microbial or insect damage, loss, and structural breakage. Each damage type was provided with clear definitions and evaluation criteria to minimize subjective differences among inspectors and facilitate systematic accumulation of conservation records.



Condition Survey of Aviation Heritage

Investigator					
Date of Investigation					
Title		Dimensions (cm / g)	Width		
Accession Number			Length		
Quantity	case item set		Height / Thickness		
Designation Type			Weight		
Primary Classification	☐ Metal ☐ Ceramic ☐ Stone ☐ Wood ☐ Paper-based Material ☐ Fur / Leather ☐ Textile / Fabric ☐ Film ☐ Polymer Material ☐ Composite Material				
Secondary Classification		Tertiary Classification			
Tertiary Classification	National Aviation Museum of Korea	Administrator / Managing Organization	National Aviation Museum of Korea		
Location	177 Hanseul-gil, Gangseo-gu, Seoul, Republic of Korea	☐ Storage Room 1 ☐ Storage Room 2			

Damage Type:	손상유형	여부	손상유형	여부	손상유형	여부
	Contamination and Foreign Substances	☐	Discoloration / Fading / Yellowing	☐	Bloom	☐
	Graffiti	☐	Stains (including Water Damage)	☐	Efflorescence	☐
	Corrosion	☐	Pest and Mold Damage	☐	Chipping	☐
	Crack	☐	Oxidation	☐	Craze	☐
	Delamination	☐	Bending	☐	Fragmentation	☐
	Fisting	☐	Abrasion	☐	Dent	☐
	Structural Deformation	☐	Crumbling	☐	Perforation	☐
	Loss	☐	Folding	☐	Shrinkage	☐
	Breakage	☐	Tearing	☐	Sweating	☐
	Fire Damage	☐	Hole(s)	☐	Other Damage	☐
	Damage Grade	☐ Grade 1	☐ Grade 2	☐ Grade 3		

Analytical Parameters	☐ Portable XRF	☐ Colorimeter	☐ Moisture Meter
	☐ Portable Digital Microscope	☐ pH	☐ Ultrasonic Thickness Gauge
Notable Features:	▸		
Overall Remarks	▸		

2. Condition Overview Photo

Front View	Rear View
Damage Photo	Damage Photo
Damage Photo	Damage Photo

〈Condition Report〉 form

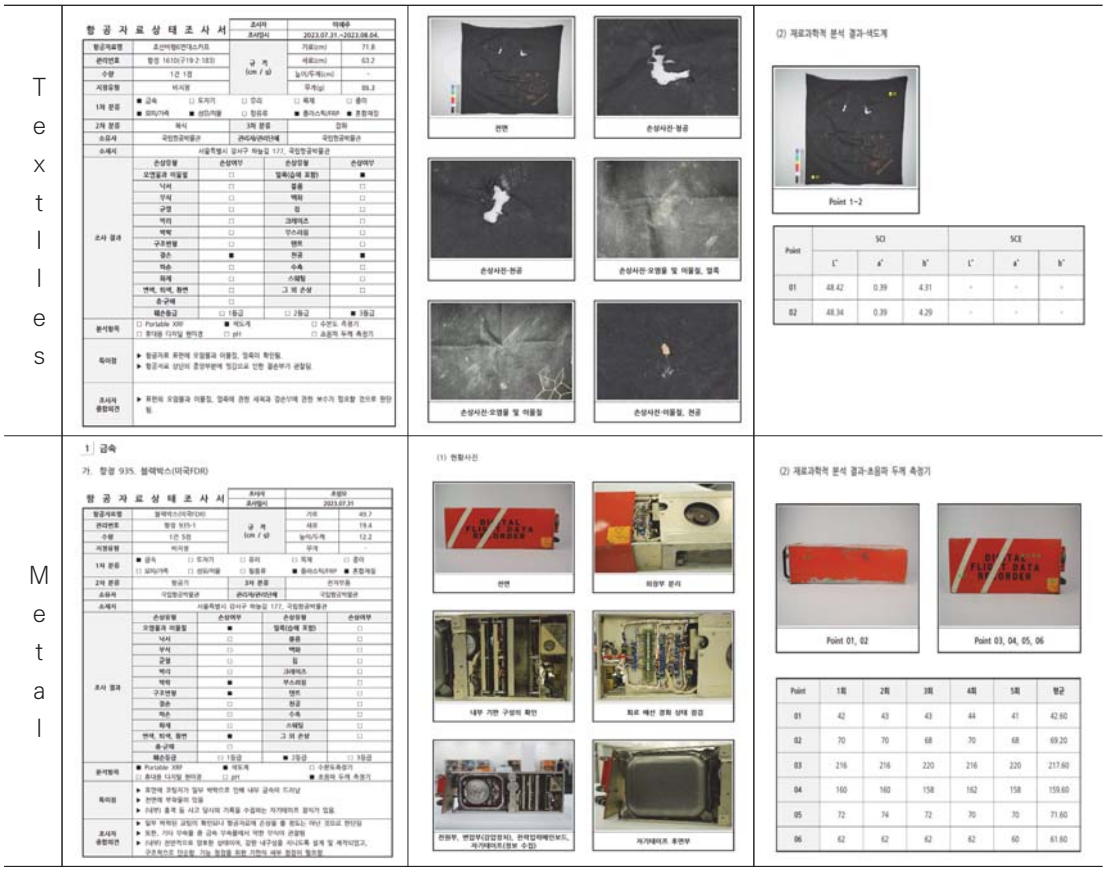
〈Damage types〉

Damage type	Definition
Dirt and debris	A foreign substance that can be removed by physical or chemical means a surface other than the original material.
Stains (including wet)	Marks on the surface of the material caused by foreign objects or moisture penetrating the material
Discolouration /fading / yellowing	Changed or yellowed from its original colour
Doodles	Artificially created text or drawings, such as writing and colouring tools.
Fungi	Damage caused by pests or bacteria and fungi

〈Damage rating criteria and actions〉

Separation	Status	What to do
Grade 1	Good	– Materials that are in a stable state
Grade 2	Moderate to mild	– Structurally stable but deteriorating materials
Grade 3	Critical	– Materials that need to be preserved immediately after a condition survey

During the actual survey process, inspectors assessed damage types and severity through visual inspection, complemented by non-destructive scientific analysis (portable XRF, colorimetry, digital microscopy, ultrasonic thickness measurements).



Examples of 2023 Condition Reports

Survey results identified 21 artefacts classified as Grade C (severely deteriorated), of which six were prioritized for immediate conservation treatments, considering exhibition potential and preservation needs. Representative treatments included deacidification of oxidized aviation-related newspapers and manuals using Bookkeeper spray and replacement of metal staples and string bindings for iron-bound printed materials.

〈Distribution by damage class according to 2023 condition survey results〉

Condition grade	number of artifacts	Percentage (%)	Remarks
Grade 1	86 artifacts	45	
Grade 2	87 artifacts	47	
Grade 3	17 artifacts	13.5	6 artifacts preserves completed

The standardized survey form developed through the 2023 survey served as a foundational tool for conservation management, subsequently becoming essential in the large-scale condition survey and enhanced classification system conducted in 2024. Building on these initial achievements, NAMOK established a more sophisticated and expanded condition assessment and management framework in 2024.

2. Expansion and Refinement of the Condition Survey Framework (2024)

Based on the classification system and standardised condition survey form established during the 2023 investigation, the National Aviation Museum of Korea conducted a large-scale condition survey in 2024, targeting a total of 13,886 artefacts as part of its annual conservation project.

This phase of the survey was carried out by the private conservation firm Modern Heritage, which was selected as the external contractor. The project maintained the multidisciplinary collaborative structure established in 2023 while strengthening field applicability and technical expertise.

The survey primarily focused on artefacts stored in NAMOK's first storage facility. Currently, the museum operates two separate storage areas: Storage 1 houses primarily organic materials such as paper, textiles, and wood, as well as small metal components. In contrast, Storage 2 contains a wider variety of non-registered materials, including large aircraft parts, newly acquired artefacts, archives, and reference materials.

In 2024, the museum prioritised surveying items from Storage 1 because of their higher sensitivity to environmental conditions and urgent conservation needs. The investigation of Storage 2 is planned as a separate, phased project to be conducted in the future.

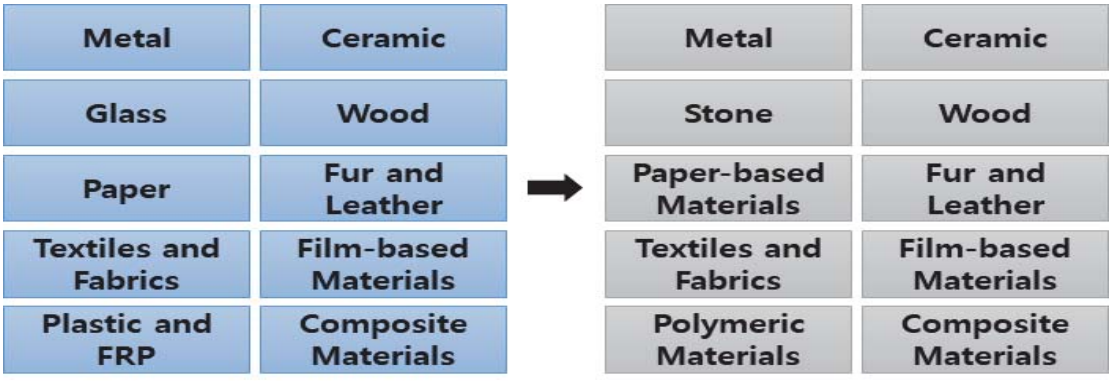
〈Storage Room Classification and Material Types – National Aviation Museum of Korea〉

	Types of archival material	Remarks
1Storage	paper, textiles, wood, small metals, etc.	conducting the 2024–2025 health survey
2Storage	large aircraft parts (e.g., engines, afterburners), reference materials, archival documents, and new acquisitions (purchased and donated items)	conduct a separate investigation in the future

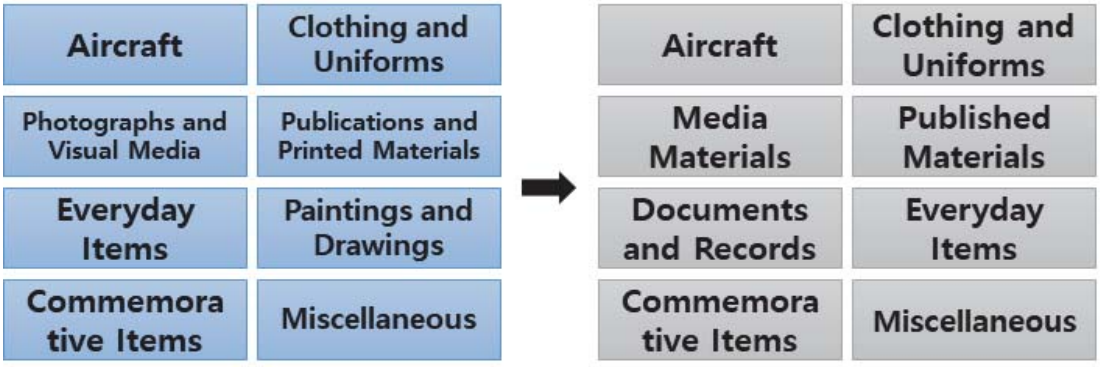
Although the 2024 survey was initially based on the classification system developed in 2023, some categories were found to be unsuitable for large-scale application during field implementation. In particular, the intermediate-Grade categories that combined material types with functional uses lacked consistency and negatively impacted the efficiency of the mass survey process.

To address this issue, some categories were revised and supplemented with a focus on improving practicality and scalability. For example, a new overarching category, "polymeric materials," was introduced to include previously unclassified materials such as stone, rubber, and vinyl. The photo and video category was also redefined in a more generalised manner to accommodate a broader range of media formats.

In addition, the original bibliographic category was divided into "bibliographic materials" and "documentary records" based on function and authorship. These were respectively reorganised as printed and visual materials for information delivery, and administrative or legal documents produced by institutions.



Comparison of Classification Systems: 2023 (Original) vs. 2024 (Revised)



Comparison of Subcategory Structures: 2023 (Original) vs. 2024 (Revised)

One of the most notable findings from the 2024 survey was that approximately 60% of the museum's collection consisted of paper-based materials. As a result, the condition survey form was refined to better capture deterioration patterns specific to paper and other organic materials.

In particular, additional damage types were introduced for materials highly susceptible to degradation. These included oxidation, bending, abrasion, crumbling, folding, tearing, and puncturing. This refinement aimed to improve consistency in judgment among investigators and enhance the accuracy of comparative analyses.

〈Additional damage types〉

Damage type	Definition
Oxidation	A chemical reaction in which acidic gases in the air or the inherent acidity within the paper weaken or break the hydrogen bonds of cellulose, the primary component of paper.
Creasing (Irreversible)	A condition in which paper is creased due to external physical force, resulting in permanent deformation that cannot be reversed through conservation treatment.
Abrasion	The wearing away of parts of the paper surface as a result of repeated use or handling.
Brittleness	A condition in which paper becomes fragile and crumbles easily due to acidification or other factors that lead to the loss of moisture and the breakdown of cellulose hydrogen bonds, reducing structural integrity.
Folding (Reversible)	A condition in which paper is folded due to external force but can typically be restored through conservation treatment.
Tearing	A physical condition where part of the paper is torn due to mechanical stress or force.
Puncture	Holes created by artificial means, such as the use of staplers, binding tools, or other devices during processing or storage.

F R P

39 23년-3차-11-04, 보잉 747 유아 장난감

항 공 자 료 상 태 조 사 서

조사기관	모던헤리티지			
조사일시	2024년 08월 20일			
항공자료명	보잉 747 유아 장난감	규 격 (cm / g)	가로	32.8
관리번호	23년-3차-11-04		세로	14.4
수량	1 건 3 점 일괄		높이/두께	12.8
지정유형	비지정		무게	670
1차 분류	■ 금속 □ 세라믹 □ 석재 □ 목재 ■ 지류 □ 모피/가죽 □ 섬유/직물 □ 필름 ■ 고분자물질 □ 혼합재질			
2차 분류	일상용품	3차 분류	장난감	
소유자	국립항공박물관	관리자/관리단체	국립항공박물관	
소재지	서울특별시 강서구 하늘길 177, 국립항공박물관 제1수장고 5-1-5			

조사 결과	손상유형	여부	손상유형	여부	손상유형	여부
	오염물과 이물질	■	변색, 퇴색, 황변	■	블룸	□
	낙서	□	얼룩(습해 포함)	■	백화	□
	부식	□	충·균해	□	칩	□
	균열	□	산화	□	크레이즈	□
	박리	□	꺾임	□	부스러짐	□
	박락	■	마모	■	덴트	□
	구조변형	□	바스러짐	□	천공	□
	결손	□	접힘	■	수축	□
	파손	■	찢김	■	스웨팅	□
	화재	□	구멍	□	그 외 손상	□
	손상등급	□ 1등급		□ 2등급		■ 3등급
분석항목	□ Portable XRF □ 색도계 □ 수분도측정기 □ 휴대용 디지털 현미경 □ pH □ 초음파두께측정기					
특이점	▶ 스티커 접착 흔적 확인 ▶ 접힘, 찢김, 마모는 상자에 한함 ▶ 비행기 모형 파손으로 인한 보존처리 필요					
조사자 종합의견	▶ 3등급 보존관리 조치 방안 적용					

(1) 현황사진


전면


후면

마모


찢김 / 박락 / 접힘


파손


변색, 퇴색, 황변

Paper-based

항 공 자 료 상 태 조 사 서

조사기관	모던헤리티지			
조사일시	2024년 08월 21일			
항공자료명	비행기, 기구 사진화보가 실린 [국제사진신보]	규 격 (cm / g)	가로	26.5
관리번호	23년-3차-08-31-01		세로	38.2
수량	1 건 1 점 일괄		높이/두께	0.4
지정유형	비지정		무게	
1차 분류	■ 금속 □ 세라믹 □ 석재 □ 목재 ■ 지류 □ 모피/가죽 □ 섬유/직물 □ 필름 □ 고분자물질 □ 혼합재질			
2차 분류	서지류	3차 분류	정기간행물	
소유자	국립항공박물관	관리자/관리단체	국립항공박물관	
소재지	서울특별시 강서구 하늘길 177, 국립항공박물관 제1수장고 5-2-5			

조사 결과	손상유형	여부	손상유형	여부	손상유형	여부
	오염물과 이물질	■	변색, 퇴색, 황변	■	블룸	□
	낙서	□	얼룩(습해 포함)	■	백화	□
	부식	■	충·균해	■	칩	□
	균열	□	산화	■	크레이즈	□
	박리	□	꺾임	□	부스러짐	□
	박락	□	마모	■	덴트	□
	구조변형	□	바스러짐	■	천공	■
	결손	■	접힘	□	수축	□
	파손	□	찢김	■	스웨팅	□
	화재	□	구멍	□	그 외 손상	□
	손상등급	□ 1등급		□ 2등급		■ 3등급
분석항목	□ Portable XRF ■ 색도계 ■ 수분도측정기 ■ 휴대용 디지털 현미경 ■ pH □ 초음파두께측정기					
특이점	▶ 13점 중 9점만 존재 ▶ 책등 손상과 편철 구멍 확인 ▶ 산화로 인한 바스러짐 확인					
조사자 종합의견	▶ 3등급 보존관리 조치 방안 적용					

(1) 현황사진


전면


후면


마모 / 찢김


천공 / 산화 / 찢김


부식 / 얼룩


접힘 / 바스러짐

Examples of 2024 Condition Reports

Survey results indicated that approximately 6% of the assessed items (935 artefacts) were classified as Grade C, requiring immediate conservation treatment. However, upon closer examination, it was found that some of these items could potentially be stabilised through short-term environmental control alone. This led to the recognition of a need for further subcategorisation within the critical condition grade.

〈Distribution by damage class according to 2024 condition survey results〉

Condition Grade	Number of artifacts	Percentage (%)	Remarks
Grade 1	7,200 artifacts	approximately 52	
Grade 2	5,700 artifacts	approximately 41	
Grade 3	935 artifacts	6	what to retain in 2025

As a result, it has become increasingly important to develop a more refined conservation grading system—one that considers not only the current Grade of deterioration but also structural stability, the rate of degradation, and the artefact's responsiveness to environmental control.

The 2024 survey served as a critical implementation phase that tested the field applicability and scalability of the framework developed in 2023. It marked the first major step toward systematic management of NAMOK's extensive aviation heritage collection, establishing a core dataset for setting conservation priorities, implementing long-term monitoring, and improving storage environments.

Moving forward, targeted investigations will be needed for items housed in Storage 2, including large aircraft components, unregistered materials, and archival records. To support these efforts, complementary strategies should include the development of customised survey tools, recruitment of dedicated conservation staff, and expansion of storage capacity.

3. Conclusion and Future Directions

In 2024, South Korea implemented the "Preliminary Cultural Heritage" designation to protect modern heritage items less than 50 years old, reflecting growing public interest in the preservation of aviation-related cultural assets. At this critical juncture, the National Aviation Museum of Korea (NAMOK) undertook a comprehensive condition survey of 14,086 items—

accounting for 61% of its total collection—laying a foundation for a systematic conservation management framework.

Using a standardized survey form developed in 2023, NAMOK quantitatively evaluated material characteristics and deterioration patterns. This effort led to the successful standardization of damage terminology across a wide range of materials, including aircraft components, paper-based objects, and textiles. It also enabled the establishment of a prioritization system for conservation treatments, improvements in storage environments, and the formulation of long-term monitoring strategies.

Nonetheless, several challenges persist. These include the need to further refine the condition rating criteria, develop classification methodologies tailored to aviation-specific materials and equipment, and establish conservation protocols for oversized and unregistered items.

Looking ahead, NAMOK aims to strengthen interdisciplinary and external collaborations, secure additional conservation expertise, and expand data-driven approaches. These efforts will contribute to the long-term sustainability of aviation heritage preservation and ensure its relevance and accessibility for future generations

Session 5

Integrating Risk Management Framework in Collections Care: A Strategic Approach

Andor Vince | Collections Care Adviser, Heritage Collections Care Consortium, New Zealand

1. Introduction

This article explores the importance of a risk management framework in shaping collections care strategies and planning. It highlights the need to integrate hazard management and risk management into a cohesive framework to effectively address collection risks and the organizational risks triggered by them. Additionally, the article outlines actionable steps and strategies for implementing this integrated approach in practice.

2. Hazard, Risk Management, and Risk Assessment

In collections care, both hazard management and risk management are essential for preserving collections. However, confusion often arises regarding the distinctions between these concepts and the importance of integrating both into a comprehensive collections care strategy. Therefore, it is important to clearly define the terms: hazard management, risk management, and risk assessment.

Hazard management focuses on identifying, assessing, and controlling hazards that could harm or damage collections. It addresses potential sources of harm that threaten the preservation of heritage assets. The ten agents of deterioration, such as fire, water, theft, and incorrect relative humidity, are all considered hazards—direct sources of harm to collections.

Risk management involves identifying, analyzing, evaluating, and mitigating risks to minimize their impact on collections. This process addresses specific risks, such as faulty wiring and fading objects caused by light exposure.

The difference between the two is that hazard management focuses on identifying and controlling potential sources of harm (hazards), while risk management involves assessing and addressing the potential consequences (risks) associated with those hazards.

Furthermore, it is essential to distinguish between risk management and risk assessment. These terms are often mistakenly used interchangeably, yet they refer to distinct processes. Risk assessment is a key component of risk management, focusing solely on identifying, analyzing, and evaluating potential risks (Picture 1).

Picture 1. Visual representation of the risk management process, highlighting the critical steps involved in risk assessment.

3. Why a Narrow Focus on Hazards is Insufficient for Collection Care

Many heritage organizations prioritize managing hazards over managing risks in collections care. One reason is that regulatory frameworks they must adhere to, such as health and safety regulations, fire safety codes, and building standards, often emphasize hazard identification. This emphasis naturally shifts the focus toward managing hazards as part of a whole organizational approach.

The other reason is that hazards prompt immediate action. For example, fire, water damage, and theft present clear concerns that give rise to a sense of urgency and the need for an immediate response. As a result, heritage organizations frequently allocate resources toward direct hazard mitigation strategies, viewing these efforts as essential for preventive care. For example, a museum may invest in advanced fire suppression systems and climate control technologies to safeguard objects from potential damage caused by fire or environmental fluctuations. While such investments can help reduce potential damage from specific hazards, focusing primarily on hazard mitigation can lead to a false sense of security and overspending.

For example, introducing a sprinkler system is not always the most cost–effective approach to managing fire hazards. It is essential to assess the risks associated with fire hazards first to determine the necessity of installing sprinkler systems. This assessment should focus on specific risks, evaluating factors such as the layout of the space, the presence of flammable materials, potential ignition sources, and the proximity of the nearest fire station, along with the response time of the fire brigade. These factors can help identify areas that may be at greater risk of fire and determine whether there is a need for sprinkler systems.

Furthermore, by investing in hazard mitigation, organizations may divert funds away from necessary risk assessment and addressing hidden or less visible risks to collections. For instance, faulty wiring in the building may pose a significant risk of electrical fires, which might not be immediately noticeable but can lead to catastrophic consequences if not identified and addressed. While having a fire suppression system may minimize the impact of a fire caused by electrical means, it does not prevent the risks from occurring. Therefore, decisions regarding hazard management should always be informed by a thorough risk assessment. Together, hazard management and risk assessment establish a comprehensive framework for ensuring the effective preservation of collections.

4. Establishing a Comprehensive Risk Management Framework

Within heritage, the risk management framework can be defined as a structured approach to identifying, assessing, and minimizing collection risks, in line with the ISO 31000:2018 standard: Risk Management – Guidelines.

To effectively implement this framework, it is essential to recognize that managing risks to heritage assets should be an integral part of the organization's overall risk management strategy. Therefore, it is important to establish a risk management framework that extends beyond merely assessing and managing risks to collections. This framework should also encompass organizational risks that may arise from collection risks, including potential reputational damage, health and safety issues, and financial and legal implications (Table 1).

Risk Description	Risk Rating	Expected Impact				Mitigation
		Collections	Reputation	Health and Safety	Financial	
A major fire affecting the entire museum building will result in significant damage and almost total loss of the collections' significant value. **Background Information** A great majority of objects on display and in storage are not made from highly flammable organic materials. However, many objects are vulnerable to smoke and water, which could cause contamination. Additionally, the collections are densely stored and displayed on open shelves. Accumulations of dust and debris in stores that can ignite and fuel the fire Poorly designed escape routes that can make it difficult for people to evacuate safely	High	Objects susceptible to fire damage are most likely to suffer substantial damage or total destruction. Objects less susceptible to fire, such as metal, stones, and fired ceramics, will be affected primarily by heat exposure, which may lead to warping, cracking, or surface degradation Significant physical damage and loss of cultural value to the museum's collections can be expected.	Sympathetic national and international press interest should be expected. The level of impact on the reputation of the museum can be high if the fire is caused by negligence, results in loss of human life, affects emergency response for collections, or is poorly managed in the press.	The impact of a fire can be classified as minor to moderate, as fire procedures for evacuating visitors and staff are in place. Minor injuries to some staff or visitors requiring first aid treatment can be expected, though significant injuries needing medical treatment and an extended hospital stay are less likely, but still possible. Additionally, there can be a significant impact on the well-being of staff, including potential psychological effects, such as anxiety, depression, stress-related disorders, and post-traumatic stress disorder (PTSD) in some individuals	The re-establishment of the museum building and storage areas, along with remedial work on the collections, would require a significant financial investment exceeding £5,000,000. A financial investment in the range of £100,000 to £1,000,000 for the conservation of damaged objects can be expected over many years.	**Enhance Fire Safety Procedures.** Regularly review and update fire safety policies and evacuation procedures. Conduct fire drills for staff, ensuring everyone knows their roles during an evacuation. **Conduct Regular Fire Risk Assessments.** Perform routine assessments to identify potential fire hazards and address them promptly. Create an Emergency Response Plan for Collections **Improve Storage Practices.** Organize collections to minimize proximity to flammable materials. Implement good housekeeping procedures and fire-resistant storage solutions for vulnerable items. Etc.

Table 1. This table illustrates how risks to collections can trigger organizational risks. When considering mitigation strategies, it is essential to take all these risks into account. While this is more evident in the case of a major fire, the same principle should apply to other risks, such as pest infestation, water damage, and fading.

For example, in a museum, the risk of pest infestation might initially be assessed as low to medium priority. However, this risk can trigger significant reputational consequences for the organization. For example, in a museum, the risk of pest infestation might initially be assessed as low to medium priority. However, this risk can trigger significant reputational consequences for the organization. Therefore, at the organizational level, it should be treated as a high priority. This necessitates appropriate prioritization, resource allocation, and effective management—actions most effectively carried out by a dedicated risk management team.

5. The Dedicated Risk Management Team

Building a risk management framework requires time, skills, and resources. Central to this framework is a dedicated and trained interdisciplinary team focused on ongoing risk assessment and management. This team regularly identifies, analyses, and evaluates risks while collaborating with various departments to encourage cross-disciplinary dialogue and promote a culture of proactive risk awareness regarding collections.

However, in many heritage organizations, systematic and strategic risk management for collections is not consistently achieved. This challenge also extends to conservation and collections departments, which may struggle to fully implement preservation strategies without incorporating risk management practices and providing training for their staff.

Furthermore, it is essential to strengthen the emphasis on risk management for collections at the senior management level. This underscores the need for conservation and collections care to be represented at the senior management level by someone with a strong understanding of conservation, collections care, and potential risks to heritage assets. This leadership role is crucial for articulating the importance of managing risks to collections, promoting interdepartmental collaboration, and ensuring adequate resources are in place to mitigate risks effectively.

6. The Role of Risk Management in Shaping Collections Care Strategies and Planning

In addition to preserving collections, actively managing risks to heritage assets serves two other essential functions:

- It helps to establish the strategy for long-term goals for collections care.
- It forms a fundamental part of collections care planning, driving specific actions and resources needed to achieve the strategic goals set for collections[1].

Strategic thinking should address two key questions: what priorities should be established for action, and how should limited resources be allocated to minimize collection risks?

To effectively navigate these strategic questions and ensure informed decision-making, various risk management methodologies have been developed for the heritage sector over the past 30 years to facilitate systematic risk assessment and management. These include the ABC methodology, created by the Canadian Conservation Institute and ICCROM in collaboration with other partners[2]; the Cultural Property Risk Analysis Model (C-Pram), developed by Robert Waller[3]; and QuiskScan, established by Agnes Brokerhof and Anna Bulow[4].

Additionally, several other tools are available as part of the risk management framework to further identify and analyse risks and their 'root' causes, such as the Risk Register, SWOT analysis, the Fishbone diagram (Ishikawa), the Root Cause Analysis (RCA), the 5 Whys method, Scenario Analysis, and the Tornado chart. These tools can provide insights that will shape the collections care strategy and planning and drive effective resource prioritization.

1) In collections care, the concepts of strategy and planning are often misunderstood, yet both are crucial for effective preservation. Strategy includes a long-term preservation of collections, setting the vision and overarching goals for the care of collections. In contrast, planning involves the specific actions and resources needed to achieve these strategic objectives. Therefore, it is important to recognise that strategy and planning represent different activities and should not be put under the same banner of strategic collection care plan.

2) Risk management for heritage collections - Canada.ca

3) Robert Waller, Risk Management Applied To Preventive Conservation. pp 21-28 In: Rose, C.L., Hawks, C.A. and Genoways, H.H. (eds.). Storage of Natural History Collections: A Preventive Conservation Approach. Society for the Preservation of Natural History Collections Iowa City, x+448pp., 1995. http://www.museum-sos.org/docs/WallerSPNHC1995.pdf

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For example, the magnitude of risks can be presented using a Half-Tornado Chart (Chart 1). The chart illustrates risks, ranked from low priority at the bottom to high priority at the top, enabling organizations to determine where resources should be allocated for effective collections care. It also provides a clear visual representation of risks, facilitating effective communication of priorities to stakeholders.

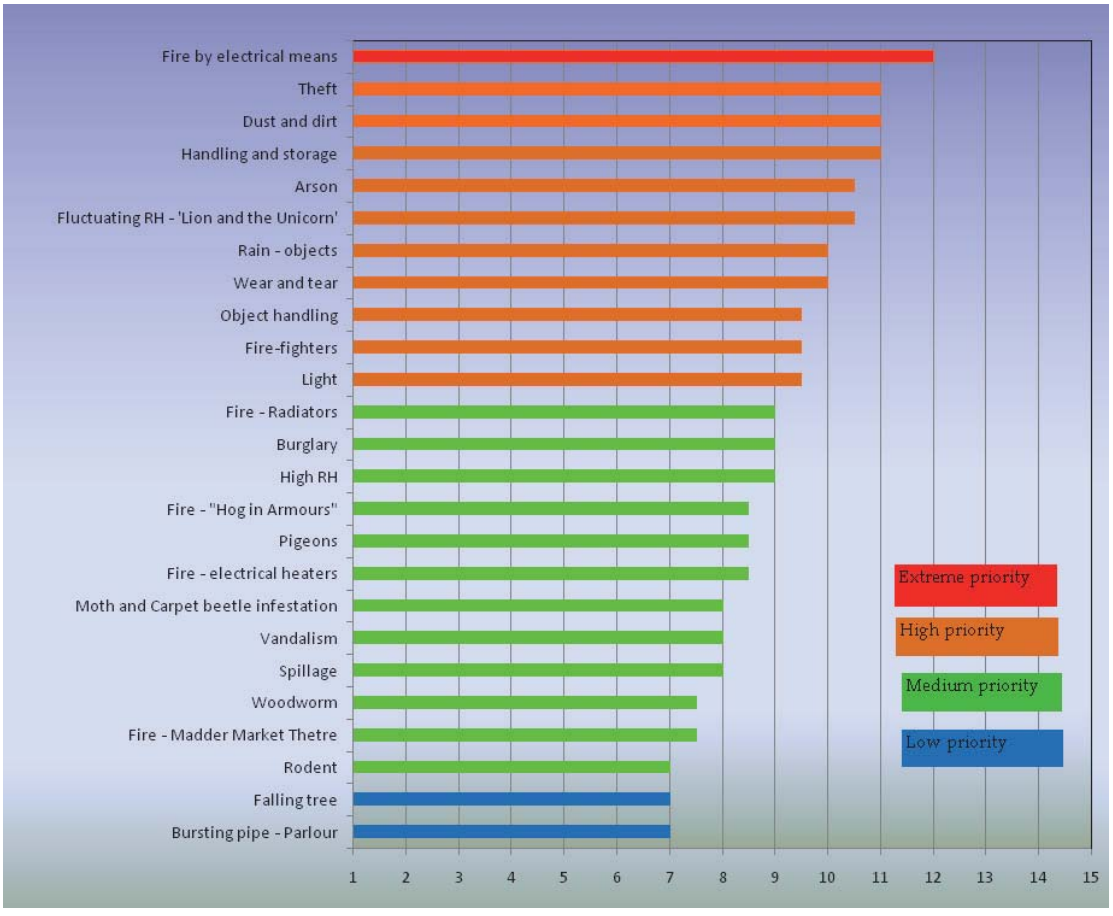

Chart 1. A half-tornado chart illustrating levels of risk, clearly presenting priorities for action.

The strength of the Half-Tornado Chart lies not only in its visual representation of priority risks but also in its ability to facilitate deeper analysis and identify underlying issues. For instance, it can be employed to analyze related risks that may share common origins or consequences. By examining the ten highest-priority risks presented in Chart 1, one may discern that several risks stem from underlying issues, such as inadequate housekeeping

and building maintenance (e.g., dust accumulation, building leaks, and wear and tear of items). Identifying these 'root' causes allows heritage organizations to pose essential questions: why are there so many high-priority risks related to housekeeping and maintenance? Are they due to restricted resources, insufficient understanding of the importance of housekeeping, or perhaps a need for better training among staff?

By addressing these strategic questions and employing risk management techniques and analytical tools, organizations can prioritize risks, allocate resources efficiently, and improve decision-making. This process is vital for developing effective strategies and long-term planning in collections care. Heritage organizations that integrate this framework into their core operations will strengthen the resilience of their collections and make significant contributions to their long-term, cost-effective, and sustainable preservation.

7. Conclusion

This article summarizes actionable steps as a practical roadmap for heritage organizations aiming to strengthen their collections care practices, adopt proactive decision-making, ensure efficient resource allocation, and cultivate a culture of risk awareness.

- **Establish a Comprehensive Risk Management Framework.** Create and maintain a risk management framework encompassing both collection and organizational risks. Secure the necessary resources for establishing the framework and organizing staff training programs. Additionally, establish communication protocols for reporting and updates and secure support from senior leadership to ensure commitment to the framework's implementation.

- **Establish a Dedicated Risk Management Team.** Form a small group of trained professionals in risk assessment and management. This team will regularly identify, analyze, and review risks and engage with various departments to develop a culture of proactive risk awareness.

- **Identify and Evaluate Risks.** Implement a systematic risk assessment and risk management approach to assess potential impacts of various risks beyond immediate threats (hazards). Use the available tools and techniques as part of your risk

management framework, such as the ABC methodology, C-Pram, and QuiskScan. Employ tools like the Risk Register, Root Cause Analysis (RCA), the 5 Whys method, Scenario Analysis, and Tornado charts to analyze risks and make strategic decisions for their mitigation accordingly.

- **Develop a Holistic Collections** Care Strategy and Plan. The results of risk assessment and the tools you employ in analyzing risks will shape and drive your collections care strategy. In this process, it is important to connect risks to collections with the organizational risks they can trigger. This approach allows for tailoring the collections care strategy at the organizational level rather than just at the departmental level. Once the strategy is outlined, a long-term collections care plan should be developed.

- **Allocate Resources.** In collections care planning, ensure that resources available for collections care are allocated based on a thorough understanding of both immediate hazards and broader organizational risks triggered by risks to collections. It may be necessary to request additional resources to manage these risks effectively. Use visual tools, such as the Tornado chart, to strengthen the case for additional resources, demonstrating the potential impact of risks on collections and the organization.

- **Regularly Identify and Review Risks.** Risk assessment and management for collections are continuous activities. Establish a schedule for ongoing risk assessments and updates to the risk management framework based on new information and changing circumstances. Communicate with stakeholders about any new risks identified, as this might trigger necessary changes in your collections care strategy and plan. Keeping stakeholders informed promotes transparency, encourages collaboration, and ensures appropriate measures are taken to preserve the collections effectively.

- **Document.** Document decisions made, risks identified, and mitigation strategies employed throughout the process to ensure accountability and transparency. The documentation process is also a valuable learning tool for developing best practices and refining risk assessment methods.

[Session 6]

Digital

Erin Napier, Sean Kearney, Al Mickeloff
Canadian Warplane Heritage Museum, Canada

Lauren DiVito
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2025
International Conference for
Aviation
Museum
Professionals

Session 6

Our Digital Experience
Canadian Warplane Heritage Museum

Erin Napier | Curator

Sean Kearney | Education & Public Program Manager

Al Mickeloff | Marketing Manager

Canadian Warplane Heritage Museum, Canada

The Canadian Warplane Heritage Museum was started by two friends in 1972 with the intent of restoring and flying a vintage military aircraft. Now in its 53rd year of operations, it has grown and evolved into a world-class museum of almost 50 aircraft with a large artifact collection, interactive exhibits, and a thriving education program. What sets the museum apart from others in Canada is that many aircraft are airworthy and are flown regularly, including one of only two flying Avro Lancasters in the world. The museum operates as a not-for-profit organization with a sustainable operating budget that is not reliant upon government funding.

In 2018, a new Virtual Reality experience called Berlin Blitz came to the museum's attention. Created by the British Broadcasting Corporation (BBC), this Virtual Reality experience brought the viewer along on a Lancaster mission in the Second World War utilizing an authentic audio recording from the period. A licensing agreement was reached with the BBC for its use for a set period of time and investments were made to bring the experience to the museum including new computers, VR goggles, and a part-time IT staff member to set up and facilitate the experience. It was incredibly well received, with many visitors moved to tears with the authenticity and emotion conveyed. It was perhaps too successful, as attendance for the summer spiked and the museum encountered limitations with the number of headsets not meeting demand. This first step into digital experiences, along with an online catalogue to showcase artifacts in a digital format, laid the groundwork for future technology expansion.

Not wanting to rest on its laurels as a flying museum, the curatorial team identified the Exhibit Gallery as a space that could be transformed to include new technologies and experiences that educate and entertain visitors across all demographics.

In late 2021, several brainstorming sessions resulted in four engaging interactive experiences that told the history of the Royal Canadian Air Force and Canada's role in the Second World War; on the home front and overseas, while utilizing the museum's unique artifact collection.

The four components of this experience feature:

- Immersive Dome
- Interactive Avatars
- HD Cinema
- Augmented Reality Experience

Once these components were established, Curator Erin Napier immediately began thinking of the stories from the museum's collection that could used for the avatars. Many years ago, the museum created a project called *Voices from the Past* in which veterans from the Second World War were interviewed and video recorded to help preserve their wartime stories for future generations. These recordings had been used in limited ways throughout the years but were never used to their full potential. Going through these interviews was like opening a treasure chest, revealing details and personal recollections that only come from someone who has had firsthand experience in the face of war.

In selecting these stories, it was important to represent a diverse selection of experiences representing all aspects of the Royal Canadian Air Force and home front, both from a male and female perspective, from factory workers to aircrew, from the European theatre to Burma.

The *Voices from the Past* interviews were viewed and quotations were recorded to write a script of each avatar's biography which would be told to the visitor in a conversational way. A storyboard was created for each of the seven subjects that highlighted key moments of the time period for each person, including where they were from, where they grew up, when

they joined the service, where they served throughout the Second World War, and most importantly, why they wanted to serve their country. Animators worked with the curatorial team to create a life-sized representation of each subject, using Unreal Engine's Metahuman software. Photographs were sourced and used to provide the animators with references to work from, in hopes of capturing as close of a likeness to that person as was possible. This included an extensive review process where the curatorial team would receive updated avatars over periods of time, which were then meticulously dissected from all angles to ensure accuracy. To give these avatars lifelike movements, including gestures and lip-syncing, motion capture suits were worn by volunteer reenactors who, after having viewed the original interviews, read from the scripts to provide movements and speech patterns. The voices of those interviewed were captured from the original recordings, and through the use of AI, were de-aged and then overlaid with the re-enactors' voices. Through using all these elements, interviews, scripts, motion capture, and original voices, the goal was to recreate a younger, wartime resemblance of these people. The user experience includes voice recognition software, so that visitors use their voice to prompt and ask questions of these avatars, who tell their story in their own words and voices.

After the stories were selected, supporting artifacts from the collection were used for reference material that the digital designers used to recreate in 3D photogrammetry. The physical artifacts would also be featured on display beside each portal. From a curatorial perspective, it was important to highlight the authentic artifact the avatars would be describing and to show the blending of new technology with original 80-year-old artifacts.

One of the seven Interactive Avatars.

The Immersive Dome and HD Cinema were created by using the museum's collection of original 16 mm films that had sat stagnant and unviewable for years within the museum's vault. There are approximately 350 films in the museum's collection including wartime documentaries, RCAF training films, and newsreels. A company was contracted to convert them to a digital format and then a selection process began of which content would be used for the Immersive Dome. In the immersive experience, located within a domed–shaped room, six oversized circular screens fill the space with images of Canadians in their wartime roles in the air force and at home in aircraft and munitions manufacturing, paired with ambient audio corresponding to each display.

The selection process of content for the Immersive Dome was decided after determining themes that reflected the values, experiences, and reasons why Canadians volunteered to serve during the Second World War in the defence of democracy. Apart from archival films, photographs and archival documents were also used to support these themes. These items were carefully digitized through scanning and photography, and enhanced with limited interventions such as colour balance, lens corrections, and clarity.

Immersive Dome, featuring six oversized screens.

The HD Cinema is set within a re-creation of an overseas pilots briefing room. Numerous sources were studied for the interior of this room and a corner of the Exhibit Gallery was filled with a flight operations chalkboard, wooden benches, and hanging pendulum lights, with vinyl maps and aircraft identification posters on the walls. The newly digitized film collection was further used, this time selecting short clips from some of the most relevant films for the determined categories. The categories appear on a touchscreen, created in the likeness of a chalkboard, allowing visitors to curate their own playlist of film clips from the categories including Women in the RCAF, aircraft, and training in the British Commonwealth Air Training Plan. A larger screen stands across from a pair of benches for visitors to watch and learn about the categories they chose.

HD Cinema, re-created as an overseas pilots briefing room.

Augmented Reality, showing a view of the cockpit of the Lancaster.

Finally, the Augmented Reality App combines films and photographs from the collection into an app visitors can access using a mobile device. Visitors can view a 3D model of the Lancaster on their phone and navigate to specific learning zones which include aircrew positions or specific features of the aircraft. A popup window opens for each zone which includes animations, images, video, sound recordings, and a unique selfie feature that allows users to put themselves in historic media. Our digital experience proved to be an opportunity for our organization to challenge itself in ways that it hadn't done before. This immense project has taught us many important lessons, which we now have the opportunity to reflect upon and learn from.

Challenges

- Project Scope
- Expectations vs. Realities
- Technical & Logistical Issues
- Balancing Authenticity: Modern expectations vs. historical accuracy

Lessons Learned

- Clearly define goals and scope before starting
- Collaboration and deep listening within teams are key
- Be ready for unpredictability, especially with new technologies
- Learn to adapt and remain open to unexpected discoveries

Benefits

- Preserving historical materials in accessible formats
- Technology & Skills development
- Organizational growth through collaborative effort
- Visitor Experience: Unique, immersive storytelling through tools like avatars

The project significantly enhanced visitor engagement and accessibility, offering innovative ways to experience and learn more of Canada's rich aviation history. The content is now more easily updated, shared, and preserved, supporting educational initiatives as well as our mandate to keep the history of Canada's role in the Second World War alive.


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Session 6

The Ingenium Digital Innovation Lab

Lauren DiVito | Manager of Digital Lab, Ingenium, Canada

1. Who is Ingenium?

Life is full of opportunities for amazement, where visitors can discover and learn. Ingenium is that experience. From soil to space, and everything in between, Ingenium is a world like no other. Across our three national museums in Ottawa dedicated to aviation and space, agriculture and food, and science and technology, we offer multi-sensory programming that engages Canadians on-site, online, and around the country.

Ingenium Centre

The Ingenium Centre is a purpose built facility designed to be one of the most accessible artifact and archive collection storage facilities in the world for museum professionals, heritage researchers, as well as for the public. With over 150,000 collection objects and 100,000 library items in the library and archives, the Ingenium Centre also features a Research Institute, conservation laboratories, workshops, staff workspaces, and the Digital Innovation Lab.

2. The Ingenium Digital Innovation Lab

The Digital Innovation[1] Lab is a collaborative hub for exploring innovative ways to improve access to museums spaces, collections, and experiences for all Canadians. Working with

1) https://ingenium.ca/en/ingenium-centre/digital-innovation-lab/

academia, start-ups, visitor-serving industries, and the disability community, the Lab explores emerging technologies, and user experience and accessible design to create more inclusive experiences for everyone.

Ingenium Digital Innovation Lab

Access not only means improving geographic access for people who may never come to Ottawa by putting 3D models of our collection online, for example, but it especially means improving accessibility for the disability community. There are over 8 million people with disabilities in Canada. Working in collaboration with these communities to find, remove, and prevent barriers to access is the first step towards a more inclusive and accessible Canada for all.

The Lab offers a variety of services (for staff and external clients) including accessibility testing and consultation, 3D scanning and rendering of objects and spaces, rapid prototyping, audio recording, and workshops and webinars on digital accessibility, 3D, and user experience design. The Lab was built with accessibility in mind from the start. This includes modular furniture to accommodate different projects/set ups, live audio that can be synced with Bluetooth-enabled hearing aids allowing users to adjust to their needs, whiteboard tables that have knee clearance for people in wheelchairs, and height-adjustable touchscreens. One of the first pilot projects the Lab undertook was the creation of an accessible and digitally immersive tractor game at the Canada Agriculture and Food Museum. People would either climb inside a tractor cab, or enter one at floor-level, with gamified elements that teach visitors about precision agriculture. The current pilot explores accessible wayfinding for people with vision impairment inside physical exhibition spaces.

3. 3D Digitization

3D scanning the Delta Test Vehicle artifact inside the Canada Aviation and Space Museum Reserve Hangar

With only 12% of the collection on display in its three museums, the Digital Innovation Lab is exploring ways to share its collection of artifacts online and to augment storytelling for its in-person visitors using 3D digitization. With three, 3D scanners—an Artec Spider for small objects, Artec Leo for medium objects, and a Leica RTC360 for scanning large objects like locomotives, aircraft, and rooms—the Lab can quickly scan and render objects for its staff, clients, and visitors. clients, and visitors.

4. The benefits of 3D digitization include:

Improving accessibility

By putting a collection online, you reduce geographic and socio-economic barriers to access and create more inclusive ways to engage. Often, our collection buildings have restricted access. Online access allows institutions to be more open with the general public. These digital models can also be 3D printed and made available as a tactile experience for visitors with vision-impairment or who are blind.

Conservation

(right) 3D model of rubber oil scupper from the (left) Canadair DC-4GM North Star from the Ingenium Collection

3D digitizing artifacts provides access to objects that would otherwise be too hazardous or fragile to touch. Capturing the object in 3D allows for planning conservation treatment, condition reporting, and replication of deteriorating parts such as with this rubber oil scupper from the North Star pictured here.

Point cloud data from LiDAR scanning the Canada Aviation and Space Museum floor

Using the LiDAR scanner, the Lab experimented with digitizing the entire museum floor of the Canada Aviation and Space Museum to collect accurate, to-scale point cloud measurements of the aircraft and building structures. Not only does this provide necessary data to the facilities teams, but it reduces the workload for conservation teams planning large artifact moves with aircraft. In future, software can be used—rather than hand-measuring and using paper-models— to determine which aircraft need to be moved to make room for new acquisitions.

Education

Once you have a digital model, the possibilities are endless in terms of entertainment and education. They can be re-purposed on websites, in games and augmented reality, used in animations to showcase how an artifact was used, and made available to 3D print in classrooms with that capability. Marketing and promotion teams can showcase the objects in beautiful online campaigns. Academics from around the world can also study the objects in full 3D without needing to travel to the object itself and request it pulled from the shelf.

Engaging with 3D Models

As the Digital Innovation Lab amasses a collection of 3D objects, it's collaborating internally to create an integrated 3D viewer on its online collection that is both accessible and engaging for the public, based on the Smithsonian's open-source Voyager tool. The ways in which we make these objects publicly accessible are still under discussion as it's critical to consider intellectual property rights, especially for museums whose objects were manufactured by companies that still exist.

3D model showing a combined and exploded view of the scale modelartifact of the Saturn V rocket

At the same time, Ingenium is working on a web augmented reality platform, based on Voyager, to create engaging 3D content for its visitors. Through augmented reality, visitors can merge the physical and virtual world by placing an aircraft from the collection into their living rooms, filling in the missing pieces of an artifact where only a few pieces are on display, or hearing artifact soundscapes. Animations can showcase how the object was meant to be used, bringing life to the static artifact behind glass. This platform has been built with accessibility in mind to ensure an inclusive experience for all visitors.

References:

www.Ingenium.ca/Lab

https://ingeniumcanada.org/channel/articles/3d-digitization-improves-access-to-the-ingenium-collection

Session 6

Digital Transformations in Aviation Museums: Strategies, Challenges, and Prospects

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Bundeswehr Military History Museum—Berlin-Gatow Airfiled, Germany

Civilian and military aviation museums are navigating a profound digital turn. Aircraft once exhibited as static witnesses to past conflicts now coexist with augmented cockpits, open-access digital collections and exhibitions, and live-streamed restoration hangars. Digital media not only extend collections beyond museum walls but also reconfigure curatorial authority, interpretive practice, and public engagement. Drawing on critical museology, sociology, and heritage studies, this article surveys the strategic opportunities and hazards of digital integration for institutions specialising in air war and military aviation. It argues that success hinges on aligning technological innovation with rigorous historiography, ethical stewardship, and inclusive governance.

1. Theoretical Foundations

Digital initiatives are not neutral add-ons; they rewrite the very *dispositif*—the apparatus of knowledge and power—that sustains the museum. Eilean Hooper-Greenhill's post-museum model recasts the institution as a dialogic arena in which curators and visitors co-produce meaning. Henry Jenkins's concept of participatory culture underscores how low-barrier networks invite audiences to tag, remix, and disseminate content, thereby complicating the unidirectional flow of expertise. Jean Baudrillard's notion of hyperreality warns, however, that richly simulated dogfights may substitute spectacle for critical reflection.

From a sociological perspective, Pierre Bourdieu's theory of cultural capital reminds us that access to digital offerings is unevenly distributed. Without careful design, museums risk reproducing the very hierarchies they seek to dismantle. Meanwhile, institutional theorists Paul DiMaggio and Walter Powell describe how organisations drift toward isomorphism,

adopting fashionable technologies for legitimacy rather than mission fit. Together, these frameworks enable aviation museums to interrogate why and for whom they digitise.

2. Digital Narratives and Historical Construction

Traditional aviation galleries have favoured triumphalist progress narratives—fabric biplanes yield to supersonic jets and stealth drones—often framed by national pride. Touch-table interfaces can juxtapose pilot memoirs, factory-worker diaries, and civilian testimonies around a single airframe. Virtual-reality walk-throughs of bombers can overlay archival footage with survivor accounts, unsettling heroic myths of strategic bombing.

Narrative plenitude carries epistemic risks. Hyperreal simulations may detach visitors from the material authenticity of rivets and engines, while gaming mechanics can trivialise suffering. Curators must therefore anchor immersive experiences in robust primary research and reflexive interpretation, drawing attention to gaps, silences, and moral ambiguities. A balanced digital narrative situates technological ingenuity alongside human cost, thus fulfilling both educational and commemorative mandates.

3. Technological and Ethical Challenges

High-impact interfaces rely on fragile infrastructures. Proprietary file formats, shifting software ecosystems, and rapid hardware obsolescence threaten to render costly installations unreadable within a decade. Sustainable planning demands open standards, redundant storage, and life-cycle budgeting that extends well beyond launch. Environmental considerations—GPU-driven energy consumption and e-waste—must also enter project calculus.

Ethically, digital reproduction magnifies questions of ownership and representation. A single click can circulate images of wartime devastation stripped of context. Museums must craft metadata, captions, and moderation protocols that honour dignity, avoid misappropriation, and counter distortion. Gamified experiences require careful scaffolding: a flak-gun simulator should culminate in a debrief that foregrounds civilian impact, not a high-score screen. Authenticity extends to replicas: cosmetic clean-ups risk falsifying evidence.

Data governance forms a new frontier. Crowd-sourced annotations, facial-recognition tagging, and algorithmic recommendations collect visitor data that must be processed lawfully, stored securely, and, where appropriate, anonymised. Algorithmic bias—such as training sets over-representing NATO aircraft—can invisibilise Global South aviation heritage. Transparent audits and interdisciplinary oversight are essential.

4. Institutional Governance and Readiness

Hardware procurement is comparatively uncomplicated, but organisational culture is decisive. A comprehensive digital strategy should state how each technology advances the mission, learning outcomes, and community obligations. Cross-functional teams—curators, conservators, educators, and digital experts— cultivate integrative thinking. Continuous professional development, pairing basic digital literacy for historians with provenance literacy for programmers, builds internal capacity and mitigates vendor lock-in.

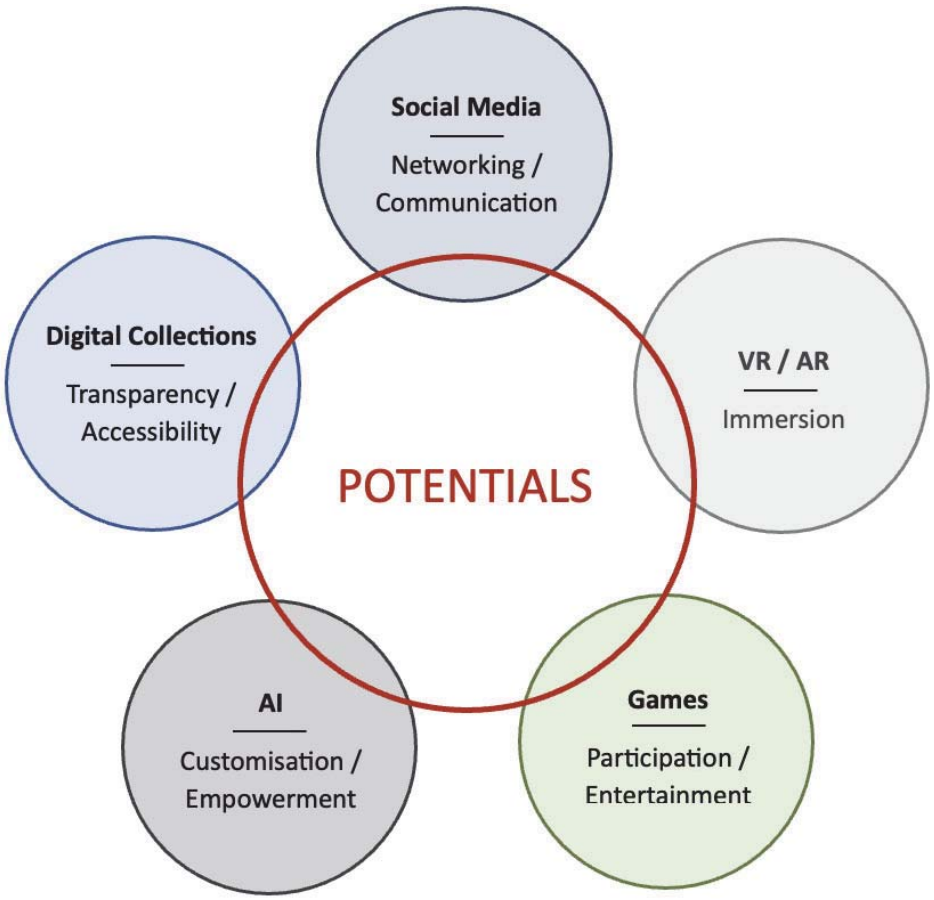
Change management must address issues particular to military heritage: hierarchical command structures, security protocols, and contested narratives. Pilot projects, iterative prototyping, and transparent evaluation temper scepticism while preventing innovation fatigue. Governance frameworks should embed accessibility standards, open-access policies, and crisis-resilience plans. The COVID-19 pandemic and the war in Ukraine alike demonstrated that digital infrastructures are no longer optional adjuncts but critical components of institutional continuity and heritage protection.

5. Social Inclusion and Digital Accessibility

Digitisation promises to democratise collections once concentrated in metropolitan centres. Openly licensed 3D models allow teachers in remote regions to integrate artefacts into classroom practice; digital exhibitions welcome visitors with mobility or other impairments. Yet structural inequalities persist: broadband scarcity, limited device ownership, and divergent digital literacies create a second enclosure of knowledge.

An inclusive strategy combines platform-agnostic design with low-bandwidth alternatives. Progressive web apps, downloadable museum packs, and phone-in audio tours broaden

reach. Universal-design principles—contrast-rich interfaces, keyboard navigation, and screen-reader compatibility—ensure that technology remains an enabler, not a barrier. Multilingual content recognises the transnational nature of air war, enabling diaspora and formerly adversarial publics to participate in shared remembrance. Participatory projects that solicit oral histories from diverse communities amplify marginalised voices and pluralise the historiography of military aviation.



The potential of digital technologies to shape the visitor experience.

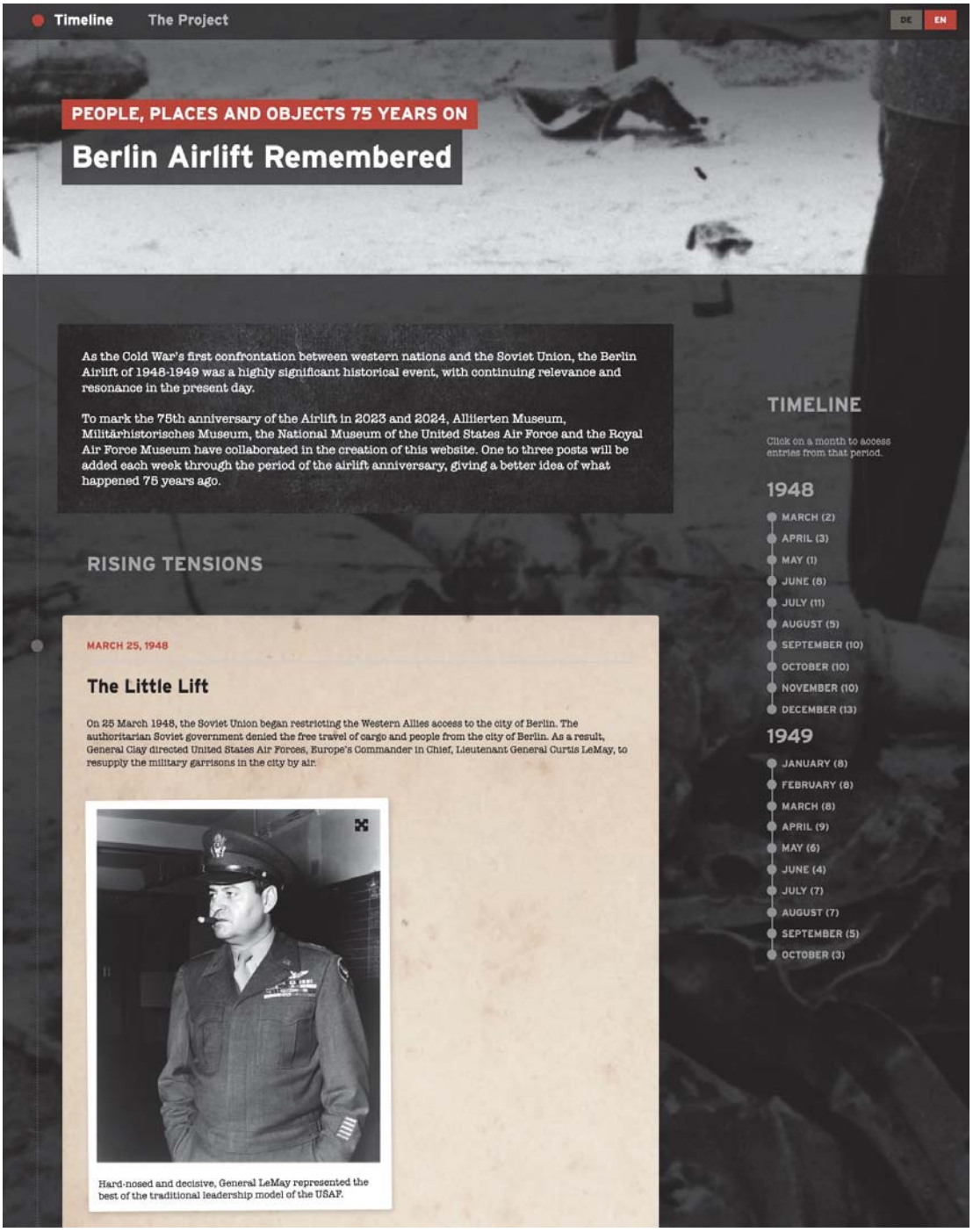
6. Selected Case Studies

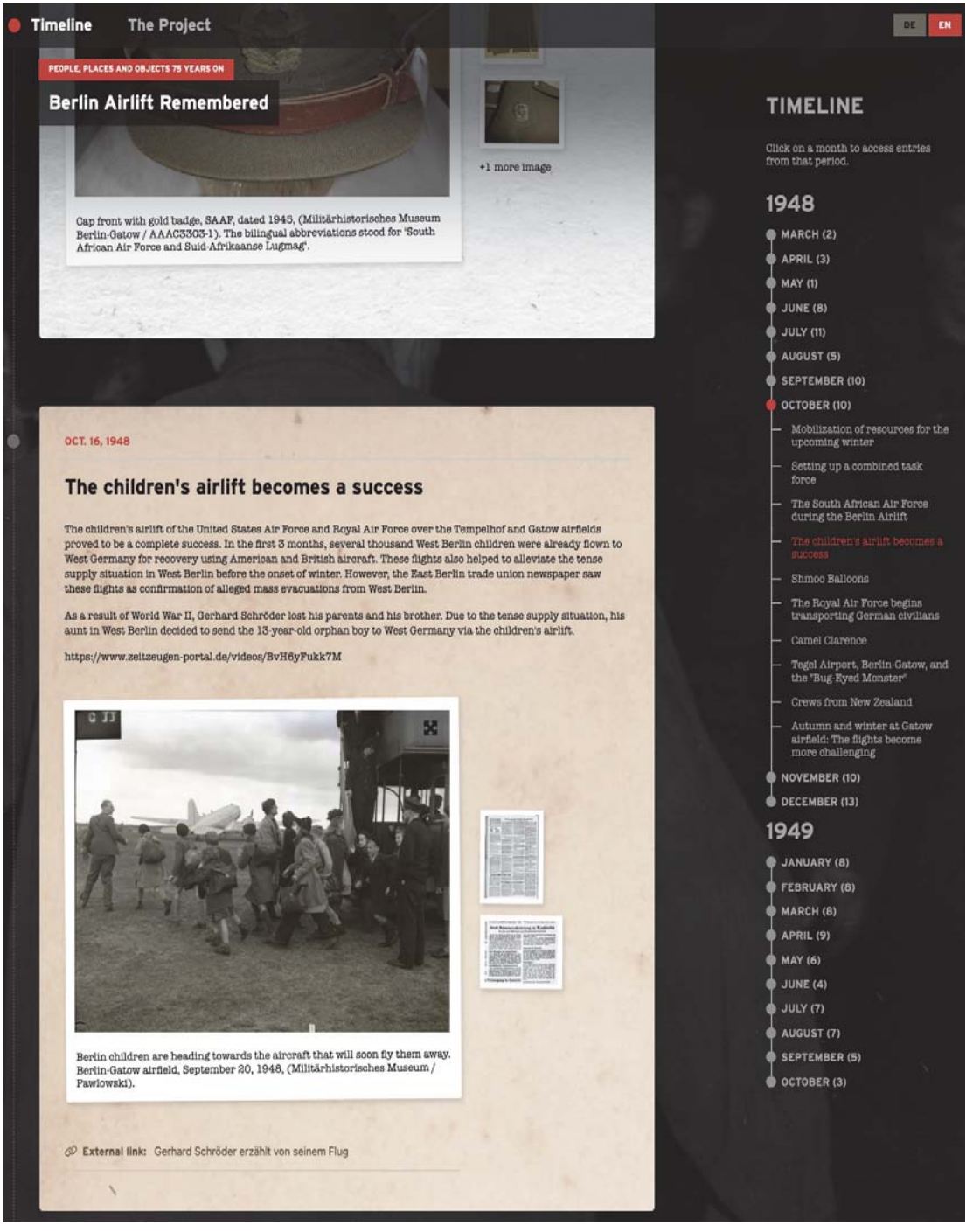
Ukrainian State Aviation Museum, Kyiv

Perhaps the most poignant example of resilient digital transformation emerges from Ukraine's State Aviation Museum, specifically through its ambitious Museum 3D Project. Confronted with the 2022 Russian full-scale invasion and the danger of air attacks, the museum closed its doors to visitors. Nevertheless, the curators deployed photogrammetry and LiDAR to capture exhibited aircraft and machinery, launching a cloud-hosted "museum in exile." Digital surrogates serve both public-engagement and evidentiary functions, documenting possible war damage for future restitution. Significantly, intellectual control remains with local staff, exemplifying community-centred praxis under war conditions. Digital technology here functions not merely as innovation but as a lifeline that sustains cultural connectivity, identity, and resilience. The Ukrainian State Aviation Museum's solution thus exemplifies effective museum management under critical conditions.

Digital Exhibition "Berlin Airlift Remembered – People, Places, and Objects 75 Years On"

To mark the seventy-fifth anniversary of the 1948–49 Berlin Airlift, four institutions—the National Museum of the United States Air Force (Dayton), the Allied Museum (Berlin), the Royal Air Force Museum (London), and the Militärhistorisches Museum der Bundeswehr – Flugplatz Berlin-Gatow—developed a joint digital platform. Weekly multimedia posts combined Allied operational records, German civilian diaries, and Soviet press propaganda to create a kaleidoscopic timeline of the blockade and relief flights. A cooperatively curated multi-dimensional narrative assembled stories from civilians and military personnel alike, forging what the responsible curators termed a "transnational participatory archive". The collaboration demonstrated how shared stewardship, distributed across differential national narratives, can transform a one-dimensional event into a cosmopolitan exercise in digital remembrance and commemoration.


Timeline
The Project
DE
EN
PEOPLE, PLACES AND OBJECTS 75 YEARS ON
Berlin Airlift Remembered
As the Cold War's first confrontation between western nations and the Soviet Union, the Berlin Airlift of 1948-1949 was a highly significant historical event, with continuing relevance and resonance in the present day.
To mark the 75th anniversary of the Airlift in 2023 and 2024, Alliierten Museum, Militärhistorisches Museum, the National Museum of the United States Air Force and the Royal Air Force Museum have collaborated in the creation of this website. One to three posts will be added each week through the period of the airlift anniversary, giving a better idea of what happened 75 years ago.
RISING TENSIONS
MARCH 25, 1948
The Little Lift
On 25 March 1948, the Soviet Union began restricting the Western Allies access to the city of Berlin. The authoritarian Soviet government denied the free travel of cargo and people from the city of Berlin. As a result, General Clay directed United States Air Forces, Europe's Commander in Chief, Lieutenant General Curtis LeMay, to resupply the military garrisons in the city by air.
Hard-nosed and decisive, General LeMay represented the best of the traditional leadership model of the USAF.
TIMELINE
Click on a month to access entries from that period.
1948
MARCH (2)
APRIL (3)
MAY (1)
JUNE (8)
JULY (11)
AUGUST (5)
SEPTEMBER (10)
OCTOBER (10)
NOVEMBER (10)
DECEMBER (13)
1949
JANUARY (8)
FEBRUARY (8)
MARCH (8)
APRIL (9)
MAY (6)
JUNE (4)
JULY (7)
AUGUST (7)
SEPTEMBER (5)
OCTOBER (3)



Digital Exhibition "Berlin Airlift Remembered – People, Places, and Objects 75 Years On" (2024).

Across these cases, success correlates with strategic clarity, interdisciplinary collaboration, and a focus on twenty–first–century audiences. Digitalisation is not merely an instrument; it has become indispensable for institutional relevance under adverse conditions.

7. Future Directions for Digitalisation in Aviation Museums

Extended reality (XR) is poised to play an increasingly influential role in both representation and interpretation. The term subsumes virtual reality (VR), augmented reality (AR), and mixed reality (MR). All three modalities position digital content along a continuum between fully immersive, computer-generated environments (VR) and direct perception of the physical world (AR), with MR denoting hybrid systems in which physical and virtual elements interact in real time. XR therefore connotes the entire spectrum of immersive and semi-immersive media. For interpretation, VR and MR experiences allow visitors to immerse themselves in historical aviation environments or explore cockpits of rare aircraft, deepening engagement and understanding.

Extended-Reality Concept for the Bundeswehr Military History Museum – Berlin-Gatow Airfield (2025).

Full-scale photogrammetric cockpit reconstructions allow visitors to "enter" aircraft that are otherwise inaccessible for preservation reasons. Inside VR, interpretive hotspots can display real-time telemetry, mission logs, or pilot oral histories, enriching narrative depth while preserving fragile interiors. On-site visitors can point a handheld device at an airframe to reveal layered annotations—engine schematics, combat markings, or video testimony—directly overlaid on the physical object. XR portals enable geographically distant publics—including scholars, veterans, and classrooms—to experience collections synchronously. For example, an MR telepresence session can place a remote expert "inside" a hangar to guide on-site staff through structural assessments of a Cold War jet. Such immersive tools must, however, be deployed with curatorial oversight to ensure they complement rather than overshadow physical collections, aligning technological innovation with the museum's educational mission and authenticity standards.

Artificial intelligence is set to advance personalisation and discovery in museum experiences. Building on current machine-learning applications, future AI-driven systems may curate adaptive exhibits that respond to a visitor's prior knowledge, interests, or learning pace—dynamically adjusting narrative depth and recommending relevant content throughout the visit. Intelligent discovery algorithms could also uncover unexpected connections among artefacts, guiding researchers and the public alike to new insights within vast aviation collections. AI-driven discovery engines can present objects and contextual information with precision, opening new research and experiential possibilities to visitors on-site or thousands of kilometres away on a screen. Embracing AI for such purposes demands a vigilant ethical framework: personalisation should augment inclusive storytelling rather than create filter bubbles, and algorithmic recommendations must be continuously audited to prevent the reinforcement of historical biases or the marginalisation of less-well-known narratives.

8. Conclusion

Digital transformation is neither panacea nor peril; it is a dynamic arena where technological affordances intersect with cultural memory, institutional capacity, and ethical responsibility. When guided by inclusive governance, sustainable archiving, critical digital literacy, and reflexive exhibition design, digital tools democratise access, diversify narratives, and

invigorate scholarship. Absent such safeguards, the same technologies may entrench inequity, erode authenticity, or lapse into obsolescence. Strategic foresight, ethical responsibility, and institutional preparedness, therefore remain crucial.

For aviation museums, the stakes are heightened. These institutions steward artefacts that embody both technological brilliance and profound human cost. The challenge is to harness virtual reconstructions, participatory platforms, and immersive media not as ends in themselves, but as disciplined instruments of public history. By doing so, museums maintain curatorial integrity while ensuring that the legacy of flight—and its attendant lessons—remains aloft for generations to come.

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2025 International Conference for Aviation Museum Professionals

Senior Leadership Meeting

National Aviation Museum of Korea

Alberta Aviation Museum

Atlantic Canada Aviation Museum

British Columbia Aviation Museum

Canadian Bushplane Heritage Centre

Deutsches Museum

Finnish Aviation Museum

Royal Air Force Museum London

Royal Aviation Museum of Western Canada

Wings Over the Rockies

2025 International Conference for Aviation Museum Professionals


2025
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Aviation
Museum
Professionals

Senior Leadership Meeting

2025 International Conference for Aviation Museum Professionals

The Senior Leadership Meeting brings together representatives from museums around the world to discuss in an open forum the various issues facing aviation museums and the ways in which they might lead their respective institutions through these challenges.

Leaders will share their thoughts and experiences on important topics such as maintaining relevance to non-traditional visitors to aviation museums, as well as key stakeholders and communities. What opportunities are there for aviation museums to become platforms for STEM/STEAM education and skills development?

They will discuss the ways in which collaboration could be a solution to limited resources. Can economies of scale be created if projects are tackled together?

Leaders will also discuss the pressures around incorporating digital elements into their museums as well as the challenges of developing and maintaining them. Do digital elements compliment tactical interactives or replace them?

Finally, they will address a problem that is common to all aviation museums regardless of size or budget: aircraft are large objects and museums have a finite amount of space.

What does collecting aircraft look like in the future? How can we preserve key assets and stories for future generations?

12:15 – 1:15 pm

Lunch/Meet and Greet in CASM's boardroom

1:15 – 3:00 pm

Discussion lead by Christopher Kitzan (Canada Aviation and Space Museum)
supported by Terry Slobodian (Royal Aviation Museum of Western Canada)
and Marcus Harshaw (Wings Over the Rockies).

National Aviation Museum of Korea

The **National Aviation Museum of Korea** (hereafter referred to as 'NAMOK') is a public institution established under the Ministry of Land, Infrastructure and Transport, in accordance with the National Aviation Museum Act (Act No. 16490), enacted on August 20, 2019, by the Government of the Republic of Korea. As the nation's first and only national museum dedicated exclusively to aviation, the museum was developed over several years beginning in 2014 and officially opened its doors to the public on **July 5, 2020**.

The opening date was specially selected to commemorate the 100th anniversary of the Korean Aviation School, which was established in California, USA, to support the Korean independence movement. The museum is the only institution in Korea that highlights the history of aviation in the context of the independence movement as a core theme of its exhibitions.

Designated as a Type I General Museum under the Korean museum classification system, NAMOK has quickly grown into a leading cultural institution, attracting more than **365,000 visitors annually**.

NAMOK operates with two key policy goals: **the promotion of aviation culture** and the **advancement of the aviation industry**. Its organizational structure consists of a president and board members, with two executive directors overseeing the Strategic Management Division and the Curation and Research Division, respectively. Each division is composed of two departments and four teams, with a total of 83 full-time staffmembers.

Additionally, the museum engages approximately 70 supplementary personnel through specialized outsourcing arrangements. These professionals are tasked with delivering guided exhibition tours, facilitating educational programs, and conducting interactive learning

sessions. Each individual is carefully selected for their relevant expertise and experience to ensure the highest quality of visitor service and meaningful engagement across all audiences.

NAMOK is fully funded by the national government, with an annual operating budget of approximately KRW 16 billion (CAD 15.73 million) as of 2025. Of this, approximately KRW 6.24 billion (CAD 6.06 million) is allocated specifically for operational projects, including exhibitions, educational programs, collections acquisition, and curatorial research.

Agenda Items

Relevance

NAMOK, as a national museum, is committed to the philosophy of a "Museum for All." The museum continuously strives to provide tailored services that meet the diverse needs of its stakeholders. Due to the nature of aviation as a theme, the primary visitors are typically elementary school–aged children and their families. However, the museum also actively engages groups that have historically been underserved in the museum sector, including people with disabilities, military personnel, and senior citizens, through specially designed programs.

Located at Gimpo International Airport, Korea's first international airport, the museum embraces the symbolic and geographic significance of its site. It offers cultural content for the local community and professionals in the aviation industry. Moreover, it conducts oral history projects and field research, producing curatorial outputs that are integrated into special exhibitions for the general public.

Networking and Collaboration

In its sixth year of operation, NAMOK has already achieved remarkable success in the fields of networking and collaboration, both domestically and internationally. In 2023, the museum hosted the ICOM–CIMUSET Annual Conference, which was hailed as the largest and most successful in the international committee's history since its founding in 1946.

This milestone laid the foundation for the launch of the Network for Aviation Museums, a global collaborative initiative aimed at strengthening ties among aviation museums worldwide. As a relatively new institution, NAMOK has addressed limitations in content and specialized staff through proactive partnerships that have yielded visible outcomes, particularly in exhibitions and educational programming.

In 2024, the museum hosted its first international joint exhibition, 〈Flying Man〉, in collaboration with the Otto Lilienthal Museum and the Deutsches Museum in Germany. Since its opening, NAMOK has signed Memorandums of Understanding (MOUs) with 46 institutions, implementing programs such as Dream Talk, a career experience initiative led by actual airline specialists for youth, and content competitions for undergraduate and graduate students in aviation-related fields.

NAMOK continues to pursue substantial and sustainable collaborations, moving beyond basic networking. Its aim is to become a leading institution in the global museum ecosystem through the co-development and execution of impactful joint initiatives.

Physical Space Limitations vs. Heritage Preservation Responsibilities

While NAMOK was established with strong support from the government, it faced significant challenges in securing sufficient land during its early planning stages, resulting in its current location. Consequently, the museum faces spatial constraints that limit its ability to fully meet the specific needs of aviation heritage preservation and exhibition.

The total floor area of the museum is 18,632 square meters; however, structural limitations restrict the amount of space available for exhibitions and hands-on experiences. This is particularly challenging for displaying actual aircraft, most of which are presented using a hanging display method. The exhibition of large aircraft is currently not feasible. At present, the museum displays 16 real aircraft, primarily smaller models.

To address spatial limitations, the museum maximizes the utility of its special and thematic exhibition materials by loaning them to other institutions for traveling exhibitions. This approach improves accessibility while balancing both preservation and practical usage.

Nonetheless, NAMOK acknowledges that such temporary solutions are insufficient to fulfill its core responsibility of safeguarding aviation heritage. Therefore, the museum is actively working to secure funding and land for the development of an open-type integrated storage facility. This long-term project aims to go beyond mere storage, incorporating public access, education, and research functions—further strengthening the museum's public value and professional capabilities.

Contact Informaiton

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Alberta Aviation Museum

Brief History

Housed in a rare WWII-era double wide-double long hangar built for the British Commonwealth Air Training Plan, the Alberta Aviation Museum was founded in 1980 and moved into its permanent home in 1991. The museum features over 30 restored aircraft, showcasing Edmonton's rich aviation history. Originally located at the Edmonton Municipal Airport, it now serves as a historic landmark in the new Blatchford community. In 2019, a 25-year lease with the City of Edmonton launched a major revitalization, ensuring the museum continues to inspire future generations with stories of flight and innovation.

Exhibitions & Education

AAM offers a multitude of programs for all ages. The mission of the museum is to provide a dynamic visitor experience and share the vast stories about the role of aviation in building the community. The museum is to educate, enlighten and engage with visitors. This entails providing programs for early learners through seniors. In recent years the museum has become heavily focused on engaging youth in aviation and aerospace industry as a future option as a career path.

Main Collection and conservation

With over 85,000 square feet to explore, the Alberta Aviation Museum houses over 35 aircraft as well as those currently in our restoration area in the process of being restored for display in the gallery. Most of the aircraft in the hangar have gone through the restoration department for cleaning, conservation or complete restoration. Having an active restoration department that has ample space to do conservation and restorative work is a major asset for such large artifacts. Recent restorative works being done include; a P39 Airacobra, the nose of a DC 6 cockpit to a fully functioning flight simulator, as well as T33 Silver Star and F86 Sabre cockpits to display status.

Agenda Items

Relevance

The Alberta Aviation Museum strengthens its connection to stakeholder groups and the wider community through a combination of educational programs, community engagement initiatives, and a strong focus on preserving Edmonton's aviation heritage. The museum offers accessible learning experiences through school programs, youth group activities, newcomer events and year-round events for all ages. Initiatives like "Community Access Nights" provide discounted, hands-on experiences, including crafts and flight simulators—for organizations that serve children and youth. To further engage the public, the museum hosts a range of community events, supports rental opportunities for local groups, and actively collaborates with partners and sponsors to enhance its offerings. A key part of its mission includes preserving and promoting the city's aviation history, particularly through advocacy for the historic Hangar 14 and the sharing of local aviation stories that highlight Edmonton's development. Looking ahead, the museum aims to expand its presence and programming, including acquiring Hangar 14 for more immersive exhibits. All of this is guided

by a strategic Sustainability Blueprint that ensures long-term value and relevance for the community, supported by a dedicated team of staff and volunteers passionate about aviation's role in shaping Edmonton.

History vs STEM

The Alberta Aviation Museum offers a variety of STEM-focused programs that bring aviation history and the science of flight to life for students. Through partnering with STEM organizations and school programs, guided tours, summer camps, and digital broadcasts, the museum provides engaging, hands-on learning experiences that align with science curriculum topics. Full-day school programs combine historical tours with flight simulator labs to teach the principles of flight, while age-appropriate tours explore concepts such as control surfaces and the four forces of flight. Virtual programs make these lessons accessible to a wider audience, ensuring students can participate from anywhere. During summer camps, participants take part in STEM-based activities like building model aircraft, parachutes, and bottle rockets. Throughout the museum, interactive exhibits and flight simulators offer immersive experiences that deepen understanding and spark interest in STEM fields. These programs are particularly aligned with Grade 5 and 6 science units, including air and aerodynamics, helping students connect classroom learning with real-world applications.

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Senior Leadership Meeting

Atlantic Canada Aviation Museum

Brief History

Founded in 1978, the Atlantic Canada Aviation Museum (ACAM) has grown into a collection of 27 airframes and associated exhibits. Located adjacent to the Halifax Stanfield International Airport, it serves to showcase the role and history of aviation throughout the Atlantic Provinces of Canada.

ACAM is governed by a volunteer Board of Directors which is accountable to the members, community, funders, and other stakeholders. They are accountable for ACAM's performance in relation to its mission, mandate, and strategic objectives, and for the effective stewardship of financial and human resources.

Vision

To be the focal point of Atlantic Canadian aviation: past, present, and future.

Mission

1. To be the centre of excellence for the preservation of our aviation heritage.

2. To engage with the community to:

a. celebrates Atlantic Canada's aviation history.

b. educates through interpretation and programming; and

c. inspires dreams of flight for future generations.

Mandate

The Atlantic Canada Aviation Museum (ACAM) is an established aviation museum located in Halifax; Nova Scotia dedicated to all aspects of aviation history of the Atlantic Provinces.

ACAM is committed to:

- the research, retrieval, restoration, and preservation of artifacts; and
- the research, recording and interpretation of significant aviation accomplishments.

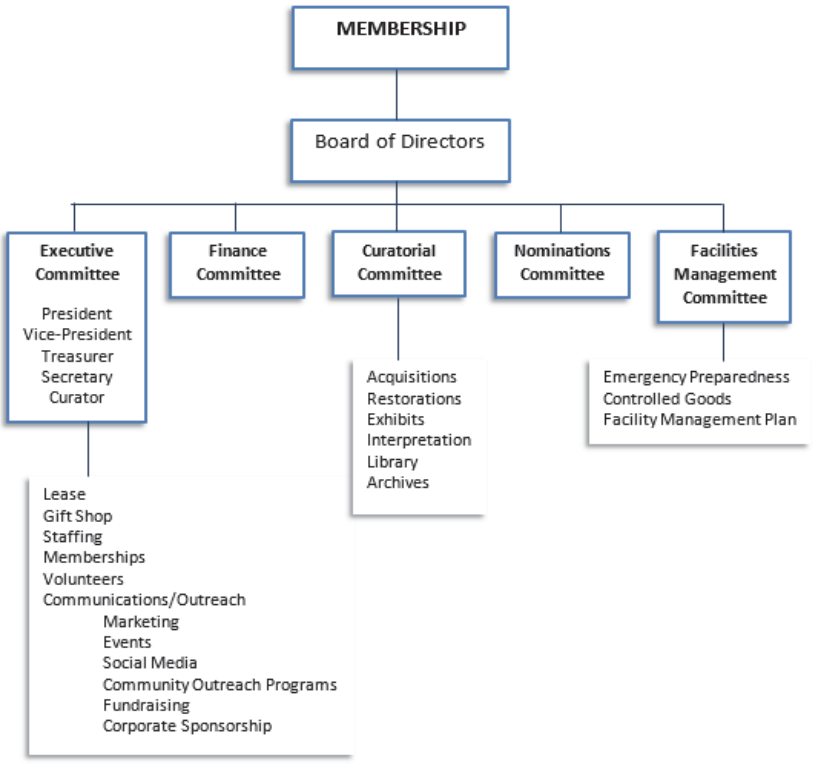
ACAM is a conduit that fosters a culture of community engagement through outreach, interpretation, educational programs and collaboration with partners and supporters.

Core Values

Stewardship: We embrace our responsibility to preserve history, tell stories, and serve our community with measured concern for social and environmental issues.

Inspiration: We are committed to inspiring a love of aviation and aviation history through community outreach, education and family-friendly events with energy, passion, and enthusiasm.

Respect: We will create a respectful environment that promotes dignity, diversity and inclusion of all with whom we interact, always striving to uphold the highest ethical standards.



Organizational chart. Util 2021, ACAM was a totally volunteer run organization. Since 2021 we have had a full time executive director, who sits below the board of directors on this chart. The chart is presented to show the challenge of running an entirely volunteer based organization.

Exhibition & Education

ACAM is in a transition period. Our existing location and facility is leased from the Province of Nova Scotia, who have advised ACAM that the existing ACAM property will be required for an interchange re-alignment. ACAM is in the process of creating a new vision, designing, and in-visioning a new ACAM. Faced with this, it has focused our attention on what and how we should move forward with. At present our exhibit plan is outdated and requires a complete upgrade, as well as new exhibits . Defining and highlighting many remarkable stories is obviously a key part of any new facility we will have to move towards. ACAM by its nature, is totally dependent on volunteers willing to take on projects as required. ACAM uses summer students, during its open season. An exhibition project or display upgrade is part of the students' work at the museum. Fresh and unprejudiced insight into what and how an exhibit should be is great exercise, when formulating and presenting a specific exhibit plan and delivery of completed exhibit.

Designing a new museum as well as addressing an exhibition plan is an important part of the new ACAM. Focusing on our exhibits and telling their stories as well as relevance to our region, is part of this process of revitalization. Addressing issues within the collection, as to exhibit relevance, is one that will come to the forefront of a new exhibit plan. This does bring into a wider context of who decides and has final say as to which exhibits/aircraft have relevance and for ultimately deciding what stays and what goes. Given the nature of the volunteer organization, this can lead to divided lines among the membership as to what should be part of the collection. The exhibit plan will also provide a guide to help this process. In some ways, the current dilemma of having to build a new facility has created the opportunity to move towards an exhibit plan that has been designed, rather than the current one, which has evolved over the past 40 years, by being dictated, what was available and overlooking the true value of an exhibit to help tell the story , to engage and inspire our visitors.

In many ways, this focus on a new facility and exhibits it will contain, has provided an opportunity for ACAM to re-set, revitalize and change the way that we present our history/offering to our audience. This has led to conversations that in prior years would not happen, as an element of status quo has existed.

In many ways we are fighting for the survival of the institution as well as defining ang

re-enforcing ACAM' s relevance and how ACAM presents the stories to our audience.

The issues faced by ACAM, are no different than most, if not all aviation museums across Canada and the world. Exhibits such as actual airframes are no different than any other exhibits in a typical aviation museum. How airframes are displayed and presented to the viewing audience is only a small part of the exhibit process. At ACAM we display a CF-104 Starfighter, with a 1909 Silver Dart replica above it. One of the key points mentioned by our tour guides is that only 50 years separate these aircraft. A stark reminder of the growth of technology between a wood and fabric aircraft to what the F-104 ,described at the time of its introduction, as a maned missile. The exhibit is not overly apparent, to the average visitor, once this is pointed out by our guides, it becomes a lightbulb moment . The complete aircraft exhibits are impressive, but small points can be effective for the learning and understanding of what the viewer is viewing. Space is certainly at a premium, so much so, that we cant physically add anymore airframes and even smaller items, due to the lack of proper storage and display space.

Refocusing on the new ACAM will entail a large education component, that in relative terms, does not exist in ACAM's current form. The process of engaging and providing education to our visitors is a major tenant of any aviation museum in today's world.

Education programs have evolved into a focus for any aviation heritage organization. Setting up and designing an education program for an aviation heritage organization is an integral component of the organization. Education programs in Canada are heavily influenced by existing provincial government education curriculum. Defining where the appropriate grade or level of education fits within the defining and relevance of aviation history and technology is a hard area to navigate for an organization like ACAM. Working with the provincial government department of education requires navigators and contacts to help navigate the education system. ACAM is focused on engaging in and understanding the provincial education system and its role and relevance to promote and integrate aviation history to a scholastic audience.

In addition, advanced education programs are also a part of an education program. The greater aviation industry, which in Nova Scotia, is significant, should be a great conduit to focus and help raise the profile of aviation careers to both the general population as well as

the education system. More work is required on engaging and purposing the role of an aviation heritage organization , into the aviation industry, both nationally and internationally. Some large aviation related companies have shown some support to aviation heritage organizations, but more work is required to highlight the connection between bringing aviation to an audience and linking that to showcasing career paths and employment in a diverse industry dealing with staffing shortages and changing customer requirements.

Our ultimate goal is to bring a seasoned education professional into the organization to fully help navigate and guide the board as to what needs and can be facilitated to effectively connect the intertwining dots between both the education system and the aviation industry. There has been significant development of these sort of networks by Chris Kitzan at CASAM. It is a desire that this sort of program could be developed as well as expanded to help regional organizations connect and build upon this network. It is a process that will help bring success for not only larger, but smaller organizations. Establishing key partners and supporters is a lengthy process. Establishing the benefits and results can be a long process, which requires an engaged and effective proponent of a well–structured and defined offering, with clear benefits to all participants.

Agenda Items

Networking and Collaboration

Understanding and developing collaboration at any level will help define the success of all those engaged and committed to the process. In past years, aviation heritage organizations have tended to work in their own silos. To some degree this has been fostered over time by the desires to create and collect aircraft and exhibits that have been best suited to the perceived needs of the respective organizations. The vast majority of Canada's aviation museum collections have evolved in the last fifty years . Most collections have a significant number of exhibits that reflect the availability of airframes over the last fifty year period. This has led to duplication and relevance of airframes and to some degree exhibits to held by organizations. This has led to most museums across Canada in this example, having duplicate examples of many aircraft from over the past fifty plus years. In some of these cases these airframes are valid in the collection, but in others, not so much. This duplication

does not just occur in Canada, In the United Kingdom, most aviation museums also suffer the same issue, not necessarily with the same types of aircraft, but to the UK's own over availability of surplus airframes again over the last fifty years or so. It is a common trend to see in most UK aviation collections a De Havilland T11 Vampire , along with the French home build aircraft of the 1930's, the Pou de Ciel (the Flying Flea). In Canada, most museums have an example of a T–33 trainer and in recent years a Canadair Tutor. These again were available in number and easy to acquire.

All this goes to highlight that aviation heritage organizations need to look at the issues related to their individual collections and how they relate to the wider national collective experience. Sharing exhibits and developing national programs to highlight Canadian aviation is a significant step in helping to define the "national " collection to deploy and exchange aircraft and exhibits that are better served by another organization.

CASAM(Canada Aviation and Space Museum) has gone a long way to start to facilitate the process, both with its own collection and its policies around it. Helping identify and assess the collective national inventory and what that can do to help each respective museum/organization is the first step in trying to deliver a consistent and unified aviation heritage sector.

From a unified and consistent aviation heritage sector will provide the opportunities to work in collaboration , raising the standard of delivery as well as the standards of that delivery. This could be scaled out using international networks to encompass the global aviation heritage sector. Together we are certainly better!

Physical Space Limitations vs Heritage Mandate

In most countries , museum aircraft, not protected from their respective environments , will suffer degradation , which depends on the immediate environment , can vary. In Canada, most aviation museum aircraft outside are subject to harsh weather conditions, which initially affect paint and markings. Longer term, corrosion and structural integrity can become serious issues. These issues will become costly , to correct or remediate in both terms of money and labour hours, both volunteer and (or) paid hours.

Longer term a rationalization of the collective "national" collection will ultimately affect most museums/organizations, to a great or lesser extent. One airframe highlights this issue. The Canadair Argus was a long range ant–submarine patrol aircraft designed and built by Canadair in Montreal. It was key program , with the aircraft serving the Royal Canadian Air Force from the late Fifties until 1984. A number of aircraft were brought into preservation, including examples with CASAM in Ottawa as well as others located at RCAF bases and museums. Complete examples exist across the country at Summerside P.E.I, Greenwood, NS, Ottawa and Trenton Ontario, and Comox BC. All these airframes vary in condition. Most , except the Ottawa example have been outside for the last Forty plus years. All examples are now outside, with no realistic possibility of protective cover, given the size and cost of building something to cover the large airframe. Some of the airframes have been subject to periodic repaints, but again these are costly and involved processes to refresh and inhibit a large airframe such as the Argus. In the case of the Ottawa example, it even became a home for a homeless person, which inflicted a number of issues on the aircraft, not including starting a fire in the tail section. Luckily this incident was caught before the airframe was engulfed and destroyed. The take away is that even those airframes are in preservation, they aren't guaranteed a long term future, without proper infrastructure. It's a widespread problem, that most aviation museums, large and small all grapple with. The days of building are limited, not only in scope, but in effective timelines. Leaving the process and decision making process to provide protection for respective collections unclear.

The case of the Argus highlights another aspect of the maintenance and upkeep of airframes exhibit outside. This problem is not unique to Canada, and other countries exhibit varying degrees of heritage at risk.

Canada's aviation heritage organizations all have outside aircraft on exhibition, or storage subject to the varying weather conditions the country presents. The solution to building buildings to cover them is costly and in most cases an exceptionally long term vision to protect and ensure the aircraft/artifacts survive for future generations. Future generations will hopefully benefit from this investment in long term protection. Buildings to house large exhibits such as airplanes are certainly even more expensive than other purposed buildings. As well as associated building costs, the building life span and maintenance requirements are in most cases not fully realized at the start of the project. There are certainly examples of

aviation museums faced with significant renovation and repair projects. A significant example of this is the Smithsonian's National Air and Space Museum, which has required an extensive building renovation, including remediating asbestos from its extensive use in the build during the early Seventies .Other examples in Canada , have included roof replacement and structural issues in hangars.

Most Canadian aviation museums face issues with the storage of not only complete aircraft, but artifacts and suitable environments to preserve and protect for future generations. Most organizations have started to address the issue, but in a lot of cases, some artifacts are complex in their material make up and composition, which require specialized conservation techniques and storage. Access to specialized organizations that can help, are useful to help try and preserve artifacts at risk.

A problem associated with most museums, is that the off view/stored artifacts can represent a significant part of the collection. In some cases,(I would argue most), museums don't have a true picture or understanding of the collection. Items have been either miss identified or un accessed to their respective collections.

Proper environmental controlled storage is an issue for most organizations, large or small. It is all a matter of scale, of the issue amongst most Canadian museums/organizations. A better understanding of other museums' needs and projects can help move surplus and or not core artifacts to others, who may need the artifact to help with a exhibit or a component for restoration. A rationalization project would help most museums decide what they should keep or what should be moved on. With the ability to define and decide the respective collections, a better plan for acquisitions of relevance can be determined. The understanding of what the true cost of bringing a certain airframe into a collection and its long term cost to the museum/organization would go a long way to help prioritize and determine an acquisition.

An example of this is determining the relevance of bringing large passenger aircraft into collections. In most cases, they will be an extremely specific reason to acquire an example. Traditionally large passenger aircraft have and are not fairing well in preservation, not just here in Canada, but around the world. It is easy to justify a Concorde, but a Boeing 737, not so much, unless you have number one, or your museum is located in the desert, with space and climate(but still subject to environmental conditions, like sun and excessive heat).Most

airliners, if they retain their passenger configured interiors, are subject to different materials, all posing their own problems in mitigating moisture , which leads to creating unique environmental conditions, affected by mold and moisture. These would need to be abated and controlled, which requires a dedicated plan and implementation on a regular basis.

The use of simulators and cabin sections can help make the airline experience more tangible. ACAM has introduced a Boeing 737 , 2 D simulator, which not only provides the unique perspective of flying but also provides a source of revenue. Going forward, the realm of welcoming a full 737 to its' collection is both unrealistic and unattainable. Focusing on the realistic and attainable is a key factor to the long term future and relevance of a collection, in both financial and sustainable terms.

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Senior Leadership Meeting

British Columbia Aviation Museum

The British Columbia Aviation Museum (BCAM) is a complex of three buildings and artifacts located on the grounds of the Victoria International Airport in North Saanich, British Columbia. This was also the site of former

RCAF Station Patricia Bay, Canada's third largest air base during the Second World War. The museum was created in the mid–1980's by four groups of aviation enthusiasts in the Greater Victoria region. The BCAM name also applies to the non–profit society registered in 1988 as the basis for conducting museum activities. The Museum is focused on preserving the history of aviation in Canada, most particularly in British Columbia. It currently has a collection of 38 aircraft. Additionally we have over 10,000 artifacts of which about 40% are on display.

Museum Vision and Mission

Vision: To become the preeminent aviation an aerospace museum in Western Canada while continuing to be a valued asset to the community.

Mission: To acquire, preserve and display significant artifacts having particular importance to the history of aviation and aerospace in British Columbia and Western Canada while promoting lifelong learning and inspiring interest in the science and technology of aviation and aerospace.

Museum Management

Paid sta1

Executive Director
- Assistant Director
- Artifacts manager
- Giftshop Manager

Volunteer Sta1

- 9 person working Board
- 9 person Policy and Procedures Committee
- 6 person Management team
- 12 person Department heads team
- Communications committee
- 3 person Human Resources Committee
- 3 person Financial committee
- Librarian / Resource Centre Manager
- Restoration Hall Manager
- Displays Manager
- Air Park Manager

- Currently we have 209 volunteers and 85 tour guides (65 active)

It is important to note that BCAM was from its inception a volunteer run museum displaying military, civil and commercial aircraft along with a myriad of historical, interactive and educational displays. All of this was accomplished by dedicated volunteers. In 2023 it was apparent that we needed full time staU to manage our aUairs and future expansion, and this has grown to the current 4 paid staU. BCAM does not receive scheduled government support and can operate as a self-funded entity. This does not stop us from applying for federal, provincial and municipal grants for which we have been very successful this past year.

An important feature of the BC Aviation Museum is that all visitors get a free tour upon entry. This was the result of feedback from our visitor surveys which highlighted the strong preference for personal tours and storytelling. It has been a great success, and we are fortunate to have enough tour guides to accomplish this. The tour guides get immense satisfaction engaging our visitors and often learn from them as well. Of course, visitors may conduct their own explorations but must have a tour guide in areas listed under Access in the main presentation.

The breakout event came for BCAM with the arrival of the Hawaii Mars. This immense aircraft has put BCAM in the international spotlight. Our visitors and revenues have doubled, and we expect to have 60,000 visitors this year.

The Hawaii Mars flew firefighting missions in British Columbia for 54 years. Its arrival, accompanied by the RCAF Snowbirds display team, was witnessed by tens of thousands around the city of Victoria and those out at the Victoria airport. The 2 ½ year eUort to get the Hawaii Mars was well worth it the eUort and it is now being enjoyed by thousands of visitors who have grown to love this iconic aircraft over the past 5 decades.

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Canadian Bushplane Heritage Centre

Brief History

The Canadian Bushplane Heritage Centre was established in 1987 by a group of dedicated aviation enthusiasts and former Ontario Provincial Air Service (OPAS) employees to preserve and tell the story of bush flying and forest fire management in Canada. The Centre has evolved from a volunteer-run organization to the largest attraction in Sault Ste. Marie, welcoming over 55,000 visitors annually. The CBCH embraces its core values, not only giving unprecedented access to historic bushplanes, but also providing low-barrier programming and education to families and seniors, strengthening its role as a community hub.

Agenda Items

Relevance

To stay relevant, aviation museums need to broaden their scope while still preserving their core mandate. As the Canadian Bushplane Heritage Centre (CBHC) evolves, staff observations and community consultations point to the need for a museum that is "people-forward". While the aircraft will always play a central role, we will reach various communities through storytelling featuring people. Displays and exhibits will be altered to focus on the people who flew the aircraft, worked on the aircraft and were touched by the aircraft, connecting visitors with the humanity of our collection. Educational and programming initiatives will highlight the same types of human stories, while expanding content to include related, but non-aviation material, such as forest ecology and the impact healthy forests have on animal populations and wildfire management. Additionally, aviation museums are large, providing ample space for a variety of programs and events that engage communities who may not have considered visiting an aviation museum. We find that once a person has entered our building for any

purpose, the awe of our collection impacts them, giving the CBHC the opportunity to gain a new customer, a new volunteer or a new advocate.

Physical Space vs. Heritage Mandate

Aviation museums need to harness the power of technology to bridge the space vs. heritage divide. Three-dimensional (3D) scanning, virtual reality and augmented reality all pose opportunities for preserving heritage, while still making it accessible to visitors. With digital assets, aviation museums could easily offer inter-museum loans of "objects", saving costly transportation, while also reducing environmental impacts. Stories can also be preserved through video and audio recordings. These recordings can again pose opportunities for sharing and collaboration among aviation museums. The CBHC tells the story of bush flying in Canada, and while our story is unique, and in many cases, one of "first-mover" advantage, there are numerous other areas in the world (Australia, Alaska, South America, etc.), where bushplanes have had significant impacts and heritage value. Access to digital stories and assets would allow the CBHC to develop temporary bush-flying exhibits giving a global context.

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Senior Leadership Meeting

Deutsches Museum

Aviation at the Deutsches Museum: History, Collection, and Perspectives

Aviation has been one of the Deutsches Museum's central collection areas since its foundation in 1903. In 1904, just one year after the museum was established, the foundation for the aviation collection was laid with an original glider by Otto Lilienthal—one of the first airworthy flying machines in history. Today, this exhibit holds an iconic status within the collection.

Systematic development of the aviation section began with the acquisition of the Etrich-Rumpler Taube in 1911, the collection's first powered aircraft. Under the chairmanship of Ferdinand Graf von Zeppelin, who joined the museum board in 1909, early aviation developments were documented and preserved. When the Museum Island building opened in 1925, the aviation collection—then consisting of seven aircraft and some smaller exhibits—received dedicated exhibition space. Due to size constraints, large aircraft had to be displayed outdoors.

During the Second World War, the collection suffered significant losses. Three particularly important aircraft were destroyed in bombing raids on Munich: a Junkers F13 (1919), the first all-metal commercial aircraft; a Dornier Wal used by polar explorer Roald Amundsen; and the Junkers J1 (1915), the world's first all-metal aircraft.

Reconstruction of the exhibition began in 1950. By 1958, the historic aviation hall had reopened, with a French-built post-war Junkers Ju 52 ("Tante Ju") in fake German livery as its centrepiece. Following the destruction of the Berlin Aviation Collection during the war, the Deutsches Museum—then with only ten aircraft—assumed a leading role in preserving Germany's aviation heritage.

In the 1970s, systematic expansion plans were developed. An advisory board was established under the leadership of former Messerschmitt engineer Ludwig Bölkow, and intensive acquisition efforts began. An architectural competition in 1974 led to the planning of a new building dedicated to the "central documentation of the German contribution to aviation and space history." The foundation stone was laid in 1978.

By the time the new exhibition hall was inaugurated in 1984, the collection had expanded significantly. In addition to approximately 85 aircraft engines, new acquisitions included the fs 24 "Phönix" (the world's first fiberglass glider), the Messerschmitt M17 light aircraft (1925), and a Douglas C-47. Another highlight was a section of the first Airbus A300 (first flight in 1972), including the left wing and engine, symbolising the rise of the European aerospace industry.

Although some exhibition texts were criticised for being overly industry-friendly, the 1984 reopening was broadly successful and attracted a record 1.5 million visitors in its first year. From today's perspective, however, it is evident that donations from industry at times influenced the curatorial narrative. In some cases, aircraft were even given new identities. An international perspective has only partially been achieved to date.

As space constraints reemerged, the historic airfield at Schleißheim—north of Munich and originally built during the First World War—offered a suitable expansion site. Beginning in 1992, parts of the collection were exhibited in a restored hangar complex and a new, light-filled exhibition hall covering 8,000 square metres. Aircraft are restored in an open workshop visible to visitors. A Bundeswehr C-160 Transall is displayed outdoors, protected by basic but effective conservation measures such as UV shielding, bird deterrents, and climate monitoring.

Today, the aviation collection includes nearly 180 aircraft and 250 engines. The new exhibitions opened on the Museum Island in 2022 present selected highlights in a modernised display. The Schleißheim branch houses the bulk of the collection and focuses on post-1945 military aviation, experimental aircraft, regional aviation history, and air sports.

Currently, the Museum Island exhibition is divided into three thematic areas: historical aviation (1918–1945), modern aviation (from 1945), and space exploration. The section

covering early aviation (up to 1918) is undergoing a redesign and is scheduled for completion around 2030.

The modern aviation exhibition takes everyday passenger experiences as a starting point to systematically explore fundamental principles of flight: What is the weight of air? How does an aircraft take off and stay aloft? How is it controlled? What aerodynamic purpose do features like winglets serve? What materials are aircraft made of, and how are they manufactured? What does a flight crew's day-to-day work involve? And above all: How is safety ensured?

Consistently positive feedback from visitors affirms that this structured, experience-oriented approach is effective. In contrast, the Flugwerft Schleißheim continues to prioritise collection breadth. However, a transition toward a more historically and thematically systematic presentation is underway there as well, including plans for a dedicated children's trail to engage younger audiences.

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Finnish Aviation Museum

The Finnish Aviation Museum is a professionally run, private museum with national responsibilities, preserving and presenting aviation history (both civil and military) in Finland. It is governed by the Finnish Aviation Museum Foundation, with stakeholders including key companies in Finnish aviation industry. The Museum was founded in the early 1970's and is located in the City of Vantaa, Helsinki Metropolitan Area, near the Helsinki Airport. The Museum currently has a staff of 20 full-time employees, supported by a large group of volunteers. Annual turnover is slightly under 1,5 million euros, of which around 50 % is self-financed. In addition to ticket sales, museum shop and cafeteria, the Museum creates revenue by hosting corporate seminars and events, as well as providing guided simulator flights for its visitors.

Compared to other museums in Finland, the Finnish Aviation Museum is slightly above-average in the size of its staff and visitor numbers. The Museum really stands out with its high percentage of self-financed funds, as well as its diverse volunteer work. As a museum with national responsibilities, the Finnish Aviation Museum cooperates closely with the 5 or so other aviation-themed museums in Finland to ensure the preservation of aviation heritage on a national level.

The Finnish Aviation Museum's mission is to expand understanding of aviation. The Museum's core values are curiosity, responsibility and communality.

The Finnish Aviation Museum is currently in the process of the largest renovation project of its history. Within the next few years, the Museum is to move into a newly constructed building (to be built on the neighboring lot) and completely revamp its exhibitions, services and whole operational concept. Core of the Museum's collections will be stored in external storage facilities, and the aim is to move from a storage exhibition to a story- and visitor

experience based one. The Museum's aim is to double its annual number of visitors, as well as its annual turnover. The New Aviation Museum is to open in late 2027 or early 2028.

The Museum's vision is to build a new, influential Aviation Museum.

Response to CASM's agenda proposals

The question of **relevance** is particularly topical for us at the Finnish Aviation Museum, now that the New Aviation Museum project is in full swing. Our ambitious goals for increasing our visitor numbers require reaching new target audiences and focus groups. Also, our operational environment will change drastically in the future. The Museum is located in the surrounding area of the Helsinki Airport, which has been sparsely built for years, and the Museum has been an isolated place to visit. The area, however, is developing rapidly. The City of Vantaa has plans to build housing for around 10.000 people in the immediate vicinity of the Museum, and 25.000 in the greater Aviapolis area. A variety of services is also being developed in the area, for instance a high school for 700 students is being built right next door to the New Aviation Museum.

One of the New Museum's key goals is to become a living room for the locals, not just a destination to be visited from afar. This requires truly connecting with the people. Vantaa is a multi-cultural, multi-lingual city, with a significant share of young people of its overall population. How could the New Museum support the City's strategic goals of preventing segregation and inequality?

As we reach out to new, non-traditional target audiences, we must also note that attitudes towards aviation have become more critical in the past years. The role of aviation industry has widely been discussed in the public debate regarding climate change issues, as well as increasing public investments in national defense. Can we discuss such sensitive topics openly, and if we do, do we risk the support of our stakeholders in the aviation and air travel industry, as well as our traditional heavy-user base?

Another topic we have discussed much while preparing for our renovation is the question of **physical space limitations vs. heritage mandate**. Our customer surveys show that many of our visitors desire to experience more than just aircraft – they want interactive exhibits,

simulators and wish to learn about aviation and aviation history. As mentioned before, we are addressing the need by moving from an aircraft-centric storage exhibition to a story-based one. To enable this (and to enable possible future accumulation of our collections, for which we currently have very limited possibilities), we are renting external storage facilities for the core of our collection.

This new operating model will, however, create issues of its own. Storage facilities mean new expenses for the museum to tackle. Collections should be accessible for the public, which creates a pressure to rotate the stored aircraft in temporary exhibitions and the like – which in turn creates new kinds of logistical needs. Furthermore, the volume of aircraft on display is the traditional attraction of aviation museums, especially for their traditional visitor base. If we display fewer aircraft to make space for exhibition design, do we fully understand its affect on the visitor experience?

These are our main thoughts on the proposed agendas.

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FINNISH AIRLINES
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Senior Leadership Meeting

Royal Air Force Museum London

The Royal Air Force Museum is a National Museum. We have two public sites, in London and the Midlands, and a collection store in Stafford. Our Vision is to Inspire everyone with the RAF story – the people who shape it and its place in our lives. Our purpose is to share the story of the RAF, past, present and future – using the stories of its people and the 1.5 million objects in our collections to engage, inspire, entertain and encourage learning. Our governance is overseen by a Board of Trustees who hold responsibility for our policy and strategic direction and who appoint our Chief Executive Officer.

Agenda Items

Relevance

We prioritise access and inclusion in all our redevelopment – onsite, offsite and online.

We enable visitors to recognise themselves in the diverse stories we share about people, finding content that is relevant to them whatever their background.

We co-create our displays and our activity programmes with our communities to find the areas of the RAF's story that they will find most engaging. By proactively engaging with new communities we are creating inclusive exhibitions and sites, increasing the number of visitors who feel the Museum "is for them"

Networking and Collaboration

Raising awareness and making available the research we each undertake. We will have similar audiences and similar challenges in broadening our engagement. We would draw

deeper insights by pooling our collective knowledge. This would allow us to identify what works well and allow others to avoid recreating our less successful endeavours.

Physical Space Limitations vs Heritage Mandate

A large part of our work has been on reviewing our stored collection ahead of a complete move to a new publicly accessible store being built at our Midlands site. We will transfer aircraft which we cannot publicly display in the next fifteen years. This approach has allowed us to acquire new airframes, with space for future acquisitions.

For larger aircraft we weigh the need to acquire the whole airframe against the interpretation we could offer by collecting its unique story and role within the RAF. As an example, we did not acquire the Boeing E3 Sentry airframe. We did, however, acquire the rotodome, suspension struts and terminals which tell the unique story of the E3.

History vs STEM

Delivering STEAM programmes within museums offers a unique opportunity to engage in hands–on activities, immersive technology and learning in practice while within a heritage environment where history can be used to show the applications of knowledge. This immersive approach enables participants to explore and enrich their knowledge and understanding of aerospace in a stimulating environment. By providing access to collection objects we offer a unique environment to inspire learning. Our new collection store includes a multi–use research space that offers STEAM teaching with our collection and rooted in the history of technological innovation in the RAF.

Digital

The RAF Museum has incorporated a range of digital interpretive elements into our exhibitions. We have used Augmented Reality to allow visitors to 'look inside' the Avro Lancaster and VR to fly in the Dam Busters raid. We layer in digital trails and use screens throughout the displays to share interviews, archive film and photographs to offer more immersive story telling. Digital based interactives introduce visitor challenges drawn from RAF roles.

Incorporating digital elements requires them to be engaging enough to attract and hold attention but not so entertaining that the visitor does not want to leave and explore the wider exhibition. Maintaining these elements needs to be considered from the outset. Where possible the technology needs to be based on modular, off the shelf systems, that can be easily replaced and are not dependent on a sole contractor. This reduces risks of escalating maintenance and upgrade costs.

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Senior Leadership Meeting

Royal Aviation Museum of Western Canada

Brief History

The Royal Aviation Museum of Western Canada (RAMWC), established in 1974, preserves Canadian aviation heritage with over 40 aircraft and 70,000 artifacts. Granted "Royal" status in 2014, it opened a stunning 86,000-square-foot facility near Winnipeg Richardson International Airport in May 2022, featuring interactive exhibits and designs inspired by flight. The museum places emphasis on preserving Canada's aviation history while engaging with Indigenous perspectives on aviation, promoting reconciliation and collaboration. The museum has successfully positioned itself as a hub of education and inspiration.

Describing the museum

RAMWC, located in Winnipeg, is more than a repository of historic aircraft; it is a dynamic hub dedicated to preserving Canada's aviation legacy and inspiring future generations. Founded in 1974 as the Western Canada Aviation Museum, our vision is to be recognized globally as a leader in aviation education and preservation, while our mission is to connect people with the transformative story of flight.

What sets us apart is our unparalleled collection and commitment to experiential education. Our museum houses 25 historic aircraft, including rare and unique designs such as the Vickers Vedette and the Dynavert CL84. Together with 70,000 artifacts, texts, and photographs, these pieces illustrate the ingenuity, courage, and impact of Canada's aviation pioneers. Notably, our restoration program allows visitors to see firsthand the meticulous processes involved in reviving and maintaining these iconic machines.

Education is at the heart of our efforts. In our 86,000-square-foot state-of-the-art facility, we offer interactive exhibits that immerse guests in aviation science and history. Our experiential education programs have been praised for sparking curiosity and inspiring students to pursue careers in aviation and STEM fields. Since opening the new facility in May 2022, we have hosted over 23,000 students through these programs, ensuring a lasting impact on future generations.

Our emphasis on inclusivity and reconciliation also makes us unique. We actively collaborate with Indigenous communities to highlight Indigenous perspectives on aviation and explore how flight has influenced cultures and connections across Canada. This initiative fosters meaningful dialogue and promotes understanding and partnership in preserving shared histories.

RAMWC has preserved the "Ghost of Charron Lake," a rare Fokker Universal lost in a 1931 crash in northern Manitoba. Discovered in 2005 after a 30-year search using sonar and local stories, the aircraft, intact on its skis, symbolizes Canada's aviation history. The museum protects this relic to honor its legacy for future generations.

Our museum has earned several prestigious accolades, including the Outstanding Science Organization Award in Manitoba and recognition as Business of the Year twice. These awards reflect the dedication of our team and the unwavering support of our community, partners, and donors. Key contributions, have allowed us to realize ambitious projects, such as the design and construction of our new facility. Contributions from industry leaders, including Standard Aero, Magellan Aerospace and Boeing, have further strengthened our ability to innovate and expand.

Since reopening in May 2022, the museum welcomes over 70,000 visitors annually, confirming its role as a cornerstone of education, inspiration, and community connection. Every exhibit, program, and event are crafted to honor the stories of aviation pioneers while fostering enthusiasm for the possibilities of flight today and tomorrow.

The Royal Aviation Museum of Western Canada is a place where history takes off and imagination soars. We invite you to visit us and experience the wonder of aviation in a way that connects communities, celebrates achievements, and inspires new generations of pioneers.

Agenda Items

Relevance

Relevance to society has become a cornerstone of the Royal Aviation Museum of Western Canada's mission, especially with only 2% of our funding sourced from government support. It is essential for us to serve our stakeholders and address pressing societal challenges.

The aviation and aerospace industry have looked to us to address the growing skills shortage by inspiring the next generation to pursue careers in these fields. Through engaging and experiential STEM education programs, we aim to become part of the pipeline that introduces students to aviation and aerospace opportunities. Since our new facility opened in May 2022, we have inspired and educated over 23,000 students, showcasing how aviation connects science, technology, engineering, and math in impactful and memorable ways.

Additionally, in Manitoba, a province with the highest child poverty rate in Canada, inclusivity in education is a priority. No student or classroom is turned away from accessing our programs, ensuring opportunities are available to children regardless of economic barriers. By broadening our appeal beyond aviation enthusiasts, we remain deeply relevant to communities and industries alike. Through collaboration and dedication, the museum continues to inspire learning, foster innovation, and make a difference to the world around us.

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Senior Leadership Meeting

Wings Over the Rockies

Wings Over the Rockies Air & Space Museum

One Organization | Two Locations

Transferred from the United States Air Force to a group of volunteers in 1994, Wings Over the Rockies Air & Space Museum™ is located in Hangar 1 of the former Lowry Air Force Base in Denver, Colorado. Today, the museum boasts more than 100,000 square feet of exhibit space dedicated to displaying iconic aircraft, space vehicles, artifacts, military uniforms and much more.

Our second location located roughly 19 miles south of Wings Over the Rockies Air & Space Museum, Exploration of Flight is a 15–acre campus set on one of the busiest general aviation airports in the nation. Through aviation–focused events, programming and exhibits, Exploration of Flight offers an immersive experience for those fascinated by flight.

Each year these two locations welcome approximately 160,000 visitors representing all 50 U.S. states and 34 countries.

Vision:

To inspire innovation and action for the next generation of aviation and space explorers.

Mission:

To education, inspire, and excite all people about aviation and space endeavors of the past, present, and future.

Agenda Items

The Relevance of Aviation Museums as Platforms for STEAM Education

Aviation museums like Wings Over the Rockies™ serve as critical cultural infrastructure that preserves the history of flight, celebrates aerospace achievements, and inspires future generations. However, in an era of rapid technological advancement and shifting visitor demographics, museums like ours must actively evolve to maintain relevance. A key strategy for ensuring this relevance is leveraging aviation museums as dynamic platforms for STEAM (Science, Technology, Engineering, Arts, and Mathematics) learning. By broadening their appeal and engaging diverse audiences, aviation museums can secure their place as essential learning hubs for the 21st century.

To expand audience engagement beyond traditional guests, aviation museums must consider how to attract those who may not initially have a strong interest in aviation. Families and young learners are a crucial demographic, and engaging them requires the development of hands-on, interactive exhibits that make aviation concepts intuitive, playful, and fun. In addition, storytelling plays a crucial role in transforming aviation history from a collection of technical achievements into an engaging, human-centered experience.

Personal narratives bring museums to life, allowing guests to connect with aviation on an emotional level. Stories of pioneering aviators, engineers, and astronauts—from Amelia Earhart to the Tuskegee Airmen—can inspire guests of all ages and backgrounds. Showcasing the struggles, triumphs, and innovations of these figures helps create a sense of

relevance and relatability. Guests may not remember the exact specifications of an aircraft, but they will remember the courage of a pilot who flew against all odds. Incorporating letters, journal entries, and oral histories into exhibits makes the past feel immediate and personal, drawing guests into the world of aviation in a way that statistics and blueprints alone cannot.

Storytelling also provides a bridge between history and the future. Aviation museums can highlight contemporary innovators—scientists working on sustainable aviation, engineers designing the next generation of space exploration, and students building their first aircraft. By intertwining the past, present, and future, museums can show guests that aviation is not just history—it is an ongoing story in which they can play a part.

One of the most effective ways for aviation museums to remain relevant is by positioning themselves as premier STEAM education centers. This aligns with national and global efforts to strengthen science and technology literacy and workforce development. Schools and educators can benefit from curriculum–aligned programs that reinforce classroom learning through handson aviation experiences. Aviation museums must partner with local science centers rather than compete with them to bring maximum value to their communities.

Beyond fostering learning engagement, aviation museums can play a crucial role in workforce development. Collaborating with aerospace companies to create internship and apprenticeship opportunities for students interested in aviation careers helps bridge the gap between education and industry. Hosting career fairs and networking events that connect aspiring professionals with industry experts can further support career pathways. Mentorship programs that pair students with pilots, engineers, and other aerospace professionals provide invaluable guidance and inspiration. Ensuring the relevance of aviation museums also requires strong connections with key stakeholder groups. The aerospace community, for instance, can benefit from exhibit collaborations with aerospace companies, featuring cutting–edge technology and innovations in flight.

Capturing the interest of those who do not consider themselves aviation enthusiasts requires creativity and innovation. Aviation museums can showcase the intersection of aviation with fields such as art, music, and fashion, making their exhibits more accessible to those with diverse interests. Multimedia storytelling exhibits that emphasize personal narratives rather than just technical achievements create an emotional connection with guests. Introducing

gamification elements, such as gallery tasks, interactive quizzes, and flight challenges, encourages active participation and engagement.

Looking ahead, the future of aviation museums depends on adaptability, inclusivity, and innovation. By actively engaging new audiences, enhancing STEAM education opportunities, and fostering meaningful industry connections, these institutions can transcend their traditional roles and become vital centers for learning and inspiration. With strategic investments in technology, partnerships, and diverse programming, aviation museums will not only remain relevant but will also play an essential role in shaping the next generation of aerospace pioneers, innovators, and enthusiasts.

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